NATURE

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

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For other Official Advertisements see pages cxxii *and* cxxvi.

THURSDAY, DECEMBER 19, 1918.

CHEMICAL INDUSTRY, NOW AND HEREAFTER.

Reports of the Progress of Applied Chemistry. Vol. ii., 1917. Pp. 536. (London: The Society of Chemical Industry, n.d.) Price 6*s.* 6*d.*

THE annual reports of the Society of Chemical Industry on the progress of applied chemistry ought to be, and no doubt are, much appreciated by all who are concerned in the development and extension of applied science. Next to the institution of their journal, no action of the society will more directly conduce to the interests of that branch of human activity which it is their special function to advance. These reports seek to bring to a focus, as it were, year after year, all additions to knowledge and to practice in the various departments of applied chemistry, as grouped in the fortnightly issues of the journal of the society. This journal was originally made up of (1) original contributions to the different local sections; (2) abstracts of papers bearing upon technical chemistry published elsewhere; (3) abstracts of chemical patent literature; and (4) reports of the annual meetings of the society, with occasional editorial reviews and notices on subjects of general interest to industrial chemists. During the present year this last item has been considerably enlarged, and placed under special direction. It is an extension, in fact, of the society's activities, and the element of "news" thereby imparted to the journal will presumably increase the number of its regular readers and add to its popularity. It is, however, mainly upon the sections of the journal as hitherto constituted that these annual reports will continue to be based. The journal itself is so admirably indexed that at first sight it might seem that these *aperçus* are in great measure superfluous. If they were simply amplified indexes—mere *catalogues raisonnés*—their value would be very limited. But the fact that each section has been entrusted to men of knowledge and discrimination, identified with and professionally interested in the subject with which they are concerned, puts a particular value on the whole work and stamps it with a special utility.

The present issue, dealing with the work of 1917, is the second volume in the series. The first volume suffered to some extent from the fact that it was the initial number. It was a new venture, and experience was needed in order to secure a reasonably high standard, comprehensiveness, and uniformity of treatment. A comparison of this volume with its predecessor shows that this to a large extent has been gained, and that the general lines of the work have now been satisfactorily settled. The new volume has been enlarged by the inclusion of several subjects which were not specially dealt with in vol. i., viz. "Plant and Machinery"; "Fibres, Textiles, Cellulose, and Paper"; "Bleaching"; "Dyeing"; "Printing and Finishing"; "Metallurgy of Iron and Steel"; "Metallurgy of the Non-ferrous Metals"; "Sugars, Starches, and Gums"; and "Electrochemistry." This to a large extent, although not wholly, accounts for the increased size of vol. ii. Some of the reports—*e.g.* that by Prof. Morgan on "Colouring Matters and Dyes," and that by Mr. Ling on "Fermentation Industries"—have been considerably enlarged. But in the main the space needed for the treatment of the several sections is substantially the same in the two volumes, which seems to indicate that, in spite of the prolongation of the war, the activity of chemical industry as a whole, as indicated by additions to the literature of chemical technology, suffered no marked diminution, although particular departments were no doubt affected.

A valuable feature of these reports, which might have been more uniformly adopted, is the short, comprehensive introduction to their particular section in which certain authors review the more striking indications of change or progress during the twelve months which have elapsed since the previous reports were published. It is here that the knowledge, judgment, and critical skill of the reporter are needed, and it is the judicious exercise of these attributes that serves to differentiate him from the mere compiler. Your wisest clerk, as Queen Elizabeth, quoting Chaucer, once said, is not always your wisest man. It requires a certain *flair*, not always possessed by the bookish man, however wide his reading, to discern the true inwardness and trend of a movement, and it is not to be expected that all who contribute to this work should possess this faculty in equal degree. No doubt certain branches of chemical industry move slowly, and years are needed to perceive that any substantial change has overtaken them. Nevertheless, each branch affects, to a greater or less degree, every other, and processes, methods, and machinery and modes of management are transferred from one to the other. It is thus that the Society of Chemical Industry, through its journal and its annual reports, influences the progress of the chemical arts as a whole, and it is for this reason that we shall continue to welcome each successive sign of its publishing activities.

As was to be expected, the general character of the reports is affected, to a greater or less extent, by the war, and most of the contributors have something to say as to its influence upon the industries with which they are concerned. Although, of course, there are exceptions, it cannot be said that the war, on the whole, has adversely affected the future of chemical industry in this country. On the contrary, under the stress of necessity, it has given an impetus in certain directions that will be maintained. New industries have been started, and old ones invigorated and extended, and it can scarcely be doubted that with the establishment of peace and the resumption of undisturbed oversea communications a new era of prosperity will dawn upon chemical industry. It is perfectly obvious that Germany has experienced a great set-back, and it may be

doubted whether she will ever again attain the ascendancy in certain departments which she has now sacrificed by her unscrupulous greed, bad faith, and insatiable rapacity. It now rests with the manufacturers and workers in this country to determine how far they mean to share that prosperity with America and Japan.

MODERN DEVELOPMENTS IN METALLURGY.

(1) *Ingots and Ingot Moulds.* By A. W. Brearley and H. Brearley. Pp. xv+218. (London: Longmans, Green, and Co., 1918.) Price 16*s.* net.

(2) *Industrial Electro-metallurgy, including Electrolytic and Electro-thermal Processes.* By Dr. E. K. Rideal. Pp. xii+247. ("Industrial Chemistry.") (London: Baillière, Tindall, and Cox, 1918.) Price 7*s.* 6*d.* net.

(1) THE authors of this book are respectively the steel-maker and works manager at one of the large Sheffield steel works, and their book is dedicated to the workmen in appreciation of their efforts to reach the ideal in actual work. They state that a considerable part of it was prepared for teaching purposes, and that the manuscript sheets have been freely criticised by men whose business it is to make steel ingots. As they point out, there is no way of studying the conditions which lead to the production of good and bad ingots more instructive than that of making ingots themselves, according to well-defined variations of the processes of ingot-making, and cutting or breaking them in order to observe their qualities. In former days a good opportunity for such observations was enjoyed at negligible cost by the crucible steel melter, when ingots were "topped" down until the pipe or other evidences of unsoundness were broken away. Such a man knew what the conditions of casting were; he was familiar with the state of the ingot mould; he saw daily perhaps from twenty to forty ingots "topped" down to nearly half their length, and his eye was trained to notice minute differences in the appearance of the fractured surfaces. Such opportunities scarcely exist to-day, because ingots are only rarely "topped."

Undoubtedly the most trustworthy way of ascertaining the changes which occur in the casting, freezing, and cooling of steel ingots would be to experiment with the steel itself. Such a method, however, involves a costly plant and an expensive material which would require handling by an experienced person. The authors, therefore, set about discovering a material which is considerably more manageable, and they finally fixed on stearin wax, which, they maintain, exhibits a close resemblance to steel in much of its behaviour. They say: "With a few pounds of stearin, a pan of water, a beaker, a Bunsen burner, a spirit lamp, a few tin moulds, and a lot of patience, a great number of observations can be made to illustrate, extend, and also in some respects to correct prevailing notions about steel ingots"; and one of the objects of their book is to commend the use of stearin for teaching purposes and to show how it may be applied to elucidate many of the difficulties relating to ingots and ingot moulds. By its aid they have studied the formation of pipe and secondary shrinkage cavities, the influence exerted on these by the shape and dimensions of the mould, the advantage or otherwise of feeder heads, the influence of casting temperatures on the soundness and strength of the ingots, and the location and effects of segregation. Their use of stearin has been freely criticised by other steel experts, but it appears to the present writer that the authors realise the limitations of the use of this material, and it is difficult to be otherwise than favourably impressed by the confession in their preface that they are "less confident than formerly that they are qualified to elucidate the art of ingot-making."

The book deals with the following subjects: (1) Crystalline structure and its effects; (2) shrinkage and contraction cavities; (3) casting temperatures; (4) ingot moulds; (5) methods of casting; (6) sound ingots; (7) blowholes; (8) segregation; (9) slag occlusions; (10) influence of ingot defects on forged steel. It is well written, plentifully illustrated, and deserving of careful study by those who desire to familiarise themselves with the subject.

(2) Dr. Rideal's book gives in succinct and well-written form an outline of modern industrial electro-metallurgy; in fact, the scope of the work is even wider than the title suggests, for three out of its eight sections deal with products which are not metallic. After a brief scientific introduction the author deals with electrolysis first in aqueous solutions, and then in fused electrolytes. Then follows a brief section on the electrolytic preparation of the rarer metals, succeeded by one on electro-thermal processes, in which, as the title indicates, only the heat generated by an electric current is used in the extraction of the metal. After this comes a section on the preparation of carborundum, and the oxy-silicides of carbon, the carbides, and the electro-thermal fixation of nitrogen by metals and metallic compounds. The concluding section deals with iron and the ferro-alloys. Electro-metallurgy has undergone very important technical developments in recent years, and Dr. Rideal is to be warmly commended for his attempt to indicate the limits and the possibilities of the application of electrolytic and electro-thermal methods in the industry.

H. C. H. C.

A NATURAL HISTORY OF PHEASANTS.

A Monograph of the Pheasants. By William Beebe. In four volumes. Vol. i. Pp. xlix+198. (Published in England under the auspices of the New York Zoological Society by Witherby and Co., London, 1918.) Price 12*l.* 10*s.* per volume.

THIS stately volume is the first of four to be devoted to the life-histories of the beautiful and interesting birds included in the pheasant family. Its outstanding merits are the beauty of

its plates, which are charmingly reproduced direct from drawings by the best bird artists of the day, the extensive series of photogravures engraved from the author's photographs of the haunts of the various species, and the graphic and popular descriptions of their habits from studies made amid their native wilds. These and other features render the work far in advance of all other books written on the subject, and make it welcome alike to the ornithologist, the aviculturist, and the sportsman.

In order to carry out the author's ideals of what a monograph should be, an expedition was organised to visit the metropolis of pheasantdom in temperate and tropical Asia, where, in Ceylon, India, Burma, China, Japan, the Malay States, Borneo, and Java, seventeen months in all were spent. That such an expedition should have been possible was due to the generosity of Col. Anthony R. Kuser, of Bernardsville, New Jersey, to whom and his wife the work is fittingly dedicated. But this is not all. With the view of supplementing first-hand knowledge, Mr. Beebe visited a number of the leading museums in Europe in order to study specimens in their cabinets and to consult their libraries.

The scope of the work may well be described as exhaustive. The introduction embraces a general account, including the historical aspect of the subject from the earliest times, classification, distribution, comparative abundance, voice, flight and gait, daily round of life (food, roosts, friends and foes), protective coloration, home life, and relation to man. Under the last heading it is distressing to learn that even in their remote haunts amid the highest mountains of the Old World these birds, mainly from the remarkable beauty of their plumage, are rapidly becoming extinct through persecution. Mr. Beebe tells us that for many years they have paid a heavy toll to the millinery trade. It is known, for example, that some years ago 45,000 Impeyan pheasants had been slaughtered; Mr. Beebe himself has seen huge bales of feathers of the silver pheasant, and Nepal and China still export large quantities. Now that the Chinese have adopted a meat diet, pheasants are no longer immune, save where Buddhists and Hindus hold sway, and they are everywhere trapped, snared, pierced with poisoned arrows from crossbow or blowpipe, or slain by repeating shot-guns. It is gratifying to know that in the British-governed regions they are protected by well-regulated game laws, and the brooding hens and chicks are free from persecution. In this connection it is important to learn that the birds do very little damage to crops, and when they appear among them it is insect life which is the main attraction.

