THURSDAY, NOVEMBER 29, 1917.

ORGANISM AND ENVIRONMENT.

Organism and Environment as illustrated by the Physiology of Breathing. By Dr. J. S. Haldane. Pp. xi+138. (New Haven: Yale University Press; London: Oxford University Press, 1917.) Price 5*s.* 6*d.* net.

DR. HALDANE'S book is a record of four public lectures delivered by him under the Silliman Trust at Yale University in 1916. In the short compass of little more than a hundred pages the author gives an admirable account of the physiology of breathing, based mainly on the researches of himself and his pupils, which have played so great a part in moulding our present ideas on the subject.

The special value of the book to students lies in the fact that the function of respiration is treated simply as one aspect of the activities of the organism as a whole, as a chapter in the unending series of adaptations, internal and external, which make up the life of an individual. There is a real danger that, in the detailed analytical study of isolated phenomena and functions which the student meets with in successive chapters of any text-book of physiology, he may lose sight of the essential unity of all the phenomena presented by a living organism.

The first lecture is devoted to the regulation of respiration and the part played therein by chemical and nervous factors. The second treats of the readjustments of regulation in acclimatisation and disease. After a description of the method in which the hydrogen-ion concentration of the blood is regulated and the effects on the organism of alterations in oxygen-tension, an account is given of the Pike's Peak experiments. It will be remembered that these experiments led to the conclusion that under such conditions of stress as are met with at high altitudes, where there is a chronic deficiency of oxygen, the taking up of this gas by the blood is enhanced by the activity of the epithelium of the lung alveoli, which transfers the gas to the blood at a higher tension than it possesses in the alveolar air. On these experiments many physiologists are inclined to reserve judgment until they have been confirmed and controlled by the use of different methods, especially in view of the fact that earlier experiments, which seemed to show the same active intervention of the alveolar epithelium at normal oxygen-tension, have been disproved by Dr. Haldane himself. It is suggested that these earlier results were obtained when the experimenters were in a condition of chronic CO poisoning, so that their alveolar epithelium had undergone the same acclimatisation as would be evoked by a stay of some duration at high altitudes.

The third lecture deals with the regulation of the environment, internal and external. It is pointed out that "the gross regulation of the circulation is of such a nature as to keep the venous gas-pressures nearly steady, while regulation of breathing keeps the arterial gas-pressures nearly steady." Emphasis is laid on the fact that, in the regulation of the blood-flow, as of the respiration, the determining factor is the metabolic activity of the body as a whole.

In the fourth lecture, which is entitled "Organic Regulation as the Essence of Life: Inadequacy of Mechanistic and Vitalistic Conceptions," the results of the preceding lectures are used as a text from which to expound the author's views as to the methods and aims of physiology. He seems herein to erect dummies, labelled "vitalist" and "mechanist" respectively, for the pleasure later of knocking them down. The reader would gather from this chapter that physiologists were divided into two camps, mechanistic and vitalistic. Is this any more true than the statement, often made by the layman, that the medical world is divided into allopaths and homœopaths? Is there fundamentally any difference in the point of view of physiologists at the present day? All pursue similar methods—the only methods which are open to them—the careful observation of the phenomena of living animals and the average sequence of these phenomena. It is true that one finds among physiologists, as among all other classes of scientific men, the tendency to over-simplify, to fit a new experience into a series which is already familiar, while neglecting details which cannot be so fitted in—an adjustment of facts to curves rather than of curves to facts. But the opposite danger is equally found. Workers, impressed by the seeming impenetrability of the unknown just in front of them, may give up too soon and yield to the temptation of relegating to the arcana of cell-activity processes which further research would have shown to fall within a known category. This faint-hearted attitude might be encouraged by a sentence such as the following: "Those who seek in physiological phenomena for the same kinds of causal explanations as can usually be assigned in connection with inorganic phenomena have no prospect but to remain seeking indefinitely." This prospect is common to all scientific workers, but if the statement implies that no useful results can be obtained in this way, it is not true. We cannot claim to understand or to know fully even the most familiar process in chemistry or physics, and there is no question that further research will considerably modify what are now regarded as fundamental principles—but are really working schemata—in physics and chemistry. The tendency of science is to make its formulæ—its shorthand of phenomenal sequence—more and more wide-embracing. It is a dangerous thing, and savouring of dogma, to set bounds to this development and to assume that the phenomena presented by living beings, as well as those observed in so-called inanimate objects, may not in the future be brought into some one great sequence or natural law.

The fact of consciousness will always remain to remind each of us that all these laws are but

mental shorthand, invented to increase man's control of his environment and his power to survive in the struggle for existence. We can never pretend that they represent ultimate reality, if such a thing is indeed thinkable. Or does Dr. Haldane believe that there is some great formula which will embrace the worlds of soul and body, and will replace, because including, the concepts which we employ in dealing with the objective world? If this were possible, we should indeed be as gods, and there would seem to remain little place for the last few pages of these lectures, in which the author, in accordance with the wishes of the founders, refers to "the presence of God in the natural and moral world." It is the teaching of biology, as of every religion or State code of ethics, that "we are not mere individuals, but one with a higher reality." No system of education is complete which does not inculcate this as its fundamental doctrine, but it is not given to everyone to make the further inferences drawn by the author of these lectures. E. H. S.

THE PERENNIAL PROBLEM OF DYES.

Artificial Dye-stuffs: Their Nature, Manufacture, and Uses. By A. J. Ramsay and H. Claude Weston. Pp. ix+212. (London: George Routledge and Sons, Ltd., 1917.) Price 3*s.* 6*d.* net.

AFTER a concise historical introduction, the authors deal with the distillation of coal and the manufacture of direct coal-tar products. In referring to the very small yield from coal of the principal colour-producing hydrocarbons, the possibility of a new source of these products from petroleum is mentioned. A more general conversion of coal into coke before consuming it as fuel would also lead to a further supply of these valuable hydrocarbons.

It is an unfortunate feature of this text-book that the chemical foundations are unsound. This detracts considerably from its utility as an introductory manual to the study of the artificial dye industry. The only other *raison d'être* for the work, namely, that of an exhaustive treatise, is disclaimed by the authors.

The azo-group present in the largest class of artificial dyes is defined incorrectly as "a radical consisting of two atoms of nitrogen which can be substituted in a suitable substance for one atom of hydrogen." The consequences of this fundamental error are to be seen in the absurd formula for Bismarck brown on p. 63. The chemical mechanism of the diazo-reaction defined long ago with precision by Griess, the discoverer of the process, is apparently not understood clearly by the authors, who on p. 41 give the formula $C_6H_5.N_2HCl$ to diazobenzene hydrochloride (*sic*). This confusion is continued on p. 42 in the formation of aminoazobenzene. It is only fair to direct attention to these elementary details, because the authors attach importance to them, stating (p. 44) that "if the reader has thoroughly mastered the explanation in the foregoing pages . . . he will be in a position to understand the nature and manufacture of almost any of the series of azo-dyes."

Pyrogallol or "*v*-trihydroxybenzene" is furnished with the structural formula of its isomeride, phloroglucinol. Salicylic acid is stated to be manufactured from anthranilic acid, but this can scarcely be the prevailing method. Confusion rules in regard to "1 : 8 : 4-dioxynaphthalenesulphonic acid," this dihydroxy-derivative of naphthalene being endowed with two atoms of univalent oxygen. Direct or "substantive" dyes are said to be formed within the fibres themselves. Phthalic anhydride is formulated as $C_6H_4(CO_2).O$, but the errant carbon atom returns to the molecule at phthalimide. On p. 111 the words "left" and "right" should replace "top" and "bottom" in the description of the quinonoid hexagon. If this formulation is accepted, it is incorrect to add that the hexagon is linked to chlorine as well as to an amino-group. The formula for *m*-tolylenediamine on p. 133 is incompatible with the constitutions assigned to tolylene red and blue on the same page.

These and other similar chemical errors mar the utility of a text-book which is much more satisfactory in its outline of manufacturing processes, and contains a series of informing diagrams. G. T. M.

THE NEW REGIONALISM.

Can We Set the World in Order? The Need for a Constructive World-culture. By C. R. Enock. Pp. 198. (London: Grant Richards, Ltd., 1916.) Price 3*s.* 6*d.* net.

THE man of fact and the brooding thinker are rarely united in one to form a great leader. Here we have pre-eminently the man of fact. Few pages of this work but evidence the travelled observer richly harvesting facts with admirable zeal for social reconstruction; we therefore warmly recommend his labours to all who would ameliorate the gross and widespread inequalities of human lot.

The author pleads for a "science of human duty in moulding the earth that it may be the home of a high and universal civilisation" (p. 34): truly a lofty ideal. He advocates a co-operative world-survey of economic possibilities, and thereafter the development of a world-order, based upon federated units of industry so organised that every region shall become, so far as geographically possible, an "organism" (p. 41), "self-supplying and self-contained," within "its natural radius of action" (p. 40). A sense of "place-possibility," or "the culture of the locality," should teach us "to regard a place as an organism, capable of being brought to a flourishing and permanent state of life, just as we bring an individual to such a state" (p. 56). To this end, useful "Town-planning" should grow into "Industry-planning" Acts, together culminating in "country-planning," or "the economic consideration and control not only of urban but of rural areas, for . . . in the

exercise of a science of corporate, or constructive, human geography, manufacture and agriculture, the workshop and the land must become reciprocal and complementary" (chap. iv.). This policy would involve national co-operation, and ultimately international also (chap. ix.).

Amongst the far-reaching consequences, Mr. Enock anticipates: scientific limitation to the growth of towns and the healthy "pruning and reconstruction" (chap. v.) of over-grown population-centres, with their nests of hunger, squalor, and disease; world-wide decentralisation of industry (chap. vi.); and the rehabilitation of native "arts and crafts" (chap. vii.), now rapidly disappearing or pathetically deteriorating under cut-throat competition of the unregulated growth of machine industry.

So much for the strength of a notable volume that courts a second study, though revealing thereby its weaknesses also.

In good faith we accept Mr. Enock's belief in the originality of his diagnosis and proposals. But his historical chapter (xv.: "The Failures of Utopias") with the book as a whole is, to one sympathetic reader at least, conclusive evidence of the insufficiency of his grasp of the work of predecessors and contemporaries; of failure or incapacity to think out fundamental principles systematically; and of inadequate assessment of human passions and financial factors.

Perhaps Mr. Enock is himself not wholly unaware of these serious defects: he mentions, frankly and often, serious difficulties, but only to pass them by on the ground—ill-chosen, we submit to him—that they are not substantially relevant.

In the spirit of his own "corporate" science we therefore venture this advice: Let the author conjoin with himself, or at least seek the frank criticism of one thinker expert in politico-economic history, and another versed in finance. And let him add a good index.

BENCHARA BRANFORD.

OUR BOOKSHELF.

Le Paludisme Macédonien. Par P. Armand-Delille, P. Abrami, G. Paisseau, et Henri Lemaire. (Collection Horizon Précis de Médecine et de Chirurgie de Guerre.) Pp. viii + 109. (Paris: Masson et Cie, 1917.) Price 4 francs.

THIS is a very lucid and terse description of the symptoms and treatment of malaria, based largely on experience of that malady among soldiers infected in Macedonia. The subject is treated after the method of many recent French writers, in that a sharp distinction is drawn between the symptoms of primary and secondary malaria. We doubt, however, the reality of the distinction, and if it exists, it practically is not of great import, for the fundamental treatment is always the same, viz. quinine. In one respect we consider the authors' mode of dealing with the subject is unsatisfactory: they discuss malaria as a whole. We believe, on the contrary, that the proper method is to determine first what species of parasite is present in the blood, and then to associate clinical observations with that species alone. That this is the sounder method is exemplified by the occurrence of comatose symptoms almost exclusively with the malignant tertian parasites, and other instances might be given.

In the section dealing with treatment, sufficient emphasis is not laid on the very important distinction between a temporary and a permanent cure. Any of the methods given in this book would suffice to secure the former, but none of them will, in the majority of cases, affect a real cure, *i.e.* the elimination of parasites from the system—*e.g.* in simple tertian malaria—at least in a reasonable time, say two to three months; for in longer periods generally *vis medicatrix naturae* alone will produce the desired result. That, however, a cure can, in the majority of cases, be effected by improved methods of quinine treatment, we believe experience of malaria in this war has shown. The student of malaria can with advantage study this book.

The Quest for Truth (Swarthmore Lecture). By Silvanus P. Thompson. Pp. 128. (London: Headley Bros., Ltd., 1917.) Price 1s.

"THE Quest for Truth" is a lecture given to the Society of Friends, of which the late Prof. Silvanus Thompson was a member; but it will be helpful to all who, like genuine students of science, put truth in the first place. Of that community any distinctive opinions are mentioned only in the latter part, and here an orthodox Churchman, though he could not admit that the Council of Nicæa decided "person" and "substance" to be the same, for the terms there used were the more adequate "hypostasis" and "ousia," and may think Prof. Thompson failed to apprehend the full significance of the "Virgin Birth," will welcome the catholicity of his creed. The earlier and larger part of the lecture deals with the methods and spirit demanded in all who undertake so toilsome a pilgrimage. Here is made clear the distinction between categorical and analogical truth, the moral obligation of truth-speaking, the evils consequent on neglecting it, and those which arise from the misuse or misunderstanding of words, from over-respect for authority, from carelessness and impatience in research, and other weaknesses of human nature—evils so patent at the present day in politics, in religion, sometimes even in science.