As regards the classification of the family, the grouping of the numerous genera under sub-families has never been satisfactory. Mr. Beebe, however, after much careful study, discovered a new character—namely, the "regular sequence in the moulting of the tail feathers," which holds good throughout the life of the bird, and agrees also with "assumed relationships which had hitherto been taken for granted." The following are the sub-families adopted: Perdicinæ, Phasianinæ, Argusianinæ, and Pavoninæ; and the various genera grouped under them are indicated. Since our author includes the Perdicinæ in his scheme, yet treats of only two of its genera, namely, Ithagenes and Tragopan, omitting many others, the work can scarcely be regarded as a complete treatise of "The Pheasants of the World." It will deal, however, with nearly one hundred forms.

The systematic treatment of the subject is on the same exhaustive lines. The volume already issued treats of twenty-one species: the blood pheasants (Ithagenes), the Tragopans or horned pheasants (Tragopan), the Impeyans (Impeyanus), and the eared pheasants (Crossoptilon). For each of these species are given the generic and specific characters; scientific, English, native, French, and German names; full descriptions of the various stages of plumage, moults, variation, hybrids, parasites, internal anatomy, characteristics as observed in their haunts, geographical distribution, migrations, food, nests and eggs. It is embellished with twenty-two coloured plates by Messrs. A. Thorburn, G. E. Lodge, C. R. Knight, and H. Gronvold, fifteen photogravures, and five maps. The volume is sumptuous in all respects except the binding, which does not come up to the standard of the rest.

While Mr. Beebe's fine work merits the highest praise, it is greatly to be regretted that its price (50*l.*) places it beyond the reach of the vast majority of those who would appreciate and use it. W. E. C.

OUR BOOKSHELF.

An Elementary Treatise on Curve Tracing. By Dr. P. Frost. Fourth edition, revised by Dr. R. J. T. Bell. Pp. xvi+210. (London: Macmillan and Co., Ltd., 1918.) Price 12*s.* 6*d.* net.

EVERY mathematician will welcome this new edition of a classical work if only as an indication that the demand for it has not diminished since it was originally published, forty-six years ago. Although the modern tendency is away from the excessive zeal for examples and exercises of a past generation, the mathematical student will derive much benefit from excursions on this "very pleasant path, on which he may exercise in an agreeable way all his mathematical limbs," especially as curve plotting is a necessity in all branches of modern science. A valuable feature of the book is the sketch of the inverse process of finding the equation of a curve the graph of which is given. Further work on this branch of the subject would be very useful.

This is the first revised edition; the second and third issues were mere reprints of the first edition. The editor has discharged his duties with restraint, and he has introduced several improvements. The printing is more compact and the use of leaded type conduces to comfort in reading. Additional

explanatory matter has been inserted occasionally, and the examples have been much improved by the inclusion of hints for their solution. In one or two places the clearness of the original is somewhat marred, as, *e.g.*, on p. 91, where two different notations are used simultaneously. It is not always obvious why formulæ have been banished from the text to separate lines, and *vice versa*; but this is a question of taste. The plates have been touched up here and there, and occasionally corrections have been made, *e.g.* ix., 3, 5; xiv., 10, 18.

It is surprising that the editor has retained the definition of curvature as measured by the *diameter of curvature*, whilst in at least one place he has used the first person in an interpolated remark.

The index and the classified list of curves are welcome additions. S. BRODETSKY.

An Account of the Crustacea of Norway. With short descriptions and figures of all the Species. By Prof. G. O. Sars. Vol. vi., "Copepoda, Cyclopoida." Parts 9–14. Pp. 105–225+54 plates. (Bergen: Published by the Bergen Museum, 1915–18.)

WITH the issue of the six parts noted above, Prof. Sars concludes the sixth volume of his great work on the Crustacea of Norway, the third of the series to be devoted to the rich and varied group of the Copepoda. This volume deals with the division Cyclopoida, which includes, for the most part, bottom-haunting species, many of them parasitic or semi-parasitic. Like the Harpacticoida treated of in the preceding volume, they are rarely found in the plankton, and must be sought for by special methods of collecting demanding much skill and patience. For this reason they have received far less attention than the relatively few species that are captured in bulk by the tow-net, and the proportion of novelties described in these volumes is very high. It is scarcely too much to say that Prof. Sars is giving us, for the first time, the means of forming a just impression of the Copepoda as a whole, both as regards their structural diversity and their habitats and distribution in northern seas. The species living in fresh water were previously better known, but here also Prof. Sars's accurate drawings will greatly facilitate the identification of species.

Apart from the faunistic value of the work, however, the iconography which it provides for many groups hitherto sadly in want of illustration will be of the greatest value to the morphologist and taxonomist. Among the numerous points of interest touched on in the parts under review, it may be noted that Prof. Sars revives Thorell's group of the Poecilostoma, although in a restricted sense and a subordinate position. In doing so he discards Claus's interpretation of the mouth-parts and reverts to that originally given by Thorell, according to which the mandibles, elsewhere so persistent, have entirely disappeared in the species composing this aberrant group.

W. T. C.

LETTERS TO THE EDITOR.

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

The Perception of Sound.

I REGRET that I overlooked Prof. Bayliss's letter in NATURE of October 17, in which he made an appeal for my opinion. But, if I rightly understand, the question at issue seems to be mainly one of words. Can we properly speak of the propagation of sound through an incompressible fluid? I should answer, Yes. There may be periodic motion and periodic variation of pressure; the fact that there are no variations of *density* seems immaterial. Consider plane waves, corresponding with a pure tone, travelling through air. In every thin layer of air—and thin means thin relatively to the wave-length—there are periodic motion and periodic compression, approximately uniform throughout the layer. But the compression is not essential to the travelling of the sound. The substitution of an incompressible fluid of the same density for the gas within the layer would be no hindrance. Although there is no compression, there remain a periodic pressure and a periodic motion, and these suffice to carry on the sound.

The case is even simpler if we are prepared to contemplate an incompressible fluid without mass, for then the layer need not be thin. The interposition of such a layer has absolutely no effect, the motion and pressure at the further side being the same as if the thickness of the layer were reduced to zero. To all intents and purposes the sound is propagated through the layer, though perhaps exception might be taken to the use of the word *propagation*.

As regards the ear, we have to consider the behaviour of water. From some points of view the difference between air and water is much more one of density than of compressibility. The velocities of propagation are only as 4 or 5 to 1, while the densities are as 800 to 1. Within the cavities of the ear, which are small in comparison with the wave-lengths of musical sounds, the water may certainly be treated as incompressible; but the fact does not seem to be of fundamental importance in theories of audition. RAYLEIGH.

Terling Place, Witham.

The Common Cause of Pure and Applied Science.

A GOOD deal of anxiety has been expressed recently in various quarters lest the great interest now being evinced in applied science may perpetuate, or even aggravate, the national neglect of pure science. As I do not share this anxiety, but, on the contrary, am strongly convinced that exactly the opposite effect will ensue; and as there seems to be some danger in the attitude that is being assumed by certain of my friends, I should like, with great respect, to ask for attention to the considerations which have led me to these opinions.

For many years past there has been in this country what the late Lord Armstrong once well called "a vague cry for technical education," a dim feeling on the part of the industrial world, collectively speaking (there have, of course, been brilliant individual exceptions), that there was some business-end of science that was worth getting hold of, and that should be got on easy terms of talent, time, and money. We know what it has failed to produce in institutions, in individuals, and in industrial efficiency; and we knew

it would. My working life has been passed in a great industrial region where this faint-hearted belief in the utility of science has been the one real obstacle to the progress of good science of every kind. At Leeds I have occupied myself greatly with the promotion of applied science, as in duty bound. But it has also been in the sure and certain hope that applied science, worthy of the name and really worthy of acceptance by industry, was indissolubly linked in bonds of mutual benefit to the purest and highest science that was ever dreamed of even by my chemical brethren, whose unworldly "stinks" profane the cloisters of more sequestered seats of learning.

It has been a hard fight, and though it would be unjust to say there have been no gains, I long since came to the conclusion that nothing short of a national cataclysm was likely to bring about anything approaching the change of heart that was so desirable and so necessary.

The cataclysm of war has, in fact, done this great thing for science. There is indisputable evidence of it, and I believe that at last British industry is generally, not exceptionally, on its way to use science well. That being so, I ask: Is there any possible escape for British industry and the British public from promoting pure science, and promoting it handsomely? I do not see it. Of course, they will not begin by endowing professorships in radio-activity or relativity, nor yet, perhaps, in that very pure chemistry which is the dearest thing to me; but they will be obliged to do it, and to do it before long. In the first instance, they will ask for what they now know they want: first-rate men who can apply science to the practical problems of industry. Already to a large extent they know that such men must have in them the root of the matter in the form of real scientific knowledge and skill, and it will follow as the day the night (if you so regard it) that science, pure and simple, must also be the object of their self-interested or patriotic solicitude.

I, for one, shall be glad to have it on those terms. For what, let us frankly say, are the alternatives for pure science? One I have just tried to set forth; the other, it seems to me, is a direct appeal for pure science, either because it is pure or because it is useful. If you extol it because it is pure, it is a worthy effort that I should honour with all my heart on one condition, and that is that you should avoid the incalculable mischief of trying to make out that there is in essence any distinction between pure and applied science, or that you should give just cause for the belief that there exists a brotherhood in science who set themselves up as the elect and disdain the implications of science in the practical arts that serve and preserve mankind.

If you extol pure science simply because it is useful—which by hypothesis you do not want to do—you embark on the task, long since essayed and long sustained, of teaching people by exhortation what at last they are in the way of finding out surely for themselves. To do that runs counter to all the precepts I have drawn from my experience of teaching.

I know very well what it is to be a prophet of pure science, even if only a minor or a minimus one, crying in the wilderness, and believe I can enter somewhat into the feelings of the major and maximus ones who are anxious and impatient under the present aspect of affairs. But they may be asked earnestly to consider the other point of view also, and to bethink themselves whether, after all, a great deal of the Philistinism of our people is not due to the detachment of locality, of interest, and of intercourse that in the past has been justly chargeable to the world of learning.

The British Association for the Advancement of Science was founded for the purpose of bringing a knowledge of science, its glories and its uses, among the people. It has done a great work, a much greater work than is known to those who will not sacrifice a week of the Alps or the oceans to do their bit and to experience the stimulus and profit derivable from the meetings—chiefly, it must be admitted, outside the section-rooms. The British Association needs revitalising, and I believe it can be revitalised. If our men of science would rally to it, it might do much that seems either to be neglected or to be falling into the hands of new organisations, the number of which alone, to say nothing of their particular distinctions or their subscriptions, is becoming quite bewildering.

It is, of course, the British way to have a multiplicity of disconnected organisations doing, or trying to do, much the same thing. We have won the war (it is true some others "also ran"), and Britain is justified in her institutions. To that no one subscribes more heartily than I, but we made some mistakes; and though organisation in the German way may be the mental path to inhumanity if followed far, I think we might profit by using a little more co-operation as we go our several ways.

Chemistry, it has been said, is a French science. Be that as it may, the immortal Lavoisier, who did more than anyone to revolutionise chemistry, began to investigate combustion because he was interested in lighting the streets of Paris. So at least says M. Le Chatelier, who is, I think, a chemist *assez pur*. According to my reading of history, so much pure science has arisen, not from the heavens above, but from the earth earthy beneath, that I will never, if I can help it, be penned off by any principality or power from the fraternity of applied science. Besides that, I owe them personally more than can ever be acknowledged for heading me off certain great dangers that threaten the academic life, and for helping me in countless ways with the promotion of pure science. We may rejoice without reserve in their temporary monopoly of popular favour. ARTHUR SMITHELLS.

The Theory of Hormones Applied to Plants.

No one would have read Prof. Bayliss's review (NATURE of December 12, p. 285) of Dr. Jacques Loeb's experiments on the "chemical correlationship" in plant growth with greater interest than John Hunter, for he had carried out many experiments on growing beans to elucidate the phenomena which are now explained on the theory of hormones. Hunter was familiar with phenomena of a similar kind in animals, and his experiments on plants were made primarily to elucidate that mysterious mechanism which went in Hunter's time under the name of "sympathy." An account of Hunter's experiments, carried out between 1772 and 1790, will be found in "Essays and Observations by John Hunter," edited by Sir Richard Owen, and published in 1861 (vol. i., p. 367). These observations were saved from destruction by William Clift. ARTHUR KEITH.

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RESEARCH ASSOCIATIONS AND OTHERS.

RESEARCH is the cry in every direction, but the public still needs instruction as to what it means and the conditions requisite for progress. Discovery of new principles on which advance can be made in the fundamental knowledge of Nature will probably be accomplished in the future, as in the past, through the genius of the few gifted men, but the dissemination of the right kind of knowledge and the creation of a widely

diffused sentiment of respect for science and for scientific work depend largely on the future education of the people generally. Since it will probably always be true that public opinion is dependent more or less on authority, the action of the Government in setting up the Department of Scientific and Industrial Research is a step of the utmost importance. The work done by this body so far, however, relates to direct applications of science to practical purposes as revealed by the report for 1917–18 noticed in NATURE for October 17 last.

The protection of the interests of pure science, regardless of immediate utilitarian application, is, however, a matter of serious importance, and a movement has been set on foot at Cambridge with this object in view. The "Scientific Research Association" has been formed, and has put forward a scheme for its organisation and functions which at first sight appears not only very comprehensive, but also somewhat complicated. It is believed that science requires larger endowments and more co-ordinated and informed allocation of those endowments than is provided by any existing machinery. It is intended, therefore, to institute a comprehensive system of intelligence as to the research that is actually being done in the various branches of science, and of new research as it is projected. By those who are familiar with the position of workers in science in the past, how largely the work done has been accomplished at the cost in time, labour, and money of private individuals or in the scanty leisure of professional men, it will be agreed that if the national life is to be increasingly vitalised and the scientific habit of mind cultivated, it is essential that an assured career should be open to the competent worker. It is, therefore, proposed to formulate an extensive scheme of endowment of research by the State which would afford inducements to the most promising students to continue their pursuit of scientific investigation. This means an addition not only to the grants now made to universities, but also to the various schemes now afloat for providing maintenance scholarships and fellowships on a more extended scale. It is not proposed to advocate the separation of teaching and research, which have been hitherto associated in so many institutions with advantage to both.

Finally, the association contemplates taking a leading part in impressing on the public the importance of scientific research in all its aspects, and the fundamental value of scientific method in every department of national life. A very strong list of supporters has already been got together, but an examination of the list reveals the fact that, so far, for reasons which are not obvious, the promoters have not succeeded in getting the co-operation of some of the most eminent men of science in their several departments. For example, the president and other officers of the Royal Society are conspicuous by their absence, and as the president is one of the most famous physicists in the world, and Master of Trinity besides, he could not have been overlooked in connection with any scheme originating in Cambridge.

The fact is probably that while the time is certainly ripe for movement in the direction indicated by the proposed association, the scheme as at present formulated requires time and further consideration to secure the complete approval and adherence of all the leading men of science of the country. Moreover, complete concurrence in any one scheme is scarcely to be expected as yet while sympathy is so much divided by the various proposals which are in the air. The endowment of research will have to be further considered by the Government, though it is possible that in view of the money placed at the disposal of the Committee of the Privy Council for Scientific and Industrial Research, and the assignment of 100,000*l.* for research in connection with dyes, some people may feel that it will be well to watch the effects of this, and of other sources of endowment like that of the Salters' Company mentioned in NATURE for October 24, before proceeding further. It is true that there is in this country no institution corresponding with the Kaiser Wilhelm Institut near Berlin, or with the Wolcott Gibbs Institute at Harvard, but the establishment of a new college does not apparently enter into the programme drawn up by the promoters of the association. The Royal Institution with its connected Davy-Faraday Laboratory is unique in both constitution and output of results. It must not be forgotten, moreover, that nearly all the British universities have adopted a scheme for the institution of degrees open to candidates from overseas to be awarded on the results of research work performed by the candidate, and probably this will lead to further demands for assistance to these universities.

In the meantime the idea of bringing together the whole body of British men of science has resulted in the formation of another association under the name of "The National Union of Scientific Workers," concerning which a letter appeared in NATURE of October 24. The draft rules declare that the object of the union shall be, in the first place, "to advance the interests of science, pure and applied, as an essential element in the national life." The second object is "to regulate the conditions of employment of persons with adequate scientific training and knowledge, and their relations to their employers and to other employees," and among other things to set up a register of trained scientific workers and to establish an employment bureau. The promotion of scientific research is also mentioned, but it appears that the union assumes more the character of a professional body acting somewhat in the trade-union spirit than an association of persons interested in the promotion of scientific education and research. It will be evident, therefore, that the National Union would be unlikely to obtain much financial support from the public for the promotion of research, whereas an organisation like the Scientific Research Association may do so.

There is evidently a certain amount of overlapping in these movements. There has been formed within the last few months in the North of England an Association of Chemists with a similar professed purpose, but this has been merged, at least so far as the principal leaders are concerned, in the Institute of Chemistry, the chartered body to which nearly all the well-qualified chemists in the country are gravitating. But another step is now being taken in the creation of a Federation of Chemists which will include not only the highly qualified, but also men of all grades, and this will probably assume the features of a club with libraries and meeting-rooms. Science is evidently not going to be overlooked, but it would be unfortunate if any serious dissipation of energy should ensue before such compromises can be effected which will provide for the needs of all branches of science, pure and applied, and especially those cases in which, as between the chemists, metallurgists, and engineers, mutual help and recognition are most desirable.

THE FUTURE DEVELOPMENT OF THE INTERNAL-COMBUSTION ENGINE.

A BRILLIANT piece of analytical work has lately been given by Mr. H. R. Ricardo to the North-east Coast engineers and shipbuilders.[1] Mr. Ricardo takes as the title of his paper "High-speed Internal-combustion Engines," and in it he compares the modern high-speed engine with the older slow-speed type, much to the disadvantage of the latter—not merely in relation to speed, but also in respect of the degree of skill shown in design. There is great force in the arguments used, and the truth which is evident in not a few of them may legitimately be regarded as one of the outcomes of the war. The war had the effect of drawing out and stimulating the hitherto hidden abilities of numbers of energetically minded and scientifically trained engineers—mainly quite young men—who in the highly inelastic system of pre-war days received but trifling encouragement for either their inventive or their organising powers. The State cared little for scientific or technical research, and the leaders of industry were in too many cases quite as conservative as the State. Then came the awakening. The perils and dangers of war required that, for the supreme cause of the safety of the State, this attitude should be completely reversed—and reversed it was. Wide scope was at once given to all with inventive and scientific ability. One result we see in the amazing strides made in aviation—mainly the work of youth. When, therefore, Mr. Ricardo compares the older types of internal-combustion engine with the aero-engine of to-day he is comparing not merely two engines, but also two systems, two worlds in fact—one where the State is little concerned what technical developments its nationals may or may not produce, and one in which the State, fighting for its life, calls anxiously for the help of all talent to be found anywhere within its borders.

[1] Transactions of North-East Coast Institution of Engineers and Shipbuilders, vol. xxxiv., October, 1918.

But for the war aviation could not have developed at a pace in the least approaching that actually attained—and steadily maintained. This development is, as regards both numbers and efficiency, the outstanding technical achievement of the past four years; naturally it has demanded intensely rapid, even drastic, changes in the power unit of such craft. The heavy loading put on such engines has caused their design to be far more difficult than that of other internal-combustion engines; they may be required to run at high power (and that involving unprecedentedly high brake mean pressures) for so long as twenty hours on end. Types which have been constructed to weigh but two or three pounds per horse-power and yet run for hours on full load will afford a magnificent start to the aerial services of peace, especially since the less strenuous specifications of future operations will allow the engine to operate normally at powers quite appreciably below the maximum. The modern aero-engine is close to the highest perfection possible for its power and cycle. Any material further advance must, it would seem, be by change of cycle, change of fuel, or perhaps a break away to some new kind of prime mover altogether.

Mr. Ricardo correctly points out that "the design of internal-combustion engines in this country has during the last twenty years proceeded along two widely different lines directed by separated schools. On one hand, we have the designers of what may be termed the slow-speed type of engine, who have consistently had to compete with, and have based their designs upon, steam-engine practice; and, on the other, we have the designers of small high-speed engines who have appeared with the advent of the motor-car. The latter have created a school of thought of their own, and have developed along lines which are distinctly enterprising." The difference between high- and low-speed engines is by no means confined to a matter of speed, since the former usually run on petrol and the latter on gas. This difference in fuel is very important, though perhaps not permanent—a small "suction producer" added to a "petrol engine" would enable the latter to be run on gas directly derived from coal fed into the producer. This may come, but it seems to be some way off at present.

The difference between the use of petrol and gas is not merely one of supply and carriage, but is also of a more essential nature. Petrol has certain very valuable advantages. For one thing, a gas mixture suffers a chemical contraction on combustion, whereas a petrol mixture shows an expansion; the evaporation of petrol in the carburettor lowers the temperature of the incoming charge, so that the weight-volumetric efficiency of the suction stroke is higher than with gas. The disadvantages of petrol are less pronounced, though they certainly exist; thus there is usually some proportion of petrol which is not properly vaporised, and escapes combustion; and a stricter limitation of richness of charge is necessary.

These essential differences tend to complicate any comparison of the usual high-speed with the

usual low-speed engine. Mr. Ricardo suggests that piston design in particular is looked on from such different angles by the two schools as to lead to very marked differences in engine types. A heavy piston means high inertia forces at the beginning and end of each stroke; this means a stout connecting-rod; both these in turn call for a strong and heavy crank requiring massive bearings, and at once we are led to the ordinary gas-engine of pre-war days. The aero-engine has developed a piston suitable for heavy loads and high speeds. It is surely unlikely that designers of other types of internal-combustion engine will fail to draw the obvious conclusion.