The quest for truth is never popular, for it is not that of the crowd, and the discovery of it is "not for him who is careless of truth in speech or deed, or in habit of mind. Neither is it for him whose thinking apparatus is in a state of confusion." Extremists in orthodoxy will doubtless place Prof. Thompson's book on their Index, and materialists will class him with the credulous; but others, and they not few, will welcome this little book as the legacy of an eminent student of science and a truly religious man.

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.]*

"Fascination" of Birds by a Snake.

I HAVE just received the following record of an observation made on September 19 by Capt. G. D. H. Carpenter, at Itigi, about 150 miles east of Tabora, on the Central Railway of late German East Africa. Capt. Carpenter's account recalls the behaviour of small birds to a cuckoo or an owl, and suggests that they were "mobbing" an enemy rather than fascinated by it. The observation may supply the clue to the interpretation of all cases of supposed "fascination" by snakes. EDWARD B. POULTON.

Oxford, November 24.

"Yesterday afternoon I witnessed what I have always found difficult to believe, namely, the strange 'fascination' of birds by a snake. I came upon a party of very pretty little finches hopping about among thick dead twigs of a fallen branch on the ground. I came on them quite suddenly from round another bush, and stopped dead when I saw them to watch them. Though I was within a couple of yards they did not fly away, but continued to hop about, all gradually coming closer and uttering faint chirps. I thought I had never seen such tame birds, and admired their beauty. While looking at the *birds* I quite missed an Elapine snake, which suddenly attracted my attention by striking at a hen finch just in front of me! It fluttered back a foot or two, and the snake got a mouthful of feathers among its teeth, which seemed to incommode it, for it went down among the thin grass at the foot of the clump of twigs, where I could still see it. The birds none of them made any attempt to get away, but actually several of them, including the one already struck at, hopped further down to get another look at the snake! The latter bird did show some signs of agitation, as every now and then she spread out her tail fanwise and kept on chirping, but still went nearer. However, after a bit the birds flew away one by one, without any excitement, and I crept up and found the snake had gone. I wished I had seen the snake before it struck, to see which way its head was pointing. Of course, I do not believe in the mesmeric theory, but it was *not* a question of a snake pursuing a victim which was too frightened to run away."

Pyrometers and Pyrometry.

I DESIRE to compliment you on the summary in NATURE of November 15 of the recent meeting of the Faraday Society on pyrometers and pyrometry; it is quite the best of the various summaries and accounts published in the technical Press.

With reference to the question of automatic control, I think it is only fair to the English pyrometer manufacturers to say that methods of the kind described by Mr. R. P. Brown, of Philadelphia, have been employed previously, using instruments of English manufacture. In my judgment the present position is rather that the instrument manufacturer is waiting on the furnace user. Heating processes, in the majority of cases, are not so far developed towards standardisation as to make any very extensive call for this automatic control. In the majority of cases an ordinary recording pyrometer, producing its record under the observation of the man controlling the furnace, achieves all that industries at present require; the shape and slope of the record line give the furnaceman a power of anticipating the temperature change which will take place in his furnace and of altering the firing accordingly.

CHAS. E. FOSTER.

Letchworth, Herts, November 19.

IRON-ORE DEPOSITS IN RELATION TO THE WAR.

THE *Fortnightly Review* for November contains an important article headed "Coal and Iron in War: The Importance of Alsace and Lorraine," which sets forth very clearly an aspect of the European war that has received far too little attention in this country, though its importance has been for some time fully recognised on the Continent. The article consists essentially of a statement as to one of the main causes of the origin of the war, and of a deduction showing the proper nature of the penalty that should be exacted from the originators. The contributory cause discussed is the intense desire of the German plutocratic group, the great German ironmasters, of which such firms as Krupp and the Deutscher Kaiser are representative, to obtain a monopoly of that vast deposit of iron ore which covers so large an area of Central Europe, and is known as "Minette." The writer in the *Fortnightly Review* rests his presentation of the case very largely upon the strong evidence contained in a memorandum submitted on May 20, 1915, by the six leading industrial and agricultural societies of Germany to the Chancellor, in which their requirements and demands in regard to the terms of peace are set forth. The most important of these in the present connection is the demand that Germany should retain possession of the French coast region as far as the Somme, because "by the acquisition of the line of the Meuse and of the French coast the iron-producing district of Briey, as well as the coal-fields of the north and of the Pas de Calais, would be acquired."

The *Fortnightly Review* has done valuable service to the nation in directing attention to this memorandum; if any evidence at all were needed to show that Germany was not forced into this war for self-defence, as Germans are so fond of alleging, but went into it deliberately for the sake of rapine and plunder, this document supplies it to the full, seeing that it specifies in detail the booty of which Germany was deliberately preparing to rob her neighbour, an act of robbery which would certainly have been consummated but for British intervention. The facts as to the importance of the Minette ores are well enough shown in the article referred to, but a full knowledge of all the circumstances makes the case even stronger. In the year 1911 a full account of the Minette iron-ore deposits appeared in the well-known German paper *Stahl und Eisen*, the figures given in which are most illuminating. It is stated that the area within which these ores are workable covers 70,000 to 80,000 hectares, of which French Lorraine possesses 40,000 to 50,000, German Lorraine 27,000 to 28,000, Luxemburg 2500, and Belgium only a

few hundred hectares, and estimates of the quantities of ore available are given as follows:—

French Lorraine ...	...	3100 million tons
German Lorraine ...	...	1841 „ „
Luxemburg	...	250 „ „
Total ...	...	5191 million tons

It may be added that the Briey basin alone, by far the most important of the French ore-fields, is estimated here to contain 2000 million tons, or more than the whole of the German deposits, and it is this particular basin that, as shown above, is the main objective of German rapacity.

There is, however, more in the question than appears even from the above figures of quantity of Minette; it is also a question of quality. The German writer of the article referred to admits that the Briey ore is at least 4 per cent. richer in iron than the Minette on the German side of the frontier, whilst other authorities put the difference at 6 per cent., averaging the German ore at 29 per cent. and the Briey ore at 35 per cent. of metallic iron. No ironmaster will need to be told that the advantage in favour of the French ore is of immense importance, and the German writer shows very clearly how great is the fear of French competition. "From the point of view of the domestic Minette-mining industry," he writes, "it would be a matter for sincere regret if in the German customs area [*i.e.* Germany proper and Luxemburg] the import of French ore were to increase more and more, thus displacing Minette of German origin."

The fear of French competition grew year by year, and in 1913 the same paper, *Stahl und Eisen*, pointed out that owing to the increasing production of the richer French ore, large portions of the Minette of German Lorraine would necessarily have to remain unworked. The anxiety of the plutocratic German ironmasters was becoming evident; they were gradually, by their methods of "peaceful penetration," getting a considerable financial control over the Briey ore-field, but these methods were too slow and too costly for their measureless greed, and they did not hesitate to sacrifice millions of human lives in order to effect their policy of rapine. So recently as October last a Pan-Germanist Leipzig paper was maintaining that Germany must not only keep Alsace-Lorraine, but must also annex the ore-fields of Longwy. It says:—

> Before the war France produced annually twenty-two million tons of ore, of which nine-tenths came from the Longwy basin, and Germany extracted annually from Lorraine twenty-one million tons, or, say, three-fourths of its entire output. If therefore Germany keeps the mines of France and of Lorraine, she would have available fifty million tons of iron ore yearly. She would then possess the monopoly of iron ore in Europe, which would furthermore assure continuous work and prosperity to the German working classes.

All this mass of evidence drives home the contention of the writer in the *Fortnightly Review*, and shows clearly how important the German ironmasters consider the ores of the Briey basin to be to them. The present war would have been impossible had not two British inventors, Messrs. Gilchrist and Thomas, shown how to convert phosphoric iron ores into good steel, incidentally also producing at the same time a slag of a high manurial value; having applied this process, which, by the way, was not discovered until after 1870, to the Minette in the portion of Lorraine already annexed, German ironmasters now want to grasp the rest of this valuable iron-ore deposit, the importance of which has been rendered evident through the basic steel process.

H. LOUIS.

SCIENCE, INDUSTRY, AND COMMERCE IN INDIA.

LITTLE more than ten years have come and gone since the suggestion was first made that lack of co-ordination, in the scientific departments of India, had often resulted in needless duplication, in useless departmental jealousies, and in the divorce of what may be called economic research from commerce and industry. Under Lord Curzon's enlightened guidance this *impasse* led to the formation of the Board of Scientific Advice for India. Since 1902 each year has witnessed important advances of a gratifying nature, so that it may be said that the annual reports of the Board, of which that for the year 1915-16 is before us, epitomise certain aspects of the scientific work accomplished in India.

The Government of India had previously tried the experiment of subsidising societies and institutions (both in India and England) with the view of delegating to them its responsibility in the matter of science research. This had the effect, not of encouraging the growth of science, but of degrading local scientific men into specimen collectors. The linking together, therefore, within India itself, of the chief scientific departments gave the strength of unity and the courage of public recognition. But has this very necessary reform been carried to its rational conclusion? The chief officers of the following departments constitute the Board: the Secretary of the Department of Revenue and Agriculture (*ex-officio* President of the Board), the Directors of Observatories, of Zoology, and of Surveys, the Principal of the Veterinary College, the Inspector-General of Forests, the Agricultural Adviser, the Directors of the Geological and Medical Services, the Secretary in the Public Works, and the Directors of the Indian Institute of Science and of the Botanical Survey.

But why is education not more directly and fully represented? Surely the utilisation of the chemical and physical laboratories of the universities, and of the services of the professors in charge of these, are obvious directions of economy and utility. So, again, one is tempted to ask, Why has statistics been overlooked? Still again, Why has the Director-General of Commercial Intelligence no seat on the Board? To the non-official mind the Department of Commerce and Industry should very possibly have a co-equal share with the Department of Revenue and Agriculture (and certainly a

stronger claim than that of the Public Works Department) to participate in the deliberations of the Board. But, leaving the great departments of State on one side, there are other very important interests that might with advantage be directly associated with State science, such as the chambers of commerce, the various associations of special trades and industries, the learned societies, the Industrial Conference, the superintendents of museums, the directors of industries, of engineering works, factories, foundries etc., and the experts in charge of the investigations into silk, cotton, jute, paper, timbers, dyes, tans, leather, tea, coffee, etc., both public and private—these and many others need opportunity, guidance, encouragement, or, it may be, direct help. The Board of Scientific Advice will not fulfil its programme of public service until it has designed a working plan that will link up all branches of industry with both official and private science research.

For some reason, unknown to the public, the old office, first designated that of the Reporter on Produce to the Secretary of State and then resident in London, and afterwards that of the Reporter on Economic Products to the Government of India and resident in India, has been abolished and its duties assumed apparently by the officers of economic branches in botany, zoology, geology, agriculture, and forestry. But this new arrangement, while it gains in official influence, fails in public advantage, since it loses touch very largely with commerce. To the merchant it is immaterial whether a resin, a medicine, or a fibre is of animal, vegetable, or mineral origin. If, therefore, he has to go from one State department to another in search of needed information, he may find his patience exhausted long before he has discovered the object of his quest. With a Reporter on Economic Products (and a commercial museum fully equipped with all products, whether of animal, vegetable, or mineral origin) attention could be focussed on the products themselves, not on departmental limitations. It is to be feared that this illustration exemplifies the danger that underlies much of the Indian departmental research, even when controlled by a central organisation such as that of the Board of Scientific Advice. The cart is put before the horse. The machinery is cumbrous and research made to supersede material, both in interest and value. Is the Board working so as finally to meet this position? Has it not even now been made evident that a bureau or exchange (call it by whatever name you please) may have to be reorganised so as to act as the Reporter on Economic Products did, as the intermediary between science and commerce in all departments?

It is scarcely necessary to classify research; there are obvious diversities according to the object aimed at—commercial, medical, veterinary, etc. Hence it follows that the field of operations covered by the Board of Scientific Advice is far wider than that of economics pure and simple, but it may perhaps be useful to concentrate attention on one issue, since it is more or less illustrative of the whole of the Board's activities. Is there any particular advantage in the report becoming a channel of publication for jottings, interesting no doubt, but often gleaned from papers and periodicals published throughout the world, instead of being confined to a fairly detailed Imperial review of the actual operations controlled by the Board? In place of jottings one is surely justified in looking for special chapters devoted, far more than they are, to narrating commercial and industrial requirements and setting forth the progress made with such previously agreed-upon subjects of investigation.

So, again, too much importance would appear to be attached to the compilation of lists of scientific papers, books, and periodicals. The report is thereby converted into a sort of advance proof of the catalogue of the Royal Society. Doubtless these classified lists, especially of extra-Indian publications, are useful to the various departments concerned, but they do not appear of sufficient importance to constitute so very distinct a feature of the annual report of the Board of Scientific Advice for India. Further enumerations of the names to new species of plants or animals, discovered during the year, scarcely amount to manifestations of scientific research. Systematic studies in the aggregate stand on quite a different platform from the mere mention of a few individual species, in themselves of no importance. Trivialities of this nature give the impression that the fundamental principles of research are being lost sight of, and possibly very largely so, through the reason set forth, namely, of science being divorced from commerce and industry.

PITFALLS OF METEOROLOGICAL PERIODICITIES.[1]

THERE is a real danger that some meteorologists, resenting the accusation frequently made against them of accumulating masses of data without making any real use of them, may be tempted to apply the processes of mathematical analysis to any and every set of observations, regardless of the considerations which limit the suitability of the method for the particular data proposed for analysis. This may easily be the case when hunting for periodicity. There is a great temptation, especially for anyone accustomed to the regularity of so many cosmic phenomena, such as eclipses, comets, planets, etc., to expect to find such periods recurring in the weather, but the work before us, consisting of the essential portions of a dissertation by Dr. Ryd, fortunately thought worthy by Capt. Ryder, director of the Danish Meteorological Institute, of a wider publication, and so included in the Communications of the Institute and done into intelligible English, should be studied before much time is spent in the search.