The war may be expected to leave its mark on internal-combustion engine design in two ways: first, by greatly lightening the motor-car engine, so that its weight per horse-power may not compare so unfavourably with that of aero-engines; and secondly, by making the slow-speed stationary, or nearly stationary, gas- or oil-engine a much less cumbrous machine.

Evolution in engine practice has long been towards ever-increasing speeds. The old beam-engines of the early part of last century gave place to an engine of much higher speed with hundreds, instead of tens, of revolutions per minute. The higher speed meant, for equal horse-power, less total force on the piston, hence a less diameter of piston, a smaller and lighter engine. Now again we find this same evolutionary process at work—piston speeds are rising and the weight per horse-power ratio grows less.

In view of the specially intense interest which the agricultural industry will have for humanity during the next term of years, it is important to consider how far our recent increase in knowledge of the potentialities of the internal-combustion engine may be harnessed to this work. Ford in America has done much—but mainly on what may be termed pre-war data. Much remains to be done in this coming post-war period. High piston speeds, light reciprocating parts, and the use of high-grade steels should, combined, produce an agricultural machine as efficient for its purpose as the motor-car and aeroplane have become. The annual output of high-speed internal-combustion engines in this country is at present at the rate of some 10,000,000 h.p. annually. A large part of this has been for air work; a smaller fraction will suffice now. Here is to be found a great opportunity for the internal-combustion engine in fresh enterprise in new fields. H. E. W.

NURSING HABITS OF ANTS AND TERMITES.

A RECENT paper by Mr. W. M. Wheeler, in the Proceedings of the American Philosophical Society, Philadelphia, gives some interesting details of the behaviour of certain ants in the care of their offspring. The larvæ of the primitive subfamily Ponerinæ are fed, not, as in the case of the most highly specialised ants, with food regurgitated by the workers, but with fragments of insects. Speaking of a species of this subfamily common in central Texas, Mr. Wheeler says:—

> These larvæ are placed by the ants on their broad backs, and their heads and necks are folded over on to the concave ventral surface, which serves as a table or trough on which the food is placed by the workers.

In the case of another species, as soon as the food is in place it is sometimes covered by the larva with a copious discharge of a secretion containing a proteolytic ferment, by means of which the food undergoes extra-intestinal digestion. Mr. Wheeler adds the curious observation that this liquid is eagerly lapped up by the nurses.

The larvæ of four species of ants belonging to the subfamily Myrmecinæ were collected by Mr. Lang in the Belgian Congo. In three of these, remarkable exudatory appendages exist, some of which consist of a basal enlargement filled with fat-cells, and a slender, tubular distal portion containing a granular liquid which the author thinks can only be interpreted as an exudate derived from the fat-cells, and capable of being filtered through the cuticula of the appendages by means of the pressure exerted by an elaborate system of muscles. That the chitinous envelope of these structures is not necessarily impervious to the passage of a secretion is shown by the researches of Holmgren, Biedermann, Kapsov, Casper, and others. From the ontogenetic and phylogenetic history of these appendages, and especially from the fact that they appear to be developed in inverse ratio to the salivary glands used in extra-intestinal digestion, Mr. Wheeler concludes that their secretion, like that of the salivary glands in the Ponerinæ, is capable of furnishing nutriment to the nurses, the benefit of the feeding habit being therefore reciprocal. This conclusion he considers to be supported by the observations of Wasmann on the Staphylinid beetle *Xenogaster inflata*, which inhabits the nests of termites. In this larva the fat-body produces an exudation which, after passing through a layer of hypodermis, reaches the surface through the cuticle. Similar phenomena are present in other beetles and Hymenoptera which frequent the nests of ants or termites, as recorded by Trägårdh; while Holmgren has found that, quite apart from their guests, termites feed to a large extent on the exudation furnished in different degrees by the several castes of their own species.

For this reciprocal feeding, whether within or without the limits of the same species, Mr. Wheeler proposes the term "trophallaxis." The practice has, he considers, an important bearing on the substitution of the social for the solitary habit in various species of Hymenoptera. The various trophallactic relations existing in communities of ants are grouped by him as follows: (1) Trophallaxis between mother or adult worker and larval brood; (2) between adult ants (mutual regurgitation); (3) between ants and true guests; (4) between ants of different species. Besides these reciprocal relations there is the ordinary trophic connection between ants and other insects outside the nest (as aphides and certain Lepidopterous larvæ), and

also between ants and various plants known as Myrmecophytes.

The author takes occasion to combat Wasmann's view as to a special symphilic instinct in ants and termites. The latter observer adduces certain ascertained facts regarding *Lomechusa strumosa,* a beetle parasitic in the colonies of *Formica sanguinea.* The adult beetles are fed and licked by the ants, but the beetle larvæ devour the larvæ of their hosts; moreover, in some colonies the presence of the parasite leads to the development of pseudogynes—*i.e.* forms intermediate between workers and females, which are incapable of performing the functions of either caste. The infection of an ant colony by Lomechusa is therefore presumably detrimental to the hosts. This is admitted by Wasmann, who nevertheless contends that *Formica sanguinea* has acquired a special symphilic instinct, not under the influence of natural selection, but in connection with the use of a process analogous to artificial selection as practised by man. Mr. Wheeler holds, on the other hand, that the beetle is the aggressor, and that the fact that it is licked and tended by the ants is a mere incidental result of the nursing habits of the latter with regard to their own offspring. F. A. D.

PHYSICS IN SCHOOLS.[1]

IN opening the discussion described in the report before us, Prof. C. H. Lees, president of the Physical Society, stated that the meeting was the outcome of the desire of the society to help those engaged in science teaching in public and secondary schools to carry out the extension of their work which will probably ensue in the course of the next few years. We may begin our notice of the report by congratulating those responsible for the idea of such a meeting and those to whom the credit of its skilful organisation belongs.

Sir Oliver Lodge opened with a characteristically direct remark:—"Mr. President, I very much agree that it is desirable that the average man should know more physics than he does at present. He could hardly know less." But the speaker did not pursue the delicate question as to the responsibility for this state of things, whether the average man or the teacher of physics is to blame. Nor need we inquire, since the one clear, unmistakable inference from the discussion as a whole was that teachers of physics are tackling with much thoughtful energy the problem of providing courses of physics which will suit those who will get in schools the only knowledge of physics they are ever likely to possess.

It is worth noting that Sir Oliver Lodge considers it best to begin with the biological sciences, for cultivating the faculty of observation. Why this should be so was not explained; nor was anything said as to how the power of observing gained in natural history studies was to be transferred to the field of physics. Here we touch on the weak side of the discussion—there was too insecure a basis of psychological knowledge, too little recognition of the imperative primary need to find out how the boy's mind will work with spontaneity as well as under discipline.

There are several clear statements in this report on the distinction between physics for the boy who will specialise in science and "Physics for All," the contribution of Prof. R. A. Gregory being particularly clear and weighty. The need for inspiring courses was well emphasised by both the opening speakers; the Harrow syllabus submitted by Mr. C. L. Bryant was an able effort to meet this need.

Every schoolmaster feels one great difficulty in carrying out his ideals, viz. the narrow limits of time within which his work has to be carried out. Dr. T. J. Baker brought this point clearly before the society, and from this point of view criticised the recommendation of Sir J. J. Thomson's Committee to lower the school-leaving age from nineteen to eighteen. Probably the majority of schoolmasters, not excluding Dr. Baker himself, would be satisfied with an "Advanced Course" which ended with the end of the school year in which the age of eighteen was reached.

Mr. A. T. Simmons showed the further difficulties which arise when the school course ends at sixteen. Too often electricity and magnetism are left out, so far as the majority of the boys are concerned—a serious matter. We may point out that this means not merely the loss of a study of fascinating interest to most boys, but the further result is that school-work and the life of the world remain divorced. Mr. Simmons did another service to the discussion by indicating things which could be left out with advantage; we suggest that one of the most necessary things to do at present is to scrap useless topics of the Nicholson hydrometer type.

If we take a longer view, it is obvious that for future progress the training of teachers of physics is of first-rate importance, and the remarks of Prof. T. P. Nunn will be read with interest. The two main theses were (1) the need for the teacher to have studied his subject critically, (2) the benefit which results from a sound apprenticeship to the teacher's art. We agree that "the way of wisdom with regard to training colleges is not to suppress or to ignore them, but to take serious pains to strengthen them for the better performance of their indispensable duties." In our opinion, the training of science teachers is one of the vitally important items of educational reconstruction, and this might well be impressed upon local education authorities during the coming year. The need for "refresher courses" for teachers who have been at work for several years, possibly in a remote school, has been recognised by the more progressive authorities; but such courses rarely include physics or chemistry. Mr. J. Nichol was only too well justified in directing attention to the financial difficulty of the science master who wishes to keep up to date (this applies especially to those whose school is

[1] "The Teaching of Physics in Schools." Report of a discussion at a meeting of the Physical Society, June 14, 1918. Pp. 43. (London: Fleetway Press, 1918.) Price 1*s.* 2*d.* post free.

far from a large town), and he was on equally sound ground when he urged that the teaching of physics should be revivified and kept in touch with everyday life, so as to defeat any attempt to standardise it and use it merely as a training in logical method (*cf.* Euclid).

The meeting was saved from the peril of a tame unanimity by a difference of view as to approaching the subject synthetically, *e.g.* by building up a theory of heat from observations of the dissected phenomena of expansion, etc., or analytically, *e.g.* by starting with a steam-engine and inquiring how it works.

The difference was somewhat unreal—at least, the real issues were not clearly defined. Surely the problem is how to harness the "wonder" and "utility" motives, and this has to be solved for each method-unit according to the characteristics of each class and teacher and of the method-unit itself. Here it may be said that the existence of a method-unit was only once referred to, when Mr. F. B. Stead directed attention to the fault that the laboratory exercise that can be done in one lesson period tends to become the unit of teaching. We are of opinion that teachers should give more attention to sectioning their subject into natural method-units, using them for revision, for the pupil's more elaborate note-taking, and for essays. Perhaps the simplest example is "expansion by heat," which is so obvious that in practice regard to this topic as a method-unit is fairly well observed.

It is not possible within the limits of this article to refer to many useful practical suggestions which teachers may gain by reading this report. We have no doubt that many will be grateful to the Physical Society and to the speakers, not forgetting Dr. H. S. Allen, who organised the symposium. G. F. D.

NOTES.

THE mineral resources of Spitsbergen have lately been receiving much attention. The signing of the armistice has allowed the two British companies which hold the principal mining estates in that country to make plans for resuming operations. A correspondence in the *Times*, initiated by Prof. F. Haverfield, of Oxford, has dealt with the value of the coal and iron-ores. Prof. Haverfield, who seems to prefer the German spelling of Spitsbergen with a "z," quotes Swedish geologists as denying the existence of high-grade iron-ores, and he characterises the attempts to utilise Spitsbergen commercially as a long series of failures from the time of the Dutch onwards. In these respects he has been misinformed. The Dutch and English whalers, and later the Russian and Norwegian trappers, did a rich trade in Spitsbergen produce. Mining ventures have not always been successful, but cases of failure have been due, not to lack of mineral ores, but to ignorance of Spitsbergen, to lack of political control in the country, and, in some instances, to mismanagement and amateur effort. During the war various Norwegian and Swedish companies, in several cases trespassers on British estates, mined large quantities of coal. This year about 100,000 tons of coal were sent to Scandinavian ports. It is merely a question of effort to make Spitsbergen one of the chief coal-producing countries in Europe. The accessible coalfields are estimated to have a content of at least 4,000,000,000 tons of good steam-coal. The iron-ore deposits have yet to be examined by competent geologists and mining engineers, but the samples brought to this country promise well. Other mineral resources include gypsum in enormous quantities, asbestos, copper-ore, oil shale, and probably free oil. The mineral prospects of Spitsbergen are great, but, with the exception of coal and gypsum, need to be thoroughly prospected by qualified men before commercial development can proceed. Meanwhile, it is essential that Great Britain should keep a watchful eye on the fate of this *terra nullius*, in which British subjects have the principal claims.

WITH the view of meeting the growing demand for technical literature, the council of the Chemical Society decided early in 1917 to increase the scope of the library of the society by a more liberal provision of suitable technical works and journals. It was also thought that by placing the existing library of 23,000 volumes and the proposed extension at the disposal of members of other societies and associations they might relieve themselves of the necessity of collecting and maintaining the literature relating to their special subjects, and assist in the formation of a representative library of chemical literature, such as would be difficult to obtain by individual effort. A conference of representatives of societies and associations connected with chemical science and industry was held to consider the means by which other societies, etc., might co-operate in this extension, and financial assistance was afterwards offered by the following societies, etc. :—Association of British Chemical Manufacturers, Biochemical Society, Faraday Society, Institute of Chemistry, Society of Dyers and Colourists, and Society of Public Analysts. Members of these contributing societies, etc., will be permitted to consult the library and borrow books from January 1, 1919. The hours of opening the library will be as follows :—Mondays, Wednesdays, and Thursdays, from 10 a.m. to 6 p.m.; Tuesdays and Fridays, from 10 a.m. to 9 p.m.; and Saturdays, from 10 a.m. to 5 p.m.

IN the *Fortnightly Review* for December "Fabricius" refers to the manifesto in support of Germany's policy and action relating to the war signed by ninety-three university professors in that country in 1914, and widely distributed. Among these professors were several occupying scientific chairs, and they must share the righteous condemnation which has been given by the intellectual world outside Germany to their misuse of authority on behalf of dishonourable dreams of conquest. As, however, most of the signatories of the manifesto were representatives of theology, law, literature, and like branches of knowledge, and not of science as it is usually understood, it is misleading to refer to them as a group of "scientists," as "Fabricius" does in the following extract from his article :—"Scientists are supposed to devote themselves to the promotion of science and of truth, for science is incompatible with untruth. However, the unceasing advocacy of a robber-policy and the exaltation of a robber-morality had so completely destroyed the instinct of responsibility and of truth amongst Germany's intellectual leaders that ninety-three of Germany's most eminent scientists, among them many prominent theologians and legists, disgraced themselves and German science for all time by issuing in 1914 a manifesto to the world in which they mendaciously proclaimed that the other Powers had forced a war upon innocent and peaceful Germany; that upon France, England, and Russia rested the blood-guiltiness; that Germany

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fought a clean war of self-defence." We note that the Brussels correspondent of the *Times* reports on December 10 that the Belgian Surgical Society, at its first meeting since July, 1914, solemnly repudiated the notorious manifesto, and resolved to break off all relations with German men of science until the calumnies, especially against Belgian medical men, are publicly disavowed.

WE learn with regret of the death on December 9 of Dr. Reginald Percy Cockin, a member of the staff of the London School of Tropical Medicine. Dr. Cockin was educated at Caius College, Cambridge, and the London Hospital. After graduating in arts and medicine in 1906 he entered the Colonial Medical Service, passing "with distinction" in the qualifying course at the London School of Tropical Medicine. In 1908 he proceeded to West Africa, and saw active service as medical officer with the Cross River Expedition into the Munchi country. In 1910 he transferred to Cyprus as district medical officer, and held the post of examiner under pharmaceutical law. During 1913 Dr. Cockin was bacteriologist and resident surgeon at the Colony and Yaws Hospitals in Grenada. He then returned to the London School of Tropical Medicine, occupying successively the posts of demonstrator, assistant in the helminthological department, and assistant entomologist. In 1916 he inaugurated one of the venereal clinics under the Seamen's Hospital Society, and as its director and pathologist organised the clinic at the Albert Dock Hospital with brilliant success. Dr. Cockin's contributions to medical literature were chiefly clinical, dealing with yaws and its treatment, rat-bite fever, and ankylostomiasis. His M.D. thesis on "Ankylostomiasis in Grenada" was of special importance in definitely associating with this infection a series of hitherto obscure cardiac symptoms. Dr. Leiper writes:—"In him we have lost one of peculiarly charming personality, wide sympathies and interests. Knowing as he did the risk of overstrain, which actually proved fatal, he courageously discharged until within a day of his death, not only his own duties, but also those of others, away on active service."

A CHRISTMAS course of juvenile lectures will be delivered at the Royal Institution by Prof. D'Arcy Thompson on "The Fish of the Sea," beginning on December 31 at 3 o'clock. The following courses of lectures will be given before Easter:—Prof. Spenser Wilkinson, Lessons of the War; Prof. MacGregor-Morris, Study of Electric Arcs and their Applications; Capt. G. P. Thomson, The Development of Aeroplanes in the Great War and The Dynamics of Flying; Prof. Hele-Shaw, Clutches; Prof. Arthur Keith, British Ethnology: The People of Scotland; Prof. Norman Collie, Chemical Studies of Oriental Porcelain; Dr. W. Wilson, The Movements of the Sun, Earth, and Moon; Prof. H. M. Lefroy, Insect Enemies of our Food Supplies and How Silk is Grown and Made; Prof. C. H. Lees, Fire Cracks and the Forces Producing Them; Prof. A. Findlay, Colloidal Matter and its Properties; and Sir J. J. Thomson, Spectrum Analysis and its Application to Atomic Structure. The Friday discourses will begin on January 17, when Sir James Dewar will give a lecture on Liquid Air and the War; and discourses will also be delivered by the following gentlemen:—Lt.-Col. A. Balfour, Prof. H. H. Turner, Prof. J. G. Adami, Prof. C. G. Knott, Mr. A. T. Hare, Prof. J. A. McClelland, Prof. H. C. H. Carpenter, Prof. A. Keith, Prof. W. W. Watts, Sir John H. A. Macdonald, and Sir J. J. Thomson.

INFLUENZA is very decidedly on the wane in England and Wales. The Registrar-General's return for the week ending December 7 shows that for the ninety-six great towns the deaths from the epidemic were 3574, which is less than one-half of the deaths in either of the two weeks ending November 9, when the complaint was at its climax. In the eight weeks ending December 7 there were 41,053 deaths from influenza in the ninety-six great towns. The *Times* of December 7 gave the following from its New York correspondent:—"Deaths among the civilian population of the United States from Spanish influenza and pneumonia since September 15 have totalled approximately 350,000. In military camps the number of deaths has exceeded 20,000." In London the deaths from influenza for the week ending December 7 were 660, which is lower than any week since that ending October 19, and is little more than one-quarter of the deaths in either of the two weeks ending November 9. The age incidence of the deaths is higher than in any previous week of the epidemic, 42 per cent. of the deaths occurring at ages above forty-five. The proportion of deaths in London from pneumonia has been smaller than the deaths from bronchitis throughout the epidemic until the week ending December 7, when the deaths from bronchitis were slightly the greater.

THE death is announced, at thirty-five years of age, of Dr. A. E. Stansfeld. From the *British Medical Journal* we learn that Dr. Stansfeld entered St. John's College, Cambridge, with a major scholarship in 1902, and gained First Class honours in both parts of the Natural Sciences Tripos, graduating B.C. in 1909, and proceeding to the M.D. degree in 1915. At St. Bartholomew's Hospital his career was exceptionally brilliant. He won there an entrance scholarship, the Kirkes scholarship and gold medal, the Burrows prize, the Brackenbury medical scholarship, and the Lawrence scholarship and gold medal. After holding the post of house physician he was appointed casualty physician and assistant demonstrator of pathology in the medical school; and at the date of his death on November 25 he was senior demonstrator of pathology at St. Bartholomew's, and physician to the Metropolitan Hospital. In 1911 Dr. Stansfeld obtained the membership of the Royal College of Physicians, and he was elected to the fellowship this year.

THE KING has been pleased to approve the appointment of the Rev. E. W. Barnes, F.R.S., Master of the Temple, to the Canonry of Westminster, vacant owing to the death of the Right Rev. William Boyd Carpenter, D.D., K.C.V.O. Dr. Barnes went to Cambridge from King Edward's School, Birmingham, as a scholar of Trinity, and graduated in 1896, being bracketed as Second Wrangler. In the following year he was placed in the first division of the First Class in the Mathematical Tripos, part ii., and became first Smith's prizeman in 1898. He was president of the Union in 1897, and in 1898 was elected a fellow of his college, afterwards becoming assistant lecturer (1902), junior dean (1906–8), and tutor (1908–15). He was elected a fellow of the Royal Society in 1909.

WE notice with regret the death on December 9, at Basle, of Mr. F. G. Aflalo, at forty-eight years of age. Mr. Aflalo was well known as a traveller, an angler, and author of numerous popular writings on natural history, especially that of fishes. He travelled widely, among other places visiting every fishing port of note. He was the editor of the "Encyclopædia of Sport" and the "Anglers' Library." In 1893 Mr. Aflalo founded the British Sea Anglers' Society, which is now a flourishing association.

MR. CLIFFORD C. PATERSON is resigning his position in the physics department of the National Physical Laboratory, Teddington, and is joining the General

Electric Co., Ltd., as director of research laboratories as from January 1, 1919. Pending the erection of the necessary laboratory buildings the temporary offices and address of the research laboratories of the General Electric Co., Ltd., will be at the Osram Robertson Lamp Works, Hammersmith, London.

ALL the exhibition galleries of the Natural History Museum, Cromwell Road, S.W., are now open to the public on weekdays as in pre-war times. The hours of opening during December, January, and February are from 10 a.m. to 5 p.m.

DURING the present year the Irish newspapers reported the discovery of the apparition of a black pig in the district of Kiltrustan, Co. Roscommon, which caused much alarm, and was supposed to forebode some serious national disaster. The question has been fully discussed by Miss Eleanor Hall in *Folk-lore* (vol. xxix., part 3, September, 1918). The writer shows that the legend of the appearance of the black pig is as ancient as anything we possess in these islands, and that it is specially connected with the great ditch known as the "Black Pig's Dyke," which can be traced in fragments all across the north of Ireland from Bundoran to Donegal Bay, and probably formed the boundary in ancient times of southern and eastern Ulster. The pig seems to have been a sacred animal in ancient Ireland, possibly the representative of the corn spirit, and the hunt of magical boars or swine is the theme of many tales. It is remarkable that it should recently have been resuscitated in Ireland for purposes of religious or political propaganda.