Dr. Ryd sets out clearly certain characteristics of meteorological data, wherein they differ essentially from, *e.g.*, astronomical data. One of these

[1] Publikationer fra Det Danske Meteorologiske Institut Meddelelser. No. 3, "On Computation of Meteorological Observations. By V. H. Ryd. (Copenhagen, 1917.)

is the impossibility of eliminating some forms of "systematic" error, which are too likely to be variable to be strictly systematic, such as the difference between the indications of a thermometer, under various conditions of exposure, and the real temperature of the air. Another is an error neither accidental nor systematic, but due to the fact that the data are meteorological; a good example of this is afforded by the mean diurnal variation of air temperature as shown on (*a*) overcast or (*b*) cloudless days.

Dr. Ryd regards harmonic analysis applied to such data as an excellent interpreter, but a very untrustworthy probe. The known periods—the day and the year—are unexceptionable, and the variation from hour to hour in one case, and from day to day, or preferably from "pentad" to "pentad," in the other, are obviously fit subjects for analysis. Dr. Ryd prefers to use both sine and cosine terms instead of the usual transformation, because the determination of mean error is more direct when two constants enter similarly. This is clearly important, as the mean error is a vital consideration. Analysis for testing a real period, such as one of the lunar periods, on the meteorological data is not quite so risky as tentative fishing for an unknown period, in which case at least one coefficient, according to Dr. Ryd, must be five times its probable error before it can be regarded as likely to be real.

The brochure is divided into two sections, the first dealing generally with such routine problems as the computation of the mean error, smoothing and adjustment of observational data, and harmonic analysis, with an additional chapter on secondary minima and maxima in the annual variation of the temperature, in which the author deals with the proverbial "Ice-men" of May 11, 12, and 13, and exposes the weakness of Dove's supposed proof of the reality of this legendary phenomenon. The second part deals fully with "mechanical" adjustment, factors of variation, and suggestions on the choice of adjusting formulæ, of which several are given, and a longer chapter is devoted to the working out of four concrete examples, viz. the hourly inequality of air temperature, Greenwich, 1849 to 1868; and of pressure, Greenwich, 1854 to 1873; the annual inequality of pressure, Batavia, 1876 to 1905; and the annual variation of temperature, Copenhagen, 1875 to 1910, the last being a case of partial data—only three observations at fixed hours of the day, instead of the full set.

Dr. Ryd reminds the reader that when data such as July air temperature for twenty years are entered in rows for days and in columns for years, they cannot be analysed similarly in both directions, inasmuch as the successive days are not independent, while the columns are. He also discusses at some length the "order" to which harmonic analysis, if used for adjustment, should be pushed, with hints for saving labour; but on the whole he prefers the "mechanical" adjustment with a suitable formula in the majority of cases, and thinks this method less liable to introduce new errors into a problem. W. W. B.

NOTES.

SIR ARCHIBALD GEIKIE, O.M., who has long been a correspondant of the Paris Academy of Sciences, has now been elected an associate member of the academy.

THE *Times* announces that the report of the Departmental Committee on salaries of teachers will be issued within the next few weeks. The report of Sir J. J. Thomson's committee on science teaching is also expected at an early date.

THE council of the Royal Meteorological Society has awarded Dr. H. R. Mill the Symons gold medal for 1918 "for distinguished work in connection with meteorological science." The medal will be presented to Dr. Mill at the annual meeting of the society in January next.

AT the meeting of the Chemical Society to be held on December 6, Dr. F. L. Pyman will deliver a lecture entitled "The Relation between Chemical Constitution and Physiological Action."

THE Hon. Sir Charles Parsons, member of council of the Institute of Metals, is to give the eighth annual May lecture before the institute next spring. He will deal with the subject of the formation of diamonds, with the artificial production of which he has been experimenting for more than thirty years.

THE death of Mr. Alexander Adamson is announced in *Engineering* for November 23. Mr. Adamson was born in Glasgow in 1846, and took a prominent part in the evolution of the modern Atlantic liner, and was later identified with the early stages of development of the Barrow works, now the most important naval armament and munition works in the kingdom. He served for some years on the council of the Institution of Naval Architects.

THE death is announced in the *Chemist and Druggist* of November 24 of Prof. Charles Caspari, jun., dean of the Department of Pharmacy in the University of Maryland, and Food and Drug Commissioner of the State of Maryland. Prof. Caspari's "Treatise on Pharmacy" is well known on this side of the Atlantic. In addition, Prof. Caspari was one of the editors of the U.S. Dispensatory and a member of the Revision Committee of the United States Pharmacopœia.

WE regret to note that *Engineering* for November 23 announces the death, from heart failure, of Mr. Peter Denny, a member of the Dumbarton family which has done so much work to establish shipping and marine engineering on a truly scientific basis. In this work Mr. Denny took an effective part, and also fulfilled in a marked degree those varied duties of an employer of labour connected particularly with the social life of the worker. Mr. Denny, who was in his sixty-fifth year, joined the Institution of Naval Architects in 1880.

AT the monthly meeting of the Zoological Society of London, held on November 21, it was stated that during the months of August, September, and October 281 additions had been made to the society's menagerie. Of these, perhaps the most interesting are a brindled gnu, from South Africa, and an anoa, from Celebes. Having regard to the times, one can scarcely be surprised at the announcement of a falling-off in receipts during 1917. From January 1 to October 31 this amounts to 3806*l*. Happily, the number of fellows elected and re-admitted shows an increase of thirteen, as compared with the corresponding period last year.

IN his presidential address to the Royal Statistical Society on November 20 Sir Bernard Mallet referred to the damage which the present war must inflict upon this and other nations. The United Kingdom has lost

by the fall in births more than 500,000 potential lives, while Germany during the same period has lost 2,600,000, and Hungary 1,500,000. At the outbreak of war the population of the Central Empires was about two and a half times as great as that of the United Kingdom, but their losses of births have been apparently ten times as great. The reason for this difference may be that while the poorer classes in this country have never experienced more favourable conditions, the Germans, if all indications are to be believed, have suffered to such an extent as to affect seriously the general health of the population. The infant mortality in Germany has been some 50 per cent. higher than in this country.

THE *Revue Scientifique* announces the death on November 4, at fifty-eight years of age, of Prof. R. Nicklès, professor of geology in the University of Nancy. Early in his career he investigated the geology of the provinces of Alicante and Valencia, in Spain, and in 1891 this was the subject of his doctoral thesis. He also published important memoirs on the Lower Cretaceous ammonites which he had collected in Spain. While professor at Nancy he collaborated with the Geological Survey of France, and devoted special attention to the coalfields buried under Mesozoic strata in Lorraine. By purely scientific work he was able to indicate the most likely spots for successful borings, and the result was the discovery of valuable coal-seams at a depth between 700 and 800 metres. Prof. Nicklès communicated several notes on this subject to the Academy of Sciences from 1905 to 1909, and the value of his researches was acknowledged by the Geological Society of France, which awarded to him the Gosselet prize in 1911.

BY the death early in November of Lieut. Cyril Green on the Palestine front a botanical career of much promise is cut short. Cyril Green was the youngest son of the late Rev. T. Mortimer Green, registrar of University College, Aberystwyth. At this college, where he studied botany under Prof. R. H. Yapp, he graduated in science in 1911, receiving a first class in botany honours. In 1912 he joined the staff of the Department of Botany at University College, London, where he showed marked abilities as a teacher. Green's investigations lay especially in the field of plant ecology, and included a detailed survey of Borth Bog, an area of no little botanical interest. He also worked at the physiological anatomy of water plants. Since the outbreak of the war he had been appointed head of the Department of Botany in the new Welsh National Museum at Cardiff, a position which was to have been held open for him until the conclusion of hostilities. Already before the war Green held a commission in the London University O.T.C., and was transferred to the Royal Sussex Regiment. Severely wounded in action in France in May, 1915, he was, on recovery, attached to an officers' cadet battalion as instructor. In June, 1917, he was sent to Egypt, and fell in action in the recent advance in Palestine. This Egyptian campaign had a special interest for Green, as it brought him in contact with a flora of which he had previously gained some knowledge in botanico-antiquarian studies carried out by him in connection with the Department of Egyptology at University College. The last correspondence received by his colleagues related to this flora. His brother, Capt. H. M. Green, of the Welsh Regiment, has been posted as missing since Suvla Bay.

THE proposed organisation of the clay industries, discussed at a meeting of employers at the Guildhall on November 23, would undoubtedly have a beneficial and far-reaching effect if properly carried out, as seems highly probable. The keynote of the speakers (among whom were Messrs. H. Lewis, J. H. Whitley, and G. J. Wardle) was cordial co-operation between capital and labour, with the ideal of substituting for the proved general inefficiency of individualism a sense of industrial solidarity for national service. Mr. Wardle intimated that the scheme does not propose to pool capital or profits, but rather technical knowledge, the inadequacy and restricted diffusion of which have been a very serious obstacle to British industry. Men of science long ago proclaimed this disadvantage, but their strenuous efforts to bring about an improvement failed almost entirely. Now, under the stress caused by a terrific world-conflict, a flood of new light has been thrown on many matters which used to be subjects for bitter controversy. Standardisation would unquestionably tend to check waste, but, as Mr. Wardle remarked, it must not stand in the way of invention and new processes. It is noteworthy that Mr. Lewis handsomely acknowledged that no grant of public money had been more usefully employed, or was likely to be productive of greater results in the future, than that voted for research purposes. This is certainly no less true of money provided for research in connection with the clay industries than of contributions made towards research in other directions.

PROF. LEONARD HILL has in Monday's *Times*, November 26, an interesting letter on scientific rationing. He points out that as a machine the efficiency of a man is about 25 per cent., three times as much heat being produced as external work done. During complete rest in bed, fasting, the energy spent in the internal work of the body is determined. This averages one Calorie per kilogram of body-weight per hour for all average people—about half the expenditure of the man doing light work. All unproductive people, idlers, old, and invalid, can save a large part of the food they eat by lying in bed warm and at rest. With regard to different classes of workers, the same measure of meat is not suitable for them all, because meat, far more than carbohydrate or fat, stimulates the living cells to live at a vigorous rate. Prof. Hill states that experience shows that the higher class of brain-workers, the organising and driving power of the nation (which must not be lessened), secures its energy most easily out of a diet containing a higher proportion of meat, and that carbohydrate is utilised very well by producers of mechanical work. He says that the Yapp ration, considering the difficulty of securing all the rationed foods, affords scarcely more than half the energy necessary for productive labour. "At current prices flour yields more than 700 Calories for a penny, meat and cheese about 100, margarine 300. To ration bread and flour, then, should be the last measure of emergency; the physiologist cannot conceive rationing these while luxury trades continue and fields are not fully cultivated or ships built to the utmost; while spirits are distilled from foodstuffs for munitions, and great stores of alcohol are left untouched; while the problem of transport of potatoes and swede turnips to the urban populations has not been solved; while shipping is not used to the maximal advantage to maintain the importation of cereals."

Fas est et ab hoste doceri. In an article on "A Central Bureau of Commercial Intelligence" in the November issue of *United Empire*, Major Cuthbert Christy urges us to follow the example of Germany in taking steps to turn to account with the least loss of time and energy the resources of the British Empire. The point which he chiefly insists on is what may be comprehensively described as the indexing of knowledge. The parts of the Empire that he has principally in view in making his present suggestions are those in Africa, especially tropical Africa. "The once 'Dark Continent,'" he says, "is certainly the richest of the

five, though the fact may be known to few, not only in mineral wealth, but also in agricultural possibilities, and must in the near future, when central and trans-African railways are constructed, become a field of vast undertakings, of thriving native industries, and perhaps the world's chief source of raw materials." What he would have in order to hasten the utilisation of these resources is, first, a central institution in London which, according to his ideas, would be merely a fuller development of the Imperial Institute on the lines of the Hamburg Colonial Institute, of which he gives an account, and, secondly, Colonial sub-centres which the chief centre would supply with abstracts of the voluminous information already collected. "It should be obvious that where the information and training are most useful is at the source of the raw material." For this idea also he acknowledges German origin, referring to his own experience at the fine botanical gardens and laboratories at Victoria, in the German Cameroon colony. All this seems well worthy of consideration, but we would add one suggestion, that the information thus collected and distributed should include, so far as possible, estimates of the cost of production of the Colonial commodities, expressed not merely in money, but also in amount of labour employed. Production per head is an even more important rubric than production per acre.

THE inaugural address on "Science and its Functions," delivered by the chairman, Mr. A. A. Campbell Swinton, at the Royal Society of Arts, on November 21, contained an appreciative reference to the work of Sir Henry Trueman Wood, who recently resigned the post of secretary of the society held by him for thirty-eight years. Mr. G. K. Menzies, who has been Sir Henry's assistant for the past nine years, succeeds him as secretary. The chairman then reviewed the progress of science in the past, showing that the most primitive peoples had applied a knowledge of natural laws in an elementary way in fashioning their weapons and implements. Later, in the kingdoms of Babylon, Assyria, and Egypt, and later in Greece, various sciences were studied, and the lecturer mentioned instances of their application to practical problems. Turning to more recent periods, he contrasted the condition of this country in 1754, the year in which the society was formed, with those prevailing to-day. The society was older than many familiar discoveries and inventions. Dealing with the problem of scientific education, Mr. Campbell Swinton pointed out that many of the greatest discoveries and inventions had been made in the past by men with little formal scientific training, and in fields quite outside their ordinary vocations. Thus James Watt was a maker of mathematical instruments, George Stephenson a colliery fireman, Arkwright a barber. Edison began life as a railway porter. Cavendish, Boyle, Sir William Herschel, and other great workers in the field of pure science might be described as gifted amateurs. No rigid distinction could be drawn between pure and applied science. Wireless telegraphy afforded a good instance of purely theoretical work leading to unforeseen vast practical results, and the same would doubtless apply to recent researches in molecular physics. Finally, the lecturer pointed out that the acquisition of wealth was not necessarily a disservice to humanity. Inventors and men of science by their discoveries created wealth, and in general received but a small fraction of the riches which their efforts conferred on the community.

IN the November issue of *Man* Mr. Harold Peak describes a figure recently acquired by the Borough of Newbury Museum. It is said to have been discovered at Silchester, and it has all the appearance of being contemporary with the Romano-British town of Calleva. It is of dark bronze, 12 cm. in height, and represents a male deity or Lar, standing erect, with the head surmounted by a sun with twelve rays. The right hand holds three ears of some grain, probably wheat, while the left, which is raised to the level of the shoulder, but with the elbow flexed, is bearing what seems to be a crescent moon attached to a handle. In the centre of the crescent is a small figure with two faces, the head surmounted by what appears to be a pair of short horns.

MR. N. W. THOMAS, in the November issue of *Man*, excusing the brevity of the account of secret societies in West Africa, published in his recent report, remarks that he was about to be initiated into the Poro Society, which is by no means banned by the Government, and carries on its rites with as little secrecy as a Masonic lodge, had he not been prevented by an order issued by a subordinate official to the chief forbidding him to allow Mr. Thomas to go near Poro, Bundu, or any other sacred bush. This case, now brought to the notice of the local Government, should lead to the reconsideration of such orders, which throw difficulties in the way of ethnographical investigations carried on by the official ethnologist.

MR. H. LING ROTH has issued in the second series of Bankfield Museum Notes, No. 9, the second part of his "Studies in Primitive Looms," this instalment being devoted to those of Africa. He finds no fewer than seven forms of loom in use in the continent: the vertical mat loom, the horizontal fixed heddle loom, the vertical cotton loom, the horizontal narrow band treadle loom, the pit treadle loom, the Mediterranean or Asiatic treadle loom, and the Carton loom. These forms are easily distinguishable, and occupy distinct areas, although in parts they overlap considerably. The most primitive of all the forms, the vertical mat loom, has a wide distribution, extending from the west coast to the east of the Great Congo Basin. The paper is lavishly illustrated by excellent sketches, and forms a valuable contribution to the study of the history of primitive weaving.

IN a paper in the *Geographical Journal* for November (vol. l., No. 5) Miss Newbigin discusses the relationships between race and nationality. After pointing out that the physical differentiæ of race, at least as they occur in the sub-races of Europe, are of little importance under modern conditions, Miss Newbigin maintains that man's power of adaptive response to his environment is incompatible with the view that the practice of a peculiar mode of life endows him with certain fixed characteristics, such as are cited by many writers as racial characteristics. Nationality is not permanent and unalterable. What makes a nation, according to the author's argument, is not only race, or religion, language, history, or tradition, but, partially at least, community of economic interests dependent upon geographic factors. One of the most important of these factors is the existence of an area capable of supporting a large population surrounded by one which becomes progressively less fitted to support such a population. Among nation-making factors she emphasises the existence side by side, within the belt favourable to population, of the most fertile lands, of those best fitted to form seats of industries, and of great nodal points focussing internal and external lines of communication.

IN May, 1903, Dr. C. Gorini, writing in the *Rendiconti del R. Istituto Lombardo* (vol. xxxvi., p. 601), directed attention to the property possessed by the bacillus of typhus and certain other bacteria of climbing up the surface of the agar used for the culture,

while other species failed to do so. This property was afterwards used by Choukevvich, Metchnikoff, and other bacteriologists for isolating the climbing species, notably Proteus, and separating them from others which do not possess the same power. In a recent number of the Lombardy *Rendiconti* (vol. xlix.), Dr. Gorini details further experiments on the method, and gives a general *résumé* of the observations of other writers bearing on the subject.

THE possibility of the transmission of plague by bed-bugs is the subject of an investigation by Lt.-Col. Cornwall and Asst.-Surg. Menon (*Indian Journ. Med. Research,* vol. v., No. 1, 1917). Their conclusion is that the likelihood of the transmission of human plague by bugs in biting under natural conditions is small. The reason for this is that though plague bacilli may survive in the stomach of the bug for nearly six weeks, bugs cannot regurgitate their stomach contents in the act of feeding. If, therefore, bugs transmit plague by biting, they must do so by washing out with the salivary secretion plague bacilli stranded in their sucking tubes, and the bacilli are unlikely to remain in the sucking tube for long after an infected feed.

AN important paper on the zoological position of the Sarcosporidia is contributed by Mr. Howard Crawley to the Proceedings of the Academy of Natural Sciences of Philadelphia (vol. lxvii., part 3). The author arrives at the conclusion that the Sarcosporidia are to be regarded, not as Neosporidia, but as Telosporidia, and as being nearly related to the Coccidiomorpha, a conclusion exactly opposite to that arrived at by Minchin, who regarded these parasites as nearly related to the Myxosporidia. But apart from problems of taxonomy, the author has much to say in regard to this group which is based upon original research, though he has failed to throw any further light on the migration of the product of the zygote into the muscle-cells.

THE skull of the lesser cachalot (*Kogia breviceps*) has recently been investigated by Dr. H. von Schulte, who records the results of his labour in the Bulletin of the American Museum of Natural History (vol. xxxvii., article xvii.). The material at his disposal comprised the skull of an adult female and that of a calf about two-thirds grown, and these are compared with those already described in other museums. The author finds that the cranium of Kogia is subject to a considerable degree of fluctuating variation, and that it is impossible to distinguish sexual characters therein. Finally, he holds that a comparison between the skulls of Kogia and Physeter shows the former to be the more highly specialised form, though both have deviated in different directions from the common ancestral type.

AN interesting account of the high alpine flora of the Upper Mekong in N.W. Yunnan is given by Mr. George Forrest in the *Gardeners' Chronicle* for October 27. Dwarf rhododendrons are the dominant feature of the region from 12,000 to 15,000 ft., forming a moorland vegetation very similar in appearance to our own heather moors. Of the 7000–8000 species of plants already collected by Mr. Forrest, fully 20 per cent. he estimates are rhododendrons. Their wealth, he writes, "is almost incredible . . . each individual seems to have a form or affinity on every range and divide differing essentially from the type." One of his new species, a shrub 1–2½ ft. high, bears masses of brilliant yellow flowers, and was found covering many acres of country.

Kew Bulletin Nos. 4 and 5, which are issued together, are almost entirely occupied by an account of the genus Strychnos in India and the East by the assistant-director. Ninety-two species are now known from this region, twenty-two being described in this paper for the first time. The genus is broken up into four sections on well-marked floral characters, and it is in the section with long-tubed flowers and large fruits that the economic species are to be found. *Strychnos Nux-vomica,* it is found, occurs wild, not only in South India and Ceylon, but also in Cochin-China. The plant from Burma and Siam formerly considered to belong to this species proves to be quite distinct, and is described as a new species under the name of *Strychnos Nux-blanda.* It is of interest that the seeds of this tree, which resemble those of the well-known Nux-vomica, contain practically no alkaloids. Another economic species, *S. Gautheriana,* from French Indo-China, about which much confusion has existed, has also been satisfactorily determined with the help of material at Paris. Several interesting questions of geographical distribution are raised in the introductory pages, and the paper is illustrated with text figures.

IN the *Agricultural Journal of India,* vol. xii., part iii., Messrs. J. H. Barnes and B. Ali give an account of investigations which demonstrate that the progress of reclamation of alkali soils can be effectively tested by measurements of the activity of the oxidising, nitrifying, and nitrogen-fixing bacteria in the soils. Mr. J. N. Sen contributes observations made at Pusa on the occurrence of infertile patches under trees, which indicate that numerous factors are involved, such as competition for light and food, production of toxins, and accumulation of soluble salts. Mr. H. E. Annett contributes the results of further experiments in the improvement of the date-palm sugar industry. The deterioration of the juice by fermentation during collection was found to be largely obviated by coating the earthenware collecting pots internally with lime. Metal buckets, as used in North America for maple juice, were found to be very unsatisfactory. The dark colour of the date-palm sugar (*gur*) was found to be due to the alkalinity of the fresh juice. When this was neutralised before concentrating the juice a very satisfactory light-coloured *gur* was obtained.

MR. T. A. JAGGAR, JUN., director of the Hawaiian Volcano Observatory, occupies sixty pages of the *American Journal of Science* (vol. xliv., p. 161, 1917) with an important and well-illustrated account of recent "Volcanologic Investigations at Kilauea," summarising much that has been published in the Bulletin of the observatory from time to time (compare NATURE, vol. xcviii., p. 436, and vol. c., p. 92). The large photographs of two aspects of Halemaumau, by Mr. Morihiro, of Hilo, are reproduced in a very impressive plate.

THE late Mr. Clement Reid's memoir on the Bournemouth district, published by the Geological Survey in 1898, was the result of his mapping of the superficial deposits; but Sir A. Geikie, as was stated in the preface, then looked forward to the issue of a more detailed account of this very interesting area. Mr. H. J. Osborne White has now prepared a second edition, which is practically a new work (Mem. Geol. Surv., Explanation of Sheet 329, 1917, price 2*s.*), as a guide to the colour-printed map which appeared in 1904. The observations and co-operation of Dr. W. T. Ord, of Bournemouth, have been largely utilised, and the gravels with Palæolithic implements receive just attention. They are regarded as the deposits of streams of much greater volume than those of modern Hampshire. The most effective passage in the memoir remains that in Sir A. Geikie's preface, where he com-

pares the Ordnance Survey map of "Bourne Mouth" in 1811 with that issued in 1893. The present geological map, with its colouring of the plateau gravels of Winton and Boscombe, and of the Bagshot Sands of Parkstone, affords a good explanation of the human development of the district.

ACCOMPANYING the main coal seams in some parts of England are often found seams of inferior coal substances. These frequently resemble cannel coal more or less closely, and are distinguished by giving a large proportion of a very voluminous ash, making them useless for ordinary fuel purposes. In some districts the carbonaceous portion, considered apart from the ash, is comparable in composition with that of a good coal, so that the substance contains a large amount of potential energy, which is at present wasted. Experiments have therefore been made in order to ascertain whether by low-temperature distillation of the waste coal any portion of this potential energy can be made available in the form of oil fuel or other valuable products. An account of these experiments is given by Mr. T. F. Winmill in the Journal of the Society of Chemical Industry for August 31. The main bulk of the liquid products obtained was a hydrocarbon oil of a new type, having a specific gravity of from 0·794 to 0·910, and boiling between the range 150° to 360° C.; it proves to be a mixture of unsaturated and polymethylene hydrocarbons. The only obvious use for the mixture is as a fuel oil. Unfortunately the experiments indicated that treatment of the coal as described would not in present circumstances be a commercially profitable process, the cheapness of the waste coal being more than offset by the fact that no residue of saleable coke is left.

IN a paper which appears in the Proceedings of the Royal Society of Edinburgh for the session 1916–17 Dr. John Aitken gives an account of his investigation of the nature of the nuclei present in air on which condensation of moisture occurs when the air is slightly supersaturated. The supersaturation is produced in the usual way by the expansion of the air by amounts which, in Dr. Aitken's apparatus, were 2, 4, 6, or 8 per cent. The smallest expansion causes condensation on the largest nuclei, and it is repeated until no further condensation occurs. Expansions of 4 per cent. then bring down smaller nuclei, and finally expansions of 8 per cent. bring down the smallest investigated by Dr. Aitken. All are much larger than the "small ions" requiring expansions of 25 per cent. to bring them down. Pure air has fewer nuclei of all kinds than polluted air, which, when freshly polluted by combustion or some other chemical process, has a great number of large nuclei, removable by a 2 per cent. expansion, and many requiring expansions up to 8 per cent. The smaller nuclei disappear faster than the larger. Many substances give off nuclei at ordinary temperatures, but heating facilitates the process, especially if chemical action occurs. Dr. Aitken takes exception to the use of the term ions for these nuclei, even when they are electrically charged.

SEVERAL aeronautical articles appear in the issue of the *Scientific American* for October 6. One article deals with the training of airmen in the States, and lays special emphasis upon the importance of the technical instruction which the men receive, enabling them to understand every detail of the mechanical equipment of their machines. A complete report is given of Capt. Hucks's paper on "A Further Three Years' Flying Experience"—noted recently in these columns. An article on "The Classification of Military Aeroplanes" is of some interest, but most of its contents is well known to those who follow aeronautical progress in this country. A short note on the use of kite balloons deserves comment, as these invaluable aids to artillery are seldom mentioned in our periodicals. Their greatest advantage lies in the fact that they are in direct telephonic communication with the battery for which they are "spotting," as the *Scientific American* duly points out. An excellent plate is given illustrating the leading types of German aeroplanes for 1917, together with a table giving their main dimensions, armament, and engine power. Among the shorter articles is one which informs us that America's first "Blimp" is now in commission. Another short note discusses the advantages of the tractor-pusher type of battleplane, a design in which a small car is mounted in front of the airscrew of a tractor machine, giving the gunner an excellent field of fire. This idea is not new, but has not hitherto met with much approval on account of the mechanical difficulties of supporting the forward car.