IN the November issue of *Man* Prof. G. Elliot Smith discusses an exhibit now in the Liverpool Free Public Museums obtained in excavations in Honduras. It represents an alligator or crocodile, from the open mouth of which a human face protrudes. The writer identifies this with various forms of the dragon in India, Japan, and Indonesia, and arrives at the conclusion that "no one who conscientiously studies the mythology of the Old World, and appreciates the fortuitous circumstances which determined the arbitrary forms assumed by many of the beliefs and ideas, can refuse to admit that the confused mosaic of the identical elements of culture in America must have come from the other side of the Pacific, and, for the most part, received the impress of Indian civilisation before the fragments were rearranged and built up again into a new pattern in Mexico and Central America."

IN recent years several discoveries of remains of ancient man in North and South America have been announced, which are critically reviewed by Dr. Ales Hrdlička in Bulletin No. 66 of the Bureau of American Ethnology. The La Brea skeleton, found in California in 1914, is now shown to possess no characteristics representative of any Americans earlier than the Indians. A long and careful review of the "fossil" man of Vero, Florida, leads to the conclusion that the remains are of modern Indian type, and represent intentional burials. Dr. Hrdlička adds the useful warning that "those in whose work credulity and fancy have no part, and who possess sufficient hard-earned experience in these matters, can be convinced of geologically ancient man in America only by facts that will make all conscientious doubt on the subject impossible. As chances of peculiar associations of human bones or human artifacts are infinite, anthropology in this country must expect to be called upon again and again to pass on alluring claims of the antiquity of such objects. But the burden of proof of antiquity of such finds lies, and will always lie, with those who may urge such claims. They must show clear, full, conclusive evidence acceptable to anthropology; and no beliefs, opinions, or convictions, even though advanced by men otherwise deserving, can ever take the place of real and sufficient evidence. Our colleagues in collateral branches of science will be sincerely thanked for every genuine help they can give anthropology, but they should not clog our hands."

AN interesting account is given by Mr. Y. Nishikado (*Ber. d. Ohara Inst. f. landwirtsch. Forsch.*, Bd. i., Heft 2, 1917) of the rice blast fungus (Piricularia), which causes serious damage to rice in Japan as well as in other countries. Various strains of this fungus were isolated from rice, Italian millet, green fox-tail grass, crab grass, *Zingiber mioga* and *Z. officinale*. By infection, cultural experiments, and morphological study it was shown that these strains exhibited a marked degree of specialisation to their host, as well as showing other differences of a morphological and physiological character. The author, therefore, distinguishes four species from one another, viz. (1) *Piricularia oryzae*, Br. and Cav. Emend., on rice; (2) *P. grisea* (Cke), Sacc. Emend., on crab grass; (3) *P. setariae*, sp. nov., on Italian millet and green fox-tail grass; and (4) *P. zingiberi*, sp. nov., on *Zingiber mioga* and *Z. officinale*. All the above species grow readily as saprophytes upon artificial media, such as rice-decoction agar. On media containing carbohydrates the fungal growth becomes deep olive to olivaceous-black, according to the species; but, grown without carbohydrates (such as on bouillon agar), the hyphæ remain white. The physiological relationship of the four species of Piricularia to various culture media, temperature, oxygen, etc., was carefully recorded. Piricularia species were found to exhibit a long vitality (of more than four hundred days) in cultures; moreover, in dry conditions the spores of *P. oryzae* maintain their vitality from the autumn until the next summer (about eight months). Therefore the spores may be a source of early infection.

WE have received the year-book and annual rainfall returns of the Norwegian Meteorological Institute for the year 1917. The mean temperature of the year, taking the country as a whole, was in close agreement with the normal, but there was a rather marked deficiency of warmth north of the Arctic Circle, the mean temperature at Alten (lat. 70° N.) being 1·4° C. under the average. January and July were remarkably warm in all parts, while, on the other hand, April and October to November were unusually cold. An interesting summary of the climatic conditions for 1916 is given for Green Harbour, Spitsbergen, the most northern meteorological station in the world, situated in lat. 78° 2′ N. The mean temperature of the year was −10·1° C. (13·8° F.), with extremes of 10·8° C. (51·5° F.) on July 1 and −45·7° C. (−50·2° F.) on January 6. Only in August did the temperature remain above freezing-point. Precipitation was scanty, and amounted to only 11·36 in. Hourly values of temperature and pressure at Green Harbour are given for the year ended June, 1917, along with the tri-daily readings of the various climatic elements. Full particulars of rainfall and other forms of precipitation during 1917 are given for 475 stations, the daily readings being shown for most stations. Monthly and annual values expressed as a percentage of the average are shown for sixty-four stations, the greatest excess, 45 per cent., occurring at Engset (lat. 62° 14′ N., long. 7° 15′ E.), and the maximum deficiency, 41 per cent., at Lille-

hammer (lat. 61° 7′ N., long. 10° 28′ E.). The isohyetals are drawn on two large-scale maps, which show clearly the sharp variations in rainfall peculiar to a mountainous country like Norway, the extremes ranging from 3400 mm. to 300 mm. of rain in the year.

THE importance of the refractometer to the technical chemist and physicist is being realised to an ever-increasing extent. The determination of the refractive index of a liquid can be made quickly and accurately by means of such an instrument, thus affording valuable information as to the purity of oils, fats, or drugs, or the concentration of solutions. The investigation of the optical properties of glasses and singly and doubly refracting crystals can be carried out with the same instrument. It is highly satisfactory to learn that British manufacturers are paying considerable attention to the construction of refractometers. We have received from the firm of Messrs. Adam Hilger, Ltd., a well-illustrated booklet describing their Abbe refractometer with water-jacketed prisms for the measurement of refractive indices from 1·3000 to 1·7000. The instruments are standardised, and not only the mechanical, but also the optical, parts are interchangeable. We have also received an account of the improved type of Abbe refractometer designed and made by Messrs. Bellingham and Stanley, Ltd. An interesting comparison is made between the features of this instrument and the corresponding features of the German type, and it is claimed that the increased efficiency results in a saving of time of about 50 per cent. in the determination of refractive indices and dispersions.

PROF. MILES WALKER read an interesting paper to the Institution of Electrical Engineers on December 5 on the supply of single-phase power from three-phase systems. In this country the advantages of three-phase distribution of power are thoroughly appreciated, and many of our large power-stations generate electrical power on this system. At the present time there is a great demand in the Midlands for electric power for smelting furnaces. As these furnaces make an excessive demand on the supply station, the companies insist that the load taken by the furnaces must be a "balanced" load, and that suitable precautions are taken to prevent resonance effects, which have on several occasions caused a breakdown of the system. For reasons which are not fully stated in the paper, Prof. Walker urged the adoption of the single-phase furnace. He described the various methods that could be used to operate this furnace without upsetting the balance of the mains. He gave full particulars of the design of a "rotating balancing transformer" for this purpose. The tests made on this machine show that its efficiency was more than 90 per cent. This is a very satisfactory achievement. We are not convinced, however, that it is best to use a single-phase furnace when the supply is three-phase. We know several excellent types of three-phase furnace, and it is possible to connect them with the three-phase transformer, so that the power factor on the primary windings is nearly unity. But even if a single-phase electric furnace was essential, why not use a choking coil, a transformer, and a rotary condenser separately? There is no need to combine them into a single machine.

AN interesting paper on the air supply to boiler-rooms was read by Mr. Richard W. Allen at the Institution of Engineers and Shipbuilders in Scotland on October 22. The paper deals with the closed-stokehold system, and a large part of it is taken up with the losses in the ducts and fan chambers, due to unscientific design. Records are given of experiments conducted on new types of deck intakes, weather flaps, gratings, etc., designed in such a manner as to secure stream-line flow in the currents of air, and the results of experiments carried out on older patterns of the same appliances are also included. For example, a grating having bars of rectangular section produced a drop in pressure of from 0·065 in. to 0·22 in. of water, whilst another having "stream-line" bars showed no perceptible drop in pressure. The delivery through these gratings with the fan running at the same speed was respectively 29,000 and 31,500 cubic ft. of air per minute. The paper constitutes a valuable illustration of the applications of science to engineering design, and as such is to be commended to any engaged in the design and installation of fans.

THE salvage of the *St. Paul* forms the subject of an interesting article in the *Engineer* for December 6. It may be remembered that this ship heeled and sank in New York harbour in April of the present year. The hull settled upon the river-bed with the decks nearly vertical, and penetrated through the bed of silt into the underlying hard soil. This rendered the matter of the removal of guns, etc., a process of considerable difficulty for the divers. Excavational work was done by means of jets of compressed air, thus blowing away the mud which had accumulated round the guns. The ooze also entered the ship through numerous open ports, and hampered the work greatly. The dead-weight of the ship is about 13,000 tons, and the ship had to be rolled forcibly back towards the normal upright position without damage. This was accomplished by use of surface pontoons, of **A**-frames attached to the uppermost side of the ship, and of pumps which cleared the water partially out of the ship. Four pontoons were used which exerted, on the rising tide, a lift of 1200 tons, and produced a righting moment on the ship. The rolling operation took about seven days to accomplish. The final operation comprised the pumping out of the entire vessel. It is of interest to note that the engineers responsible adapted the oxy-acetylene torch for under-water service, and employed it for cutting drainage openings in various parts of the ship. The entire salvage operation has been accomplished with conspicuous success.

THE poisonous character of some cargoes of Burma beans having been noticed, it was suggested that the Burma Department of Agriculture should encourage the cultivation of varieties containing less hydrogen cyanide than does *Phaseolus lunatus*. It has been found, however, that imported Madagascar beans were not suited agriculturally to replace Pe-gya and Pe-byugale, and that the prussic acid content increased during two years' cultivation. As bearing on the same problem, the agricultural chemist of the Government of Burma has studied the hydrogen cyanide content of the commonest Burma bean, Pe-gya. The results obtained are described in Bulletin No. 79 of the Agricultural Research Institute, Pusa, by Messrs. F. J. Warth and Ko Ko Gyi. It was found that the method of estimating hydrogen cyanide by distillation (after hydrolysis of the glucoside with acid) into sodium hydrogen carbonate solution and titration with iodine solution could not be used owing to the presence of a substance which gives a slight iodine reaction. The prussic acid was therefore estimated by conversion into Prussian blue, which was ignited and weighed as ferric oxide. Details of the method are given in the bulletin. From about one hundred single-plant samples collected in the cultivators' fields of the Sagaing district ten samples of seed were selected, including two of the highest hydrogen cyanide con-

tent, two of the lowest, and four intermediate. These were grown in Hmawbi (high rainfall), Tatkon (intermediate rainfall), and Mandalay (low rainfall). From the results of the analyses of the seeds obtained the following conclusions are drawn:—(1) That the hydrogen cyanide content is an inherent character of pure single-plant cultures; (2) the content varies considerably with the soil and climatic conditions; (3) that cultures giving low amounts of hydrogen cyanide in one locality give low figures under all the conditions tested; (4) that differences in the colour of seeds from a single culture are not correlated with the different hydrogen cyanide content of their progeny; and (5) that the best cultures hitherto found contain prussic acid, but only half that present in the originally imported Madagascar bean.

MESSRS. STANDLEY BELCHER AND MASON, LTD., Church Street, Birmingham, writing with reference to the article on scientific glassware contributed by Dr. M. W. Travers to NATURE of December 5, state that "already by November, 1914, we were supplying beakers, etc., made in our own moulds, from a formula supplied by us." In Dr. Travers's article those firms only were mentioned which mark their glass with the name of the maker and the words "British made," and that accounts for the omission of the names of other firms. No injustice was intended, but it must be admitted that, by displaying and selling glassware which does not bear the maker's name, certain dealers fail in their obligations to British industry and belong to a different category from firms concerned solely with ware distinctly shown to be of British manufacture.

OUR ASTRONOMICAL COLUMN.

FIREBALL ON DECEMBER 6.—At 9h. 36m. a very fine meteor was observed at Bristol, Weston-super-Mare, and Falmouth. The object lit up the partially clouded sky like a vivid flash of lightning. From the descriptions already to hand it appears that the meteor moved slowly from a radiant at 133°+69°, and fell from a height of 67 to 24 miles along a path of 67 miles. The position was from above Rhayader to south-east of Carmarthen, in South Wales, but further observations are necessary for the determination of very trustworthy results.

COMET 1918*d* (SCHORR).—A new comet, of feeble luminosity, was discovered at Bergedorff (Hamburg) by Dr. Schorr on November 23. From observations made on November 23, 24, and 25, Messrs. J. Braae and J. Fischer-Petersen have calculated the following orbital elements:—

$$T = 1918 \text{ August } 7{\cdot}906 \text{ G.M.T.}$$
$$\left.\begin{aligned} \omega &= 230^\circ\ 42'\cdot18'' \\ \Omega &= 129^\circ\ 16'\cdot90'' \\ i &= \ 5^\circ\ 27'\cdot21'' \end{aligned}\right\} 1918{\cdot}0$$
$$\log q = 0{\cdot}19222$$

The following is an extract from the ephemeris:—

1918	R.A. 1918·0 h. m. s.	Decl. 1918·0 ° ′	Log r	Log Δ
Dec. 21	3 58 15	+12 54·3	0·3749	0·1666
25	3 57 41	+13 10·3	0·3816	0·1844
29	3 57 30	+13 27·1	0·3883	0·2024

During December the computed brightness ranges from the 14th to the 15th magnitude.

SPECTRA OF BINARY STARS.—In a communication to the American Astronomical Society (*Pop. Ast.*, vol. xxvi., p. 635) Dr. R. G. Aitken summarises the results of a comparison of his list of close double-stars with the unpublished new Draper Catalogue of stellar spectra. The spectral classes of 3919 pairs, including practically all those as bright as 8·5 B.D. magnitude, were identified, with the results shown in the following table, which also includes the 605 spectroscopic binaries (in the entire sky) which were known in October, 1917:—

Spectral Class	Visual Binaries Numbers	Percentages	Spectroscopic Binaries Numbers	Percentages
O–B8	157	4	198	33
B9–A3	1251	32	161	26
A5–F2	532	14	61	10
F5–G0	1093	28	71	12
G5–K2	837	21	95	16
K5–Md	49	1	19	3
Totals	3919	100	605	100

The figures show that while spectroscopic binaries are most numerous among stars of class B, the visual binaries are relatively most numerous among stars of class G.

A NEW "SOLAR CONSTANT" OBSERVATORY.—The Smithsonian Institution has established an observing station at Calama, Chile, for further investigations of the apparent variations of the solar radiation, to which so much attention has been given by the director, Dr. C. G. Abbot (*Pop. Ast.*, vol. xxvi., p. 633). The site is 2250 metres above sea-level, and, according to several years' records, is the most cloudless station in the world. For the two years 1913–14 the average number of wholly cloudless days at 7 a.m. was 228, at 2 p.m. 206, at 9 p.m. 299, and of completely cloudy days none. The precipitation is zero, and the temperature seldom falls below 0° C. or rises above 25° C. The observational conditions would thus appear to be extremely favourable for the work contemplated.

MEDICAL RESEARCH.

MUCH has been said of late as to the importance of encouraging research work in the applied sciences. In the fourth annual report of the Medical Research Committee[1] we have ample illustration of the enormous field presented for research work in medical science under conditions both of peace and of war. The diversion of scientific research to war purposes has nowhere led to more marked service than in the sphere of medical research. When considered from the point of view of mere economy of expenditure, and quite apart from the enormous saving of life and suffering, medical research is shown to pay; thus, by improved methods in the treatment of heart cases at the Colchester Hospital, cures were effected more rapidly, with a consequent saving of 50,000*l.* in a single year.

Although attention has naturally been focussed on the magnitude of pain and on the toll of life involved in war casualties, it must not be forgotten that in times of peace the volume of avoidable suffering and loss is measurable in terms of similar magnitude to those which obtain in war. Among the grave problems with which we are now faced is that of the low standard of our national physique, the statistics of which have recently been described by the Prime Minister as "staggering." The investigations carried out under the auspices of the Medical Research Committee on problems connected with tuberculosis, rickets, growth factors, industrial diseases, industrial fatigue, etc., are a step towards the scientific establishment of a healthy race, and have already reached important results.

A remarkable feature of medical research since the

[1] Fourth Annual Report of the Medical Research Committee, 1917–18. (London: H.M. Stationery Office, 1918.) Price 4*d.* net.

commencement of the war, and especially during the present year, has been the increasing prominence of the work of physiologists; thus the problems of war by poison gas, of aviation, and of surgical shock call for solution on the lines of experimental physiology. It has often been said in the past that British physiologists, though second to none, have not established and maintained sufficiently close contact with clinicians, and this statement, like its converse, is incontestably correct. In this connection, however, fine distinctions cannot be made between academic and practically applied science; it is for the academic worker to discover, and for the practical worker to apply. This is strikingly shown by the application of the researches of Prof. Bayliss on colloids to the treatment of surgical shock, which takes the practical form of the injection of gum solutions to restore the deficient circulation underlying shock. Practical surgery has thus profited in an unexpected way from the results of purely academic labours.

Conversely, in the investigation of the restricted breathing and distress following exposure to poisonous gases, Mr. Barcroft and Dr. Haldane have not only been able to suggest valuable lines of treatment, but have also revealed important new facts in the physiology of respiration.

The work reported in the present publication is divided into three sections, viz. the work of the Central Research Institute, the researches framed before the war, and the work in connection with the war. These researches are, to a great extent, interdependent. It is impossible to give here even a brief summary of the important work which has been carried out, or of the valuable results which have followed from such work carried out, under the auspices of the Medical Research Committee. The present report is itself such a brief summary of work done or projected, and in it reference is made to more than 150 published papers and reports on these various subjects. It is to this annual report and to the publications therein mentioned that the reader should refer for detailed accounts.

Among the subjects of investigation which have yielded important results are those connected with problems of national physique mentioned above, with diseases of the heart and nervous system, and with the study of diabetes. These are researches commenced or framed before the commencement of the war. In connection with the war the information which has been elicited is often of a confidential nature, but much of it has already been made current. Valuable service has been rendered by the Committee to research workers at home and abroad, both by the provision of special apparatus not procurable through the usual channels of Army supply, and by the dissemination of information. With regard to the latter, the monthly "Medical Supplement," containing abstracts of foreign (including enemy) scientific medical work, which have been supplied by the Committee for publication by the War Office General Staff, has been much appreciated.

The most important investigations carried out in connection with the war are those dealing with the medical history of the war, the treatment of infected wounds, of gangrene, dysentery, typhoid, cerebro-spinal fever, trench nephritis, soldiers' heart, chest wounds, surgical shock, "gassed" cases, brain injuries, T.N.T. poisoning, etc. Special mention should also be made of investigations of medical problems connected with flying, and with the testing of aviators as to suitability for flight. Investigations connected with the manufacture and administration of salvarsan are also in progress. Researches into the epidemiology of phthisis, measles, whooping-cough, plague, and influenza are also occupying the attention of various workers under the Committee.

THE BRITISH GLASSWARE INDUSTRY.

THE British Chemical Ware Manufacturers' Association, the British Flint Glass Manufacturers' Association, the British Lamp-blown Scientific Glassware Manufacturers' Association, and the British Laboratory Ware Association—organisations representing the manufacture and distribution of scientific glassware—have jointly addressed the Inter-Departmental Glass Trades Committee, representing the Board of Trade and the Department of Optical Munitions and Glassware Supply (Ministry of Munitions), setting forth their views as to the steps which should be taken to secure the permanent establishment of the trade in this country. They point out that in 1914 the shortage of scientific glassware threatened disaster. Industries such as agriculture, food production of all kinds, and the manufacture of armaments, iron and steel, non-ferrous metals, gas, dyes, explosives, leather, and oil, also our military and civil medical services and the public services responsible for public health and hygiene, which could not be conducted without efficient scientific control, were in danger. The "master key" to the maintenance of our position, and to ultimate victory, was for the moment in the hands of our enemies.

During the war the energy and enterprise of our manufacturers have enabled them to build up the industry and to supply all the requirements of the country, but having always before them the immediate needs of the country rather than the future of the industry, the position in which they now find themselves is highly unfavourable compared with that of manufacturers in enemy and neutral countries. Since the outbreak of the war the cost of materials has risen threefold and wages have doubled. The cost of experimental work, the payment of excess profits duty, and the heavy charges on capital account have made it impossible to accumulate the funds necessary for the proper financing of the industry; and even so far as money has been available, there has been great difficulty in procuring material for the construction of buildings and furnaces suitable in quantity and quality. The labour difficulty and the calling up of all lads of eighteen years of age have seriously hampered the industry.

In view of the importance of the industry, the associations petition the Government to prohibit the importation of scientific glassware into the country, subject not only to licences being granted in the case of articles not manufactured in the country, but also to the control of prices, and later to impose a duty upon imported goods. They also direct attention to the need for financial assistance, and for aid in carrying out those scientific and technical investigations which are essential if the industry is to be established permanently in the country.

THE ANTARCTIC ICE-CAP AND ITS BORDERS.[1]

THOUGH much of the foundation of the Antarctic ice-cap is certainly elevated land, it is quite possible that elsewhere the dome rests upon a floor actually below sea-level. In any case, it is most probable that the smooth ice-surface masks a very irregular rock-basement. The thickness of the ice may, therefore, be expected to be extremely variable, no doubt reaching a maximum of several thousand feet.

An ice-formation of such magnitude introduces questions relating to the flow of its substance and

[1] Introduction of a discussion at the Geological Society on November 6, by Sir Douglas Mawson.

the abrasion of its foundations which do not enter into the physics of ice-masses of smaller dimensions. Here the static pressure on the lower zones of the ice may reach 1 ton per sq. in. At the same time, the temperature may be so increased by ground heat as to be much higher than that prevailing above. As a consequence, when the ice-formation is very thick a more plastic base must be admitted.

The outflow of the inland ice is principally deflected at the coastal margin into depressed areas outlining the heads of gulfs and bays. In such localities the rate of movement and the volume of ice entering the sea are both great—so great, indeed, that extensive floating "glacier tongues" are a feature of such situations, often extending forty to fifty miles from the shore.

Along other stretches of the coast less well placed for receiving contributions from the interior of the continent the outflow is so much less that the destructive influences at work on reaching the sea easily maintain its boundaries at approximately the true coast-line.