Engineering for November 23 contains an illustrated article on the armament of aeroplanes, in which reference is made to the arrangements whereby a machine-gun can be fired through the propeller. The German Fokker of 1915–16 had a fixed quick-firing gun mounted in this way, and combined with the engine, so that its firing synchronised with the working of the engine. This method has been adopted on most of the French and enemy machines. Illustrations of a Parabellum gun and also of a Maxim gun with the synchronising device attached are given in the article. The ammunition used by the Germans is also illustrated; the belt contains ordinary, perforating, incendiary, and explosive bullets. The incendiary bullets are hollow and filled with an incendiary material, the basis of which is phosphorus; these bullets produce a trail of light, the object of which is to fire airships and petrol tanks, and also to enable the gunner to correct his range. The perforating bullets consist of a hardened steel core surrounded by a German-silver cover. The belts contain about 10 or 15 per cent. of explosive bullets, the action of which is that of small explosive shells.

SINCE 1906, when Mr. Palin Elderton's useful volume on "Frequency Curves and Correlation" was published, many further advances have been made in statistical method, and the author has now issued an addendum (C. and E. Layton, 1917) with the idea of bringing the book up to date. The first part deals with the exceptional types of frequency-distribution derivable from Prof. Karl Pearson's differential equation, and the second and third parts describe briefly the calculation of a coefficient of correlation for a two-rowed table by Prof. Pearson's method and the correlation-ratio respectively. The pamphlet should be in the possession of all owners of the original work, a list of errata in which is also given. We have also received a reprint of a short paper on the coefficient of correlation by Mr. W. G. Reed, of the U.S. Weather Bureau, from the Quarterly Publications of the American Statistical Association. The paper gives illustrations of the calculation of the coefficient, and a bibliography of the literature. One illustration seems a little misleading, though it is given as a warning. The correlation between the phase of the moon and the height of high-water is found to be near zero. But the phase of the moon is measured by the number of days after full moon; if it were expressed as a periodic function the correlation would be high.

MR. V. C. SHIPPEE contributes to the *Chemical News* for November 2 an interesting note on pure sodium chloride. A specimen prepared by dissolving metallic sodium in distilled water, neutralising with pure hydrochloric acid, and precipitating with hydrogen chloride

contained a considerable amount of potassium salt as detected by the flame test. After four recrystallisations from distilled water, however, the purified salt contained only 0·01 per cent. of potassium chloride. A sample prepared and purified in the same way, except that caustic soda "pure by alcohol" was employed, contained 0·03 per cent. of potassium chloride, whilst four recrystallisations of a sample of "C.P." common salt gave a product containing 0·07 per cent. of the same impurity. The chief conclusion drawn is that although potassium chloride obstinately persists with sodium chloride, it can be removed by repeated recrystallisations.

A GREAT deal of information is contained in a paper on gas-firing boilers read by Mr. T. M. Hunter at the Institution of Electrical Engineers on November 22. Mr. Hunter believes that there is a great future for this method of firing boilers, despite the unfortunate experiences which have been the lot of many engineers in the past. Mr. Hunter's paper—which is almost a text-book on the subject—should assist engineers to understand and to obtain the proper conditions for economical gas-firing. In connection with the testing of results, the following extract is of interest:—"The apparatus for boiler control will cost a considerable amount, and it must not be overlooked that the best outfit of recording instruments is useless unless a constant and intelligent use of them is enforced absolutely. If, in addition to this, the boilermen and the man in charge of the boiler plant are given a premium for maintaining good results, boiler control will soon develop into a fine art, and prove an important source of revenue." We think that Mr. Hunter's remarks should be noted by owners of boilers. There are numerous cases where CO_2 recorders, pyrometers, etc., have been installed, and are practically ready for the scrap heap after a few weeks' life, when they have served much the same purpose as toys. On the other hand, if these instruments are kept in thorough working order, and if the workmen are taught to take an intelligent interest in their records, it is astonishing what improvements can be effected in the working of the plant.

WE have received a small booklet from Messrs. Watson and Sons (Electro-Medical), Ltd., of 196 Great Portland Street, W.1, entitled "The Sunic Record," dealing with some recent developments in the production of apparatus for the generation and application of X-rays. The work is edited by Mr. T. Thorne Baker, and is an interesting indication of present activity in the British electro-medical industry. In addition to the description of new apparatus the booklet contains an original article on the suppression of the "inverse" current in induction coils, notes on the X-ray examination of metal castings, radio-active paints, the Coolidge X-ray tube, reviews of books, etc. It is proposed to continue the publication monthly, and the proprietors undertake to send copies to those who will forward their names and addresses.

MESSRS. H. K. LEWIS AND CO., LTD., 136 Gower Street, W.C.1, have sent us a list of the new books and new editions added to their Medical and Scientific Circulating Library during July, August, and September. As the library contains upwards of 13,000 works dealing with medicine, surgery, astronomy, biology, botany, chemistry, electricity, engineering, geology, microscopy, mining, physics, philosophy, sociology, technology, voyages and travels, zoology, etc., and as any recent book of importance which may be applied for, if not already available, is added to it, it should be of great service to science workers. The list will be sent to any address on application.

OUR ASTRONOMICAL COLUMN.

THE TOTAL ECLIPSE OF THE SUN, JUNE 8, 1918.—The total eclipse of the sun on June 8, 1918, will be visible in the United States along a belt having a maximum breadth of sixty miles, extending from the State of Washington, through parts of Oregon, Wyoming, and Idaho, across Colorado and Kansas, and finally reaching Florida about sunset. The duration of totality will diminish from 2m. 2s. at the coast of Washington to less than half that amount in Florida. It is reported in *Science* (October 26) that Profs. Frost and Barnard have made a personal investigation of certain localities, and have decided upon Green River, Wyoming, as the principal station for the expedition from the Yerkes Observatory. Green River is situated between Cheyenne and Ogden, in the so-called Red Desert, and with a rainfall of about 10 in. per year, and an elevation of 6000 ft., it appears to be one of the most promising stations along the belt of totality. The transparency of the air on the day of the visit of the Yerkes astronomers is described as extraordinary. Denver is a possible observing station, but there appears to be some risk of cloud in the Colorado mountains on a June afternoon. It is probable, however, that a spectrograph from the Yerkes Observatory will be attached to the 20-in. equatorial of the University of Denver. Another site very favourably reported upon is near Matheson, Colorado, about sixty miles south-east of Denver, at an elevation of 6000 ft. On account of the war no British expeditions have been organised for observations of this eclipse.

REPORTS OF FRENCH OBSERVATORIES.—From the official report on the provincial observatories of France for 1916 it appears that a large amount of valuable work has been carried on, in spite of the serious depletions of staff which are recorded. Meridian observations, observations of minor planets and comets, and work connected with the astrographic chart of the heavens are prominent features of the reports. Considerable attention has also been devoted to terrestrial magnetism and meteorology. At Lyons M. Luizet has continued his important studies of short-period variables, and numerous observations of double stars have been made by M. Montangerand at Toulouse. The retirement of M. Coggia is announced by the director of the Marseilles Observatory; M. Coggia joined the staff of this observatory in 1866, and was the discoverer of seven comets, of which Comet VII. (1873) and Comet III. (1874) were especially notable.

STRUCTURE OF PLANETARY NEBULÆ.—An investigation of the internal movements and possible structure of the planetary nebulæ 6543 and 7009 of the N.G.C. has been made by Mr. W. K. Green (Lick Observatory Bulletin, No. 298). In each case several long-exposure photographs of the spectrum were taken with different orientations of the slit, so as to give the radial velocity at a large number of points. The central portion of each nebula gives direct evidence of rotation about the shorter axis, but the outer portions along the major axis seem to be rotating in the opposite direction, and some of the observed velocities follow no regular law. Photometric measurements of plates obtained with the Crossley reflector have been made, and curves are given showing the distribution of intensity along various diameters. Both sets of observations point to a rotating ellipsoidal shell as a possible form, but the luminosity curves which have been calculated for such forms are in disagreement with the observations as regards the major axis. An attempt is made to explain the reversal of direction of rotation at the outer ends by supposing that the central ellipsoid is surrounded by a fainter ellipsoidal shell or ring, which rotates in the opposite direction, but this hypothesis is not considered to be entirely satisfactory.

THE EDUCATION BILL.

THE important conference between representatives of the local education authorities and Mr. Fisher, President of the Board of Education, held in London on November 20, is indicative of the keen interest taken by responsible men in the Education Bill so far as its vital clauses are concerned. Mr. Fisher was not called from his high office as Vice-Chancellor of the University of Sheffield simply that he might promote a measure embodying certain changes in methods of educational procedure and administration, or to increase the bureaucratic powers of the Central Authority with some possible advance in the essential features of education, but in response to a growing and insistent demand, largely induced by the lessons of the fierce conflict in which we are engaged, which has thrown a lurid light upon the defects of our educational system, that Parliament should initiate a liberal measure of educational reform so complete and all-embracing that no child of the nation shall be allowed to escape from its fostering care, however insistent may be the demands of industry.

Mr. Fisher has enthusiastically responded to this demand, and by his speeches in and out of the House has aroused a deep and almost universal desire that his educational reforms, by no means rising to the height of his aspirations or fulfilling the ardent hopes of some educationists, should be given a chance of legislation. Unfortunately, the measure is weighted with certain provisions which, in the opinion of many persons jealous of the claims of local government, are likely to impede the initiative and sap the public spirit and independence of the local authorities. From the tenor of the interview mentioned above it is fairly clear that Mr. Fisher is prepared to go a long way to meet the criticisms offered so far as certain of the administrative clauses are concerned, and there is hope therefore that an agreed measure may result which will dispose of the excuse that the Government cannot find the necessary time for its discussion.

Many measures of reconstruction, to take effect after the war, are afoot, but most of them are likely to be futile of result in the absence of an educational measure of the character Mr. Fisher has placed before the nation. It is accordingly with warm approval that we note that an important body like the British Science Guild has on this ground approached the Prime Minister with a demand that facilities shall be given to enable the Bill, after due consideration and such amendments as may be found necessary, to become law in the course of the present session of Parliament. In all, 331 resolutions, of which 156 are from Labour organisations, have been received by the Government urging that the Bill should be pressed forward with all possible speed. The prospects of the Bill becoming an Act have, indeed, improved greatly during the past few days. On November 23 Mr. Fisher, in a speech at Brighton, declared that the Government intends to pass the Bill, and the Parliamentary correspondent of the *Times* says it is understood that the Government is prepared to consider favourably the giving of facilities for the Bill this session, provided that a guarantee is given that the debates in the House of Commons are limited to a specific number of Parliamentary days.

A large deputation, representative of all parties in the House of Commons, waited upon the Prime Minister on Monday to urge the importance of passing the Bill into law without delay. Mr. Lloyd George was unable to give any definite pledge, but he suggested that if the present session were prolonged it might be possible to take the Bill towards the end of the session, and if not, it would be given priority next session. It is possible, therefore, that the second reading will be taken before Christmas, and, in any case, the Bill is to be given precedence next session if it does not come on before.

MARINE BIOLOGY.

FOURTEEN papers, forming vol. xi. (1917, pp. 360), are issued from the Department of Marine Biology of the Carnegie Institution of Washington. Three papers record observations on the scyphomedusa, *Cassiopea xamachana*, which is common in shallow water near the laboratory at Tortugas, Florida. This medusa, which thrives well in aquaria, is accustomed in nature to a considerable range in salinity and in temperature, and, having commensal algal cells, is in some measure independent of the oxygen supply of the surrounding water. On removing, by means of two circular cuts, the peripheral region, including the sense-organs, and the central stomach, an annular piece of tissue is obtained which is paralysed (owing to removal of the sense-organs), but is capable of stimulation by an induction shock until a contraction wave going in one direction is entrapped in it. Such a wave may maintain itself for days with little change of rate provided the temperature, CO_2, salinity, and H-ion concentration of the sea-water remain constant. Such rings of tissue provide extremely favourable material for the study of variations in the rate of nerve-conduction in natural sea-water and in artificial sea-water solutions. Dr. A. G. Mayer concludes, after many experiments on these rings, that nerve-conduction is due to a chemical action involving the cations sodium, calcium, and potassium (magnesium is non-essential), the sodium and calcium combining with some proteid. The high temperature-coefficient of ionisation of this ion-proteid may account for the high temperature-coefficient of the rate of nerve-conduction.

Dr. L. R. Cary has carried out experiments to test the influence of the sense-organs of the medusa on metabolism and regeneration. The oral arms and stomach having been cut away, a strip of subumbrellar ectoderm, in which alone the nervous elements are contained, was removed along a diameter, and thus nervous connection between the halves of the disc prevented. Comparison of such insulated halves, in one of which the sense-organs were present, while in the other they had been removed, showed that the half-disc with sense-organs always regenerated more rapidly, especially in the early stages. The experiments indicate that the rate of regeneration is simply an expression of the general metabolic activity of an animal, and as such is subject to the influence of the nerve-centres Dr. S. Hatai gives an account of the composition of normal and starved medusæ.

Prof. E. N. Harvey describes experiments on, and discusses, the chemistry of light-production in animals. He has studied in detail a Japanese marine ostracod Crustacean, *Cypridina hilgendorfi*, in which light-giving material is formed in a gland opening near the mouth and, on agitation of the animal, is readily extruded as minute yellow globules which dissolve in water to a colourless solution. Oxygen is necessary for light-production, in which two substances—"photogenin" and "photophelein"—are shown to be concerned. Photogenin, present in the luminous gland cells, is colloidal, and probably a proteid. Photophelein, which is found in high concentration throughout the body of Cypridina, is crystalloidal and of unknown composition. One part of the gland in 1,700,000,000 of water will give visible light on the addition of photophelein. A similar photogenin-photophelein reaction was found in Japanese fireflies (Luciola). Mrs. Harvey records observations on Noctiluca, the luminescence of which is traceable to granules (photogenin) in the protoplasm, but photophelein could not be demonstrated.

Dr. A. J. Goldfarb has investigated the variability of the eggs of sea-urchins; Dr. H. L. Clark records the habits and reactions of a Comatulid (Tropiometra); Dr. A. L. Treadwell describes several new species of Poly-

chæta; Dr. H. E. Jordan gives an account of the structure of the striped muscle of Limulus, and also traces the embryonic history of the germ-cells of the loggerhead turtle from the emigration of the primordial germ-cells from the yolk-sac endoderm to their arrival in their final positions.

RESEARCH PAPERS FROM THE UNIVERSITY OF SYDNEY.

THE University of Sydney has recently issued (for private circulation) several volumes of reprints of papers by members of its staff and by its research students during the period 1909–16. It is clear that the University is doing its duty in contributing to scientific progress, and in training its best students in the methods of research. Thus in vol. A we have a list of upwards of sixty papers (twenty of which are included in this volume) ranging over the subjects of mathematics, physics, chemistry, agriculture, and engineering; and although, of course, they are of unequal value in the eyes of an expert, they are all concerned with genuine scientific problems, the solution of which means something more than a mere class exercise. One paper is of an exceptional kind, as dealing with a chapter of mathematical history. This is Prof. H. S. Carslaw's Napier commemorative lecture, which gives a clear and interesting account of what Napier's logarithms were (even yet this is often wrongly stated), and of the way in which they were calculated. The other papers are technical, and we must content ourselves with noting those in the complete list which obviously deal with specially Australian matters. These are: (1) Two papers on superannuation and pension funds; ; (2) one on the teaching of mathematics in Australia; (3) one on Australian coalfields and collieries; (4) one on the Hargreaves goldfield, N.S.W. None of these, however, appear in this volume, probably because the stock has been exhausted.

An interesting record of the activities in research of the anatomists and biologists of the University is contained in vol. i., series B. Unfortunately the volume is by no means complete, for of the fifty-seven papers which have actually been published during the period covered (1909–16) only twenty-eight are represented. This, however, is five more than we are led to expect from the table of contents, which is to that extent inaccurate. These papers represent the original research of a dozen different authors, and naturally range over a wide field, from pathological anatomy to zoogeography. The most distinctively Australian contributions are those dealing with the fauna of the great island-continent. The botanical side of biological science is but slightly represented, though we may expect to see a great advance in this direction now that a separate department of botany has been established in the University. A good many of the papers were originally published in English journals, and are already well known to workers in this country. Of the remainder, the Proceedings of the Linnean Society of New South Wales furnish a very large proportion. We may direct special attention to Mr. E. F. Hallmann's "Revision of the Monaxonid Sponges described as new in Lendenfeld's Catalogue of Sponges in the Australian Museum." Such a revision was greatly needed, for the catalogue in question is a singularly unsatisfactory piece of work. Mr. R. J. Tillyard's papers on dragonflies constitute a conspicuous feature of the volume and a very notable contribution to the study of this group of insects, which is dealt with from the different points of view of systematic zoology, geographical distribution, and physiology. We note that Messrs. Hallmann and Tillyard are, or were, both Linnean Mackay fellows in zoology. These fellowships have done much to promote the study of zoology in a country where an immense amount of work still remains to be done before our knowledge of the fauna can be placed upon a really satisfactory footing. The issue of this volume coincides with the retirement of Prof. Haswell from the chair of zoology, which he has so long held. He himself contributes four memoirs to the collection, and we hope that his valuable researches in Australian zoology will long be continued.

Series B, vol. ii., is concerned with geology, pathology, and physiology, the first-named science occupying by far the greatest portion. The papers include a series by W. N. Benson on the "Great Serpentine Belt of New South Wales," where the perennial subject of the connection between radiolarian cherts and pillow-lavas comes up for discussion in the case of rocks of Middle Devonian age. The association of frequent casts of Lepidodendron with radiolaria has raised interesting physiographic questions. The alluvial deposits of Copeton, N.S.W., containing tinstone and diamonds, have been worked since 1873, and Mr. L. A. Cotton has recorded (1914) a diamond in a quartz-dolerite of the district. He regards the basic magma as the true matrix, and does not suggest a derivation from underlying rocks. Prof. Edgeworth David has stimulated so much of the geological work in the University of Sydney that his address to the Australasian Association in 1913 seems very fittingly included in this volume. It deals with the influence of an Antarctic continent, varying in dimensions in geological time, on the climate of Australia, and attributes the cold Permo-Carboniferous conditions to the immense extension of land in the south of the southern hemisphere. Among the physiological papers is one of importance to chemists, by Mr. H. Wardlaw, on "The Accuracy of Neumann's Method for the Estimation of Phosphorus." Though this author's work has been largely concerned with milk, of human or other origin, he has found time for a specially Australian study on the variations of temperature in Echidna.

THE SURVEY OF INDIA.

THE Indian Survey Report for 1915–16 contains nothing of special interest either in the department of exploration or in that of science, but it is a good record of solid work carried out under the direction of Sir Sidney Burrard, curtailed in certain branches by the exigencies of war service, but on the whole a most satisfactory report. The progress made in the topographical mapping of the huge area of India in the ten years preceding 1916 shows that between one-fourth and one-fifth of that area has been completed on various scales and by various methods up to date, but one is left in doubt as to the comparative values of the revision necessary in the mapping of an older date than 1905. The whole of India (or very nearly the whole) must have been mapped by then, on scales which are much the same as those now adopted for various classes of land area. Surely very little revision is necessary in those barren areas (within the frontier) that were mapped on the smaller scales. On the other hand, much of the 1 in. per mile mapping must have required actual re-survey. The area remaining to be mapped amounts to 1·382767 square miles (or thereabouts?), so the Survey of India has still a career before it.

It is worthy of note that thirty-six "Imperial" officers have been withdrawn for active service, and that of that number no fewer than seven have already laid down their lives for their country. A survey party has been attached to the forces in Mesopotamia, and the result of its work will be of special interest, but otherwise no trans-frontier geo-

graphical work is reported. The trigonometrical branch has necessarily been curtailed in its activities, the scientific work of that branch (astronomical, magnetic, and tidal) making up its chief record, with but little reference to the extension of geodetic triangulation. In the department of map publication there has been great activity, the total number of maps published (626,329) during the year being in excess of that of the year previous. T. H. H.

MODERN DEVELOPMENTS OF THE GAS INDUSTRY.

OWING to sudden illness, Mr. W. B. Worthington asked at the end of October to be released from the duties of the presidency of the Institution of Civil Engineers. Mr. Harry Jones, who has been elected to succeed him, delivered the presidential address before the institution on November 6. Mr. Jones is the chairman of the High Explosives Committee, of which Lord Moulton is president, and is the first member of the gas engineering profession who has occupied the chair at the Institution of Civil Engineers. In his address he dealt with modern developments in gas practice, how far the practice has been making itself useful during the war, the fresh prospects it has in the coming time of peace, and, finally, the special qualification of the gas engineer and the work he has to do. Subjoined are extracts from the address.

There has come about in the work of the gas engineer an entire revolution. We used to be called "gas light companies," and the ancient Act of Parliament used to speak of "furnishing a luminous vapour." The revolution that I speak of is in the fact that the use of gas for direct lighting has become almost extinct, and there has been an enormous development of gas as pure fuel, both for domestic and trade purposes, as well as for motor-cars. So extensive has the growth been that it is estimated that, allowing for the use of incandescent mantle burners, not 5 per cent. of the whole output is now used for direct illumination.

The fuel and engine use varies as the towns are more or less industrial, but evidence is not wanting that that also is growing very rapidly. For instance, in the East of London the Royal Mint melts the whole of the coinage by gas furnaces, and Messrs. Rothschild's large refinery uses the same means of smelting. It is remarkable that the gas company which furnishes that supply, having made fuses for war purposes, was found to have by its furnaces melted the metal with such good effect as to produce an alloy so superior that the company has been specially asked to smelt metals on a large scale for the Munitions Department, and is now carrying out a considerable amount of smelting for that department, and you may be interested to learn that this is entirely done by women operators.

Sir Robert Hadfield has stated that in his Sheffield works he uses as much as 500,000,000 cub. ft. of gas per annum for smelting and metallurgical purposes, which represents the output of 45,000 tons of coal. Mr. Hanbury Thomas, the manager of the Sheffield Gas Company, has stated that his company has no fewer than 642 furnaces, consuming 372,000,000 cub. ft. of gas, at work in his district, while 15,116 h.p. gas engines consume 789,000,000 cub. ft. From Birmingham, Manchester, Glasgow, and, indeed, from all the manufacturing towns, we hear similar statements. For such purposes the cleanliness, flexibility, intensity of heat, and control of gas fuel must be very great considerations indeed. The effect of all these uses of gas has been to level the load factor and to remove the maximum demand peak from night-time in midwinter, which was formerly the time when people wanted special light, and often some heat; but to-day the midday cooking hour on a summer Sunday forms the peak in the industrial suburbs of London. There is no hour which demands so much gas as that particular hour on a July Sunday.

An important result of these extended uses of gas appliances has been their ready applicability to the rapid furnishing of munitions on emergency. Acknowledgment is due to makers of furnaces and stove plants for the aptitude and energy shown by them in forcing their output to meet the stress of war, in face of scarcity of materials and labour. Moreover, they have devised a great variety of useful and ingenious plant for facilitating processes of all kinds and for speeding up output, and these have been eagerly accepted by those engaged on munition works.

But, quite apart from general service of this kind, a special direct supply of high explosive material was effectively furnished at short notice in adequate quantities to the War Department, and, although I must not enlarge upon this, I have obtained Lord Moulton's permission to quote to you the full and generous recognition he has given publicly to these services of the gas industry. Among other complimentary and generous expressions he has stated:—"Without the direct aid of the gas industry, and, further than that, the assistance and the knowledge which have been acquired by those who devote their lives to it, it would have been perfectly impossible for this country to have waged the campaign of the last three years, or even for any but a trifling time resist the overwhelming floods of enemies that were poured upon it. When I first was asked to take charge of the manufacture and production of explosives, it took me but a few days to realise my absolute dependence on your great industry. My appeal to the leaders to assist me was made immediately. . . . The response has been so splendid that we have become, I might almost say, affluent where I expected nothing but pauperism, and gradually we have seen ourselves creeping up to an equality with the supplies that our enemies have been piling up year after year in anticipation of a war that they intended to bring upon us, until now I think that our anxiety in this department, which at first was probably the keenest anxiety of all, has passed away through your assistance."

The explanation of this graceful acknowledgment is that at the time the appeal was made there was in the hands of the gas engineer neither a process nor plant for the recovery of one special requirement. For the best process the plant foundations and housing wanted months for execution. But Dr. Carpenter found that by using our own tar as a solvent at a suitable temperature and diverting part of our existing plant from its normal use, the greater part of the recovery could be effected at once, and that, too, by gasworks below the scale justifying the special plant being erected. Lord Moulton sanctioned this departure, and within a fortnight some of us got going on the Carpenter process, and began to "deliver the goods," which were at that time very vital. So much has been needed since that we have mostly installed the more complete plant on large-scale works, but no profit at all is got out of this; moreover, the service of the chiefs of the staff for organising the co-operation of all the gas undertakings in this work has been furnished by the gas companies without any charge whatever to the Government, and many other accommodations have been gratuitously afforded.

The extended number and variety of processes arising in the prosecution of war service generally in the furnishing of munitions inevitably lead us to the consideration of how far these processes will help us in

times of peace in the future. Inevitably connected with the present distribution of gas as fuel, the chief residual, coke, though not valued as it deserves to be, is a useful smokeless fuel, and can be converted into water-gas, and so made use of as a fuel. Ammonia, when fixed by the acid from our sulphur, is of great value as a fertiliser, and is wanted everywhere for the land. Tar yields chiefly pitch, which is also a fuel, but is needed for the repair of our roads. It is also the parent of many useful by-products. In the past it has been almost a drug in the market, chiefly, it is feared, through our own supineness in allowing the recovery processes largely to leave this country, although the country itself is a large buyer of most of the developed products. The sub-products can, for simplicity, be shortly grouped as follows:—There are ten products which, by their energetic combustion, are capable of explosion for war or motor fuel; there are nineteen various colour dyes of great brilliancy; there are nine drugs and antiseptics, among which are saccharine and aspirin; there are eight perfumes and flavourings; there are ten salts of ammonia and cyanogen, and one sulphur for acid-making and fixing ammonia and cyanogen; altogether fifty-seven, and these may be brought out by further permutations into an almost endless number of interesting and probably, in the future, most valuable products. For war purposes the first ten products and the last eleven are especially useful; but I must not tell you how or why, at any rate at present.

Most of these products, such as the drugs and dyes, have sprung into unexpected importance lately, owing to the limitation of imports due to the war. Their manufacture previously had been very largely appropriated by the Germans, who bought the raw products extensively in this country. Now, more wisely, the larger gas undertakings and newly formed British companies are increasing their production at home.

When the full value of these products is realised under peace conditions steps must be taken to prevent —as has long been done in Germany—the inevitable loss of these values where raw coal is burned to destruction, as in ordinary grates and furnaces under steam boilers. To this end there are important inquiries going on into the question of the conservation of coal as a national asset.

With regard to the general question of the destruction of fuel and of meeting other general needs, considering the now universal demand for gas and coke fuel, pitch for roads, benzol for motor transport, and ammonia for the land, to say nothing of the lesser products, it is surely wise to distribute their production where the population exists, and it is clear that the existing supply of gas, as at present arranged, lends itself to that distribution, as the population lies around the works. This will be true also, in a less degree, of even scattered rural populations, as they eagerly avail themselves of gas as a fuel, the distribution of coal being difficult and expensive in such small quantities. Through the extended use of gas already a very large amount of coal has been displaced for domestic and trade use, to the great improvement of the atmosphere and to the cleanliness of buildings.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—The following doctorates have been conferred:—*D.Sc. in Chemistry:* Mr. W. H. Gibson, an internal student, of University College, for a thesis entitled "The Products of Nitration of Toluene." *D.Sc. in Geology:* Mr. C. B. Horwood, an external student, for a thesis entitled "The Gold Deposits of the Rand," and other papers. *D.Sc. in Physiology:* Dr. N. C. Lake, an external student, for a thesis entitled "Report upon an Investigation into the Effects of Cold upon the Body," and other papers.

BY his will the late Dr. Archibald Carmichael, who died in February of last year, has bequeathed the residue of his estate, subject to certain life-rents, to the University of Aberdeen. The value of the residue is estimated at about 12,000*l.*, and the income thereof may be applied "for the advancement of the work of the medical side of the said University in such manner and subject to such regulations as the Senatus Academicus of the same University may from time to time determine and think fit." The late Dr. Carmichael was a graduate of Aberdeen University.

THE Bureau of Education, India, has issued the seventh of its "Occasional Reports." It deals with the methods of school inspection in England, and is by Mr. H. G. Wyatt, inspector of schools in the Rawalpindi Division. There is much in the volume which will be of practical value in India, where the history of school instruction and of inspection has passed through phases similar to those in England. The respective functions of general and specialist inspectors are explained with considerable clearness, and the author points out that in India, where specialists are already being employed for certain subjects, such as science and handicraft, the chief lessons from the English experience are that the specialist should keep in close contact with the general territorial inspector and consult him in formulating his general recommendations; that he should see something of the general work of the school, and not confine his attention to his special subject. In the particular case of the inspection of secondary schools, Mr. Wyatt urges that the danger of specialist inspections is that they tend to disregard the aims and character of the school as a school, and consider it too much as an aggregate of classrooms. It is satisfactory to find that India has witnessed a revulsion from "grind" and from examination, and that inspection has ceased exclusively to regard the pupil and the results of instruction, and has tended to focus rather on the class and the teacher's methods.

A COPY has been received of an essay by Mr. Fletcher Durell on the "Reform of the Princeton University Curriculum," which was awarded the Philip Le Boutillier prize in February, 1916. Among other subjects discussed is the function of a college. The view generally held, the essay maintains, is that it is the principal aim of the secondary school to train the mind, so that it shall be a good working machine; that the leading function of the college is to have the pupil use his mind after it is thus trained so as to obtain a general world view; and that it is the essential aim of university education, or of other training subsequent to college work, to master some specialty or life-calling. In other words, after the school has laid the foundation, the college is to teach something about everything, and the university everything about something. But the functions of these three periods of education must overlap. During the secondary-school stage the pupil should assimilate large stores of varied information; at college the development of thought-power should continue, and as comprehensive a grasp as possible of the world's affairs should be secured. The American elective system of deciding a student's course of work is examined, and the treatment of the problem at Princeton University explained. The essay then suggests that to assist students in the choice of a faculty each department should work out a concise statement of the vital principles and most representative facts in its domain, and that in drawing up these statements attention should be directed to the efficiency or value aspects of the principles and facts. Princeton should,

Mr. Durell pleads, aim at developing in her sons the broadest scholarship and deepest general culture, and thus safeguard specialism from vagaries and develop it to the highest pitch.

WE have received a report on trade catalogues drawn up by the Technical and Commercial Libraries Committee of the Library Association. The report points out that much information of value to students of science is contained in these catalogues, and that therefore it is desirable that they should be collected and indexed in such a way that students may readily ascertain what new apparatus and inventions have been devised relating to the field of study in which they are working. The Library Association is of opinion that a National Lending Library of books suitable for giving assistance in scientific and industrial research would be of the greatest advantage to technologists. In such a library trade catalogues would hold an important place. It is pointed out that there are peculiar difficulties in indexing trade catalogues. They are seldom dated, and are therefore not easily identified, though the name of the firm by which they are issued can be given. Moreover, they are frequently without any precise description of their contents. The librarian would therefore find it necessary to call in the aid of scientific experts to help in the special indexing required. The report refers to the index to the collection of trade catalogues at the Department of Commercial Intelligence (foreign samples) published by the Board of Trade as an example of an alphabetical subject-index of such catalogues. In view of the special difficulties inherent in collecting and organising the literature of the trade catalogues, and with a view to the widest possible dissemination of the undoubtedly valuable information which these catalogues contain, the committee of the Library Association recommends that proposals be submitted to the leading professional societies and trade journals for the organisation of this class of literature on standardised lines, and possibly for the publication of periodical condensed catalogues of British manufacturing firms.

IN proposing his amendment to the Representation of the People Bill, which, as we recorded in our issue for November 15 (vol. c., p. 216), was adopted, giving separate Parliamentary representation with one seat to the University of London, Sir Philip Magnus gave the House of Commons some interesting details of the size and activities of the University. London University consists of a collection of colleges and special schools, about eighty in number, scattered over the County of London. It was founded in the year 1837, and for the past fifty years it has been represented in Parliament. It includes under its ægis three large and important classes of teaching institutions. First, there are the Incorporated Colleges, with endowments and other funds, administered by the Senate of the University. These comprise University College and King's College, each of which is a complete university in itself. The second group of teaching institutions, known as the "Schools of the University," are thirty-three in number, and include the Imperial College of Science and Technology and the School of Oriental Studies, both of which have been established to meet not only national, but also Imperial needs. Somewhat similar in its Imperial character is the School of Economics. But among these thirty-three schools of the University are the eleven medical schools attached to our hospitals, the Royal Holloway College, Bedford College for Women, and other institutions. The third class of teaching institutions, twenty-seven in number, include all our polytechnic schools, the laboratories of which are now rendering valuable help to the Ministry of Munitions. There is also the vast scheme of University Extension Lectures. In the session immediately preceding the war 135 courses of lectures were delivered on philosophy, economics, history, and other subjects, and were attended by 12,902 students. Attached to the University itself are more than 100 professors; and, in addition, there are 1200 recognised teachers; 21,000 members of the University are or have been serving in his Majesty's forces, and of these nearly 700 have already made the supreme sacrifice. At the General Election in December, 1910, the number of graduates who voted at the University of Oxford was 6895, at the University of Cambridge 7145, and at the University of London 6072. The number of graduates, therefore, who voted at the London election was only 823 fewer than those who voted for Oxford, which has the privilege of sending two members to Parliament. The total number of male London graduates is about 11,500.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 22.—Sir J. J. Thomson, president, in the chair.—C. H. **Browning** and R. **Sulbransen**: Bactericidal properties conferred on the blood by intravenous injections of diaminoacridine sulphate. Whereas antiseptic compounds are in general greatly reduced in their bactericidal activity by the presence of serum, it has been found that salts of 3 : 6-diaminoacridine, both unsubstituted and also various derivatives with methyl groups substituted in the amino-side-chains, or in the benzol-rings, or in both situations, are enhanced in their lethal action on bacteria by the presence of serum; this is also the case with the salt of 3 : 6-diamino-10-methylacridinium. The sulphate of 3 : 6-diaminoacridine has been found specially suitable for intravenous injection on account of its low toxicity. By means of an intravenous injection of diaminoacridine sulphate in a dose which had no harmful effect on the treated animal (rabbit), it has been possible to confer antiseptic properties on the blood so that the serum from a specimen of blood withdrawn as late as from two to two and a half hours after the treatment failed to yield a culture when inoculated with *Staphylococcus aureus* or *B. coli*.—W. D. **Lang**: The Pelmatoporinæ: an essay on the evolution of a group of Cretaceous Polyzoa. The evolution of this sub-family is considered in detail. In order to present the facts intelligibly, they are marshalled according to the following theoretical considerations:—The species lie along diverging lineages; towards the bases or proximal ends of these are forms (radicals) with less calcareous skeletal matter and less elaboration of structure, and these forms appeared earlier in geological time; towards their higher or distal ends are forms with more skeletal matter and more elaborate structure, appearing later in geological time. The evolutionary tendency was to deposit the increasing superfluity of calcium carbonate where it least interfered with the organism's bionomics, if possible in such position and shape as might even be useful to the organism. Sooner or later the race perished through being unable to cope with its constitutional and increasing habit of excessive secretion of calcium carbonate.

Geological Society, November 7.—Dr. Alfred Harker, president, in the chair.—Dr. F. **Oswald**: The Nimrud crater in Turkish Armenia. The Nimrud volcano, one of the largest craters in the world, is situated on the western shore of Lake Van, and was surveyed geologically for the first time by Dr. Oswald in 1898. The western half of the crater is occupied by a deep fresh-water lake, while the eastern half is composed of recent augite-rhyolites. The crater-wall is highest on

the north (9903 ft.). The southern wall only reaches the height of 9434 ft. The crater-wall has slipped down on the south-west to form a narrow shelf. The crater is nearly circular, and the lowest points lie on the long axis. The crater-wall has an external slope of 33° on the south and east. The history of the volcano may be summarised thus :—(1) Its forerunner was the Kerkur Dagh on its southern flank—a denuded mass of grey augite-trachyte. It was probably erupted in the Pliocene period, following the folding of the Armenian area, in which the latest folded rocks are of Miocene (Helvetian-Tortonian) age, consisting of limestones with corals and oysters. It came into existence at a period when the sedimentary rocks could no longer be folded, but were fractured along definite lines, and Nimrud is situated on the great fracture transverse to the Armenian folds at the apex of their bending round from the Antitauric to the Persian direction. (2) Numerous flows of augite-rhyolite built up the vast cone of the Nimrud Dagh, and the increasing pressure on the central vent became relieved by extrusions of augite-trachyte along radial fissures. (3) A presumably long period of inactivity was followed by violent explosions destroying the summit of the cone, and from this crater vast lava-flows of a fluid basalt flooded the country and filled up the valleys, which have since then been eroded a little below their former depth. (4) Further explosions widened the crater, in which a large lake was formed, while the eastern half of the crater became filled by a succession of outflows of augite-rhyolite. (5) The last eruption was recorded in 1441 by a contemporary chronicler, and resulted in the extrusion of a viscous augite-rhyolite along a north-to-south zone of weakness, both inside the Nimrud crater and also to the north. (6) A violent earthquake in 1881, which destroyed the village of Teghurt, was the last sign of activity: but earthquakes are still frequent in the Plain of Mush, and recent fault-scarps are visible along the borders of this faulted depression. Dr. Oswald has presented his model of the crater to the Museum of Practical Geology, and the rocks and slides to the British Museum, where his fossils from Armenia are preserved.

Physical Society, November 9.—Prof. C. V. Boys, president, in the chair.—C. R. **Darling** and A. W. **Grace**: The thermo-electric properties of fused metals. In a previous paper ("Proceedings," vol. xxix., part i.) the authors described experiments with bismuth, the apparatus then used only being capable of furnishing readings up to 560° C. Methods have now been devised in which the metals examined may be heated in the tube of an electric furnace, and observations made up to the temperature limit of the furnace. The metals experimented with were lead, tin, and antimony up to 1000° C., and zinc and cadmium up to temperatures approaching the boiling point. No change in thermo-electric properties was noticed at fusion, except in the case of antimony, which, like bismuth, shows an abrupt bend in the E.M.F.-temperature curve at the melting point, 632° C. This exceptional behaviour of antimony and bismuth is in keeping with the anomalous properties of these metals, both of which expand on solidification; and it is suggested that an allotropic change occurs at fusion in these metals. In the case of lead, which is used as the reference metal in thermo-electric diagrams, it is shown that extrapolation of lines in the diagram beyond 300° led to serious errors, and that although at low temperatures the E.M.F.-temperature curves are approximate parabolas, the departure from this shape above 300° is so marked as to render thermo-electric diagrams of little value.—T. **Smith** and Miss A. B. **Dale**: Triple cemented telescope objectives. The paper describes the four series of triple cemented thin telescope objectives which can be made from two kinds of glass, and determines their construction when first-order spherical aberration and coma are eliminated. The second-order spherical aberration and coma are then calculated, and the former found to be of the same sign for all optical glasses when the surfaces are spherical. The best standard attainable varies very little over a considerable range of glasses. Diagrams show the variations in the curvatures as the glasses are varied for refractive index and dispersion. Contrary to the general belief, it is found that the objectives with least second-order aberrations (absolute values) are not those with the least curvatures for their refracting surfaces.

Linnean Society, November 15.—Sir David Prain, president, in the chair.—Dr. D. H. **Scott**: Notes on Calamopitys, Unger. Calamopitys is a genus of fossil plants, with structure preserved, of Lower Carboniferous age; some species may perhaps go back to the Upper Devonian. The first part of the paper deals with the origin and division of the leaf-trace in *C. americana*. The relations of the five known species among themselves, and of the genus as a whole, are then considered.

Aristotelian Society, November 19.—Dr. H. Wildon Carr, president, in the chair.—Mrs. K. **Stephen**: Thought and intuition. An attempt to bring out the meaning of Bergson's theory of knowledge. Bergson confines his attention to knowledge of existence, and maintains that the best way of knowing existence is to be directly acquainted with it. Thought, which can only give knowledge *about*, is, according to him, a *pis aller*, and he only deals with it so far as it affects the actual experience which we get by acquaintance. Thought and acquaintance defeat one another. Nevertheless, in practice we try to carry on both operations together, and the result is our everyday experience of things having qualities and relations. This experience is a hybrid product. It still has some of the content of the original act of intuition, but whatever could not be used as material for thought has been left out of it, and it has borrowed the form which belongs to the symbols used by thought. It has been "intellectualised." As a new philosophical method, Bergson proposes that instead of limiting our attention to just so much of experience as provides material for thought, and instead of intellectualising our experience, we reverse our mental habits, make an effort to enlarge rather than to limit the whole field of experience with which intuition acquaints us, and attend to it directly without any intermediary.

Royal Meteorological Society, November 21.—Major H. G. Lyons, president, in the chair.—Dr. G. C. **Simpson**: The twelve-hourly barometer oscillation. (1) The existence of the twelve-hourly atmospheric vibrations, one parallel to the circles of latitude and the other parallel to the meridians, first suggested by A. Schmidt in 1890, and investigated by E. Alt in 1900, has been proved. (2) A mathematical expression for the amplitude and phase of each vibration containing the geographical position as the only variable has been obtained. (3) The interference of these two waves has been shown to account very completely for the observed variations in amplitude and phase of the twelve-hourly barometer oscillations, especially in high northern latitudes.—W. W. **Bryant**: Abnormal temperature, with special reference to the daily maximum air temperature at Greenwich. The author proposes that for certain meteorological elements a value shall be defined as "abnormal" if the departure from a well-established normal is at least twice the mean residual, both normal and residual being determined

by smoothing values from a long series of observations. He applies this method to the maximum air temperatures at Greenwich for the period 1841 to 1916, using the first sixty-five years as a standard. The limit thus calculated varies at different times of year from 8° to 12·5° F., so that a fixed limit of 10° would not be applicable. In the analysis it appears that one day in ten is abnormal, the proportion being higher in the months from May to October, and much lower in December and January. Additional tables deal with spells or alternations of heat and cold, and generally with the distribution of abnormal days. The principle is also extended to monthly and annual values, and the effect of a higher limit, three or four times the mean residual, is considered. The relatively hottest month in the period was June, 1846, and the coldest December, 1890, the hottest year 1868 and the coldest 1879.

CAMBRIDGE.

Philosophical Society, October 29.—Prof. Marr, president, in the chair.—G. H. **Hardy**: The convergence of certain multiple series.—G. N. **Watson**: Bessel functions of large order.—H. **Todd**: A particular case of a theorem of Dirichlet.—L. J. **Mordell**: Mr. Ramanujan's empirical expansions of modular functions.—Dr. A. **Kienast**: Extensions of Abel's theorem and its converses.

MANCHESTER.

Literary and Philosophical Society, November 13.—Mr. W. Thomson, president, in the chair.—Miss Constance **Lightbown**: The Siphonozooids of the sea-pens. The author made an investigation of the Siphonozooids of a large number of sea-pens to determine the presence or absence of the mesenteric filaments. It was found that these filaments are usually present in the fleshy forms, but absent in the slender ones. In species of Pennatula and Pteroeides which possess Mesozooids the mesenteric filaments are usually absent.—Dr. J. H. **Salter**: Regional distribution of the native flora of Teneriffe. Particular attention is directed to the evergreen character of the vegetation and the large proportion of shrubby or arborescent forms. The large number of endemic forms is due to the long isolation of the island from the African continent, and to the climatic conditions, which differ considerably from those of the adjacent continent. Among the Compositæ nearly 50 per cent. are endemic to the island, while in such genera as Senecio, Euphorbia, Sempervivum, and others the proportion is still higher. In the coastal region there is a definite foreshore vegetation of cosmopolitan character, including many Chenopodiaceæ (goosefoot family), with only two endemic forms belonging to the genus Beta. On the barren slopes above the foreshore is a desert-like vegetation, in some places ten kilometres in breadth, largely given up to Opuntia (prickly pear), formerly cultivated in connection with the cochineal industry, and now a serious pest in the island. The upper portion of the coastal region comprises all the more fertile portions of the island, and is mainly under cultivation with the aid of a system of water channels. Of the native plants, Sempervivum, Euphorbia, and Dracæna (dragon tree) are the most characteristic of this region, while certain xerophytic ferns, such as Notochlæna, Ceterach, and Cheilanthes, are also in evidence. The "cloud region," commencing at about 2500 ft., runs up to 5000 ft., the lower portion forming the characteristic "Monte Verde," while the last 1000 ft. constitute the "Pinar" (pine woods). The former consists of a transition from scrub to woodland, comprising several species of Cistus (rock-rose), *Erica arborea* (tree heath), *Ilex canariensis* (the native holly), *Myrica Faya* (the candleberry myrtle), and several forms of laurel. The higher-lying pine forests consist mainly of *Pinus canariensis*. Above the cloud belt vegetation is very scanty and mainly characterised by scattered bushes of the broom-like "retama" (*Spartocytisus nubigenus*). There is no true alpine vegetation, but, protected by the retama, several grasses and other plants of small stature are found to occur.

EDINBURGH.

Royal Society, November 5.—Dr. John Horne, president, in the chair.—Dr. J. **Horne**: Opening address: Science applied to industry. The president reviewed the work of the Committee of the Privy Council for Scientific and Industrial Research and of the Advisory Council during the past year. Reference was made to the appointment of a Fuel Research Board; and other administrative changes, such as have been proposed in reference to the Geological Survey, the fisheries, oceanography, geodesy, etc., were also noted among the signs of the times. A special appeal was made on behalf of Dr. Bruce's Oceanographical Laboratory, established for a number of years in Edinburgh, and now suffering lamentably from want of funds.—R. K. S. **Lim**: Period of survival of the shore-crab (*Carcinus maenas*) in distilled water. Shore-crabs survive a short time in fresh water, and the duration of survival is closely connected with the moult cycle. The harder the shell, the longer the period of survival. Examination of the immersed fluid showed the presence of salts which must have been derived from the animal before its death. Thus the survival depends upon the rate of loss of salts and the rate of intake of water, and these factors vary with the condition of the membranes, and therefore with the moult age.

SYDNEY.

Linnean Society of New South Wales, June.—Dr. H. G. Chapman, president, in the chair.—Dr. W. N. **Benson**: The geology and petrology of the Great Serpentine Belt of New South Wales. Part vi., General account of the geology and physiography of the western slopes of New England (concluded).—R. J. **Tillyard**: Studies in Australian Mecoptera. No. 1, The new family, Nannochoristidæ, with descriptions of a new genus and four new species; and an appendix descriptive of a new genus and species from New Zealand. With the exception of a single specimen from Ebor, N.S.W. (5000 ft.), all the representatives of this family were discovered in Tasmania, where they are to be obtained by sweeping the vegetation bordering lakes and small mountain-streams. The insects are of small size, and quite unlike other scorpion-flies in appearance; indeed, they might almost be described as "four-winged Diptera." The venation is much reduced for Mecoptera, and resembles that of the Diptera Brachycera in having R_{2+3}, a straight, unbranched vein. The head is globular, without a prominent beak; the mouth-parts are in a very interesting stage of evolution, the mandibles being absent or vestigial, the labium beginning to form a proboscis, with labellum, but no pseudotracheæ. Wishing to put the "Antarctic theory," as advocated by Hedley, to the test, co-types of the Tasmanian type-species were sent to correspondents in New Zealand, with a suggestion that similar insects should occur there. In reply, Mr. A. Philpott, of Invercargill, sent the pair of specimens herein described, which had been taken in 1913, and put by as "anomalous lacewings."

July.—Dr. H. G. Chapman, president, in the chair.—Dr. A. J. **Turner**: Revision of Australian Lepidoptera. Part vi. (first instalment), Nineteen genera of Australian Lepidoptera. Nineteen genera and forty-six species of the subfamily Boarmianæ, family Geometridæ, are reviewed.—T. G. **Sloane**: Description of a new tiger-beetle from the Northern Territory.—T. G. **Sloane**: The endo-skeleton of the head, the anterior coxæ, and the an-

terior coxal cavities in the families Carabidæ and Cicindelidæ (Coleoptera).

August 29.—Dr. H. G. Chapman, president, in the chair.—E. F. **Hallmann**: The genera Echinaxia and Rhabdosigma (Porifera). The genera were proposed in a recent paper, without definitions, for two species wrongly referred to Axinella and Sigmaxinella respectively. The definitions are now given, with remarks on the probable relationships of the two genera, and redescriptions of the type-species.—T. G. **Sloane**: Carabidæ from tropical Australia. Twenty-one species belonging to the tribes Scaritini, Harpalini, Odacanthini, Lebiini, and Helluonini are described as new. The Australian genera of the tribe Odacanthini, including four proposed as new, are tabulated.—Dr. A. J. **Turner**: Revision of Australian Lepidoptera. Part vi. (second instalment), Eighteen genera, and eighty-two species of the sub-family Boarmianæ, are discussed.

Royal Society of New South Wales, September 5.—J. H. **Maiden**: Notes on the genus Acacia, No. 111 (extra-tropical Western Australia). Several species are proposed as new to science (one on behalf of Mr. W. V. Fitzgerald), and also a new variety of *A. pyrifolia*. Several imperfectly known species are more fully described, and *A. chisholmi*, hitherto known only from Queensland, is shown to belong to Western Australia. The synonymy of certain species is elucidated, and additional information is given as to distribution and other points.

CAPE TOWN.

Royal Society of South Africa, September 26.—Dr. L. Péringuey, president, in the chair.—W. von **Bonde**: Note on the abnormal development of the genital organs of *Jasus lalandii*.—G. H. **Malan**: The colour-octahedron as a complexity: being suggestions towards a mathematics of colour. Developing certain ideas of Meinong, who contends that the possibility of representing certain well-known facts in connection with colour-psychology by a diagram in the form of an octahedron rests on the presence of certain *a priori* relations incidental to the very nature of colour itself, the writer is led to examine Meinong's contention critically in the light of modern mathematical logic (as expounded by B. Russell). The result of this examination is (1) to show that Meinong's theory, though true in its intention, is at fault in its practical conception of an *a priori* science of colour, and (2) to necessitate a more exact discrimination between the viewpoints of empirical psychology and mathematical science.—Miss A. M. **Bottomley**: A list of South African fungi. This paper is a systematic compilation, with indexes of all the South African fungi in the Government Mycological Herbarium. It records some 276 genera and 800 named species, some of the more important or more interesting of which are illustrated by photographs of actual specimens. Considerable space is occupied by the rusts, the perisporiales, and the pore fungi, three groups which are receiving particular attention in the mycological department.

BOOKS RECEIVED.

British Rainfall, 1916. By Dr. H. R. Mill and C. Salter. Pp. 256. (London: E. Stanford, Ltd.) 10*s*.

How to Collect and Dry Flowering Plants and Ferns. By H. S. Thompson. Pp. 56. (London: G. Routledge and Sons, Ltd.) 7*d*. net.

Lord Lister. By Sir R. Godlee, Bart. Pp. xix+676. (London: Macmillan and Co., Ltd.) 18*s*. net.

Vegetable Forcing. By R. L. Watts. Pp. xx+431. (New York: Orange Judd Co.) 2 dollars net.

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 29.

LINNEAN SOCIETY, at 5.—(1) Intensity and Direction of Light as Factors in Phototropism; (2) Spore-coloration in Agaricaceæ: Dr. Harold Wager.

FRIDAY, NOVEMBER 30.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—"Thomas Hawksley" Lecture; Heat Engines: Captain H. Riall Sankey.

SATURDAY, DECEMBER 1.

GEOLOGISTS' ASSOCIATION, at 3.—The Gold Coast: A. E. Kitson.

MONDAY, DECEMBER 3.

ROYAL SOCIETY OF ARTS, at 4.30.—Progress in the Metallurgy of Copper: Prof. H. C. H. Carpenter.

ARISTOTELIAN SOCIETY, at 8.—The Development of Criticism: F. C. Bartlett.

VICTORIA INSTITUTE, at 4.30.—Prehistoric Man: his Antiquity and Characteristics: W. Dale.

TUESDAY, DECEMBER 4.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—Presidential Address: The Economics of Coal Production: Prof. H. Louis.

INSTITUTION OF CIVIL ENGINEERS, at 5.30.—Recent Developments in By-product Coking: G. B. Walker.

WEDNESDAY, DECEMBER 5.

GEOLOGICAL SOCIETY, at 5.30.

ENTOMOLOGICAL SOCIETY, at 8.

ROYAL SOCIETY OF ARTS, at 4.30.—Inaugural Trueman Wood Lecture: Discovery and Invention: Sir Dugald Clerk, K.B.E.

SOCIETY OF PUBLIC ANALYSTS, at 5.—The Valenta Number as a Discriminative Test for Oils and Fats: P. J. Fryer and F. E. Weston.—The Composition of Sharps and Bran: H. E. Cox.—Notes on Porcelain: W. T. Burgess.—Note on the Colorimetric Estimation of Iron: E. R. Dovey.

THURSDAY, DECEMBER 6.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Series of Legendre: Prof. W. H. Young.—The Discharge of Gases under High Pressures: L. Hartshorn.—The Electrostatic Problem of a Conducting Sphere as a Spherical Cavity: Dr. Alexander Russell.—The Zeroes of Bessel Functions: Prof. G. N. Watson.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Electrical Cooking as applied to Large Kitchens: W. A. Gillott.

CHEMICAL SOCIETY, at 8.—The Relation between Chemical Constitution and Physiological Action: Dr. F. L. Pyman.

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