As exceptions to this latter prevailing condition, however, there are known already two notable localities where the general overflow from the land maintains itself as an immensely thick floating structure extending far out over the sea—a veritable oceanic ice-cap. To this type of formation we apply Prof. Nordenskjöld's term "shelf-ice." The formations referred to are the Great Ross Barrier at the head of the Ross Sea, and the Shackleton Shelf off the coast of Queen Mary Land.

The former occupies what is really the head of the Ross Sea—a somewhat triangular area. From apex to base it measures five hundred miles, with a base-length of about four hundred miles. This great raft of ice presses forward to the open sea at the rate of a few hundred yards per annum. The available figures, quoted by David and Priestly, show that, at the present rate of advance, the ice now appearing at the sea-face must have left the inner extremity of the floating sheet at some time during the seventh century. A survey of the ice-cliff forming the sea-face indicates by its changing height that the Ross Barrier is of varying thickness. This has been explained by the presence, in localities where it is thickest, of the remnants of the massive-ice contribution received during its course from certain of the large tributary glaciers. The ice from these glaciers, in fact, constitutes a strong framework which stiffens and contains the more crumbling structure derived from the consolidation of the annual snowfall.

To a great extent this must certainly be so; but the influence of a varying snowfall, and the effect of violent periodic winds—a feature of the region—in sweeping the loose snow from certain areas and depositing it in other favoured localities, must be reckoned with. The snowfall is lighter on the eastern side than on the west. Furthermore, the snow tends to accumulate on the western side owing to the fact that the winds regularly blow from the quarter south to east, and not from the west.

In the case of the Shackleton Shelf, this is the more remarkable because it maintains itself as a pontoon stretching into the open sea, even across the drift of the prevailing ocean current.

The deluge of ice, after descending to the sea, presses northwards as an integral whole, at first touching bottom at intervals, then forcing its way past several islands, and eventually reaching an extreme distance of 180 miles from the land before it is mastered by the swell and currents of the Southern Ocean. It is somewhat triangular in form, with the apex out to sea. The base against the land, though not completely charted, extends in all probability for a distance of about two hundred miles.

The main body of the shelf-ice advances rather slowly, but the Denman Glacier, which contributes to it, has a much more rapid movement, very well illustrated by the fact of its ploughing through the other shelf-ice with such force that a shatter-zone some miles wide is developed.

The wall of the shelf-ice on the west side offers an excellent example for study, as it is a section from the point of its departure from the land to its crumbling apex. In the case of the Ross Barrier, the cliff-face is a section across the direction of movement.

At the land end the Shackleton Shelf, from the surface down, is hard glacier-ice breaking with a characteristic fracture. A few miles farther out, away from the influence of the winds descending from the land slopes, a *névé* mantle commences to make its appearance over the original ice formation. As one steams along the face away from the land this capping is observed to increase steadily in thickness. The overburden of *névé* is arranged in regular bands, each of which corresponds with a single year's addition. This being so, it is possible to make some sort of estimate of the age of the formation.

The weight of these additions depresses the top of the original ice below the surface of the water. Though there is a regular annual addition above, it must not be imagined that the total thickness of the pontoon is correspondingly increased; for the solution of the lower surface by the sea has also to be reckoned with. Very often, however, in the *névé* sections of glacier-tongues the cliff-face above the water is observed to stand higher than in the wholly ice zone at the land end. This is to be expected on account of the lighter nature of the *névé* ice added, there being a larger proportion of air sealed up in it.

The observed height above sea-level of Antarctic shelf-ice so far recorded ranges from about 20 ft. to more than 200 ft. A common figure is from 90 ft. to 120 ft., suggesting a total thickness of 600 ft. to 1000 ft.

Although the height of the cliff-face presented by shelf-ice gives some idea of its total thickness, a really accurate method of determination is badly needed. The Australasian Expedition hit upon a method which gives positive results, in some cases at least. This consists in taking serial temperatures of the sea-water in depth near the face of the shelf-ice. As there is always a current flowing beneath the ice, the bottom of it is likely to be marked by a sudden slight change in the water temperature, easily observed when the observations are plotted as a graph.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The titular degree of M.A., *honoris causa*, has been conferred upon Mr. Frederic William Harmer, of Norwich, in recognition of his researches in geology, especially the geology of the Eastern Counties. Mr. Harmer is the father of Dr. S. F. Harmer, Keeper of the Department of Zoology, British Museum (Natural History).

LONDON.—At University College arrangements have now been completed in the faculty of engineering to enable students whose courses have been interrupted by war service, or those who were unable to begin their engineering studies last October owing to war conditions, to resume or begin their studies by entering next term, January 13, 1919. For both classes of students additional work will be provided during parts of the Easter and Long Vacations, so as to enable

them to get in a full session's work between January and August, 1919. Arrangements of a like kind are in contemplation in other faculties.

OXFORD.—On December 3 the honorary degree of D.Sc. was conferred on Mr. William Crooke. In presenting Mr. Crooke, the Public Orator referred to his admirable work as a member of the Indian Civil Service, and especially to his continuation of the research on the anthropology of the native races of India so ably begun by the late Sir Herbert Risley, whose chief work Mr. Crooke had lately edited. The recipient of the degree, it was added, was recognised as a leading authority on the important subject of caste and tribal groups in India generally, and particularly in the N.W. Provinces and Oudh.

Magdalen College has long been honourably noted for the support that it has given to natural science in the University. Two recent elections by the president and fellows of that society have worthily carried on the tradition. Mr. E. S. Craig, of University College, Assistant Registrar of the University, has for many years been well known as a successful teacher of mathematics and physics, especially in the electrical department, where he acted for some time as demonstrator under Prof. Townsend. His election to a fellowship at Magdalen is widely welcomed in the University as a well-merited recognition of excellent scientific work, as well as of capable and courteous administration. Mr. E. G. T. Liddell, of Trinity College, has been elected to a senior demyship in the same college. Mr. Liddell, who was recently placed in the First Class in the final honour school (physiology), has been engaged in research work at the Lister Institute of Preventive Medicine.

THE annual meeting of the Association of Public School Science Masters will be held at the London Day Training College, Southampton Row, on December 31, 1918, and January 1, 1919, under the presidency of Sir Ronald Ross. The subject of the president's address will be "Observations on the Results of our System of Education." A lecture on poison-gas warfare will be given by Lt.-Col. Smithells. There will be discussions on the importance of restricting specialisation in university scholarship examinations and giving weight to general education, opened by Mr. F. S. Young; science in the general education of boys, opened by Mr. W. D. Eggar and Mr. C. V. G. Civil; and courses in general science for classical Sixth Forms, opened by the Rev. S. A. McDowall.

THE annual meeting of the Geographical Association will be held on Friday, January 3, and Saturday, January 4. In the afternoon of the former day Mr. A. R. Hinks will give an address on war-maps at the Royal Geographical Society's house, Kensington Gore, S.W.7. A collection of captured maps and maps made by the R.G.S. will be on view; and there will also be an exhibition of war maps, kindly lent by the authorities, at the London Day Training College, where the remaining meetings will be held. An address will be given by the president, Prof. Grenville A. J. Cole, on the narrow seas and the Arctic route to Muscovy; and other subjects to be brought forward are:—The historical geography of West Africa, by Mr. W. H. Barker, and when and how often should we teach the geography of the British Isles to our pupils, a discussion led by Miss D. D. Adam and Mr. C. B. Fawcett.

DETAILS of the bequests under the will of Mrs. Russell Sage, whose death was announced on November 4, are contained in the issue of *Science* for November 22. Mrs. Sage was the widow of Mr. Russell Sage, who died in 1906, bequeathing a fortune of about fifteen millions sterling almost entirely to her. Her will disposes of an estate estimated at 10,000,000*l*., of which more than 8,000,000*l*. is to be distributed among charitable, educational, and religious institutions. It is said that since the death of her husband Mrs. Sage had given between seven and eight millions sterling to various institutions and charities, using part of the principal, as well as the income, of the Sage estate in these benefactions. Certain sums given by Mrs. Sage in her lifetime to institutions are to be deducted from the bequests under the will. Among the benefactions under the will may be mentioned:—Russell Sage Foundation, 1,120,000*l*.; Metropolitan Museum of Art and the American Museum of Natural History, 160,000*l*. each; the New York Botanical Garden, New York Zoological Society, Troy Polytechnic Institute, and Union College, Shenectady, 160,000*l*. each; Syracuse University, 320,000*l*.; and 160,000*l*. each to thirteen other colleges and universities in the United States. Smaller bequests are made to six other educational institutions.

AT the annual prize distribution on December 7 of the Northampton Polytechnic Institute, St. John Street, London, E.C.1, the principal, Dr. R. Mullineux Walmsley, read a full report of the many activities of the institution during the session 1917–18. In the Engineering Day College the manufacture of high-class munitions upon a commercial scale, commenced on July 1, 1915, was continued uninterruptedly during the whole session. During its existence this workshop has produced 14,720 high precision gauges, many of them accurate to two ten-thousandths of an inch, and 43,511 gun parts for Woolwich Arsenal—a record which is believed to be in excess of the record of any similar educational workshop in the metropolis. In the Technical Optics Department the work of training women students in full-time classes in lens and prism grinding was vigorously prosecuted throughout the whole year. This work was pressed forward, with the result that an almost continuous stream of women workers in the industry was available for the development and extension of existing optical workshops, not only in England, but also in Scotland and Ireland. The training of disabled sailors and soldiers to take their place in the life of the country was continued. During the session nine complete courses for training suitable men as electrical sub-station attendants were held, and the whole of the men trained were placed out. This brought the total number of such courses held since they were started in June, 1916, to twenty. The number of individual students who joined the Colours during the war was 2052, including twenty-five members of the staff; of these 237 obtained commissions, 90 gave their lives in the service of their country, and 190 names occur on the Roll of Distinction.

AN announcement has been published by the Department of Demobilisation and Resettlement of the Ministry of Labour in connection with the higher education and training for men who have served in the Forces. In order to restore the supply of men of higher scientific, professional, and business attainments whom the nation needs for every profession and industry, the Government has decided in suitable cases to provide financial assistance for ex-Service men who desire to resume suitable education and training, with a view to their resettlement in civil life, but who cannot otherwise afford to meet the expenses involved. The scheme sanctioned applies equally to officers, warrant officers, non-commissioned officers, and men in the ranks, provided they are of

suitable educational promise. The amount of the assistance to be granted will be limited to the actual sum deemed sufficient to meet the necessary fees and the expenses of maintenance of the candidate, after due account has been taken of his private means, if any. It is intended, however, that the amount of the assistance shall be such as will enable a candidate to take his course of training under reasonably adequate conditions. The types of training for which assistance may be granted are :—(1) Courses of higher education in institutions approved by the Board of Education or by the Board of Agriculture and Fisheries, or by the corresponding Departments for Scotland or Ireland; (2) such practical training in offices and works and professional employments as may be approved by the Ministry of Labour; and (3) such practical training on farms, etc., as may be approved by the Board of Agriculture and Fisheries, or by the corresponding Department for Scotland or Ireland. The Ministry of Pensions will co-operate in the working of the scheme on behalf of disabled officers and men, who will be eligible for assistance under the scheme, subject to compliance with the prescribed conditions. The existing provisions of the Royal Warrants as to training the disabled will remain in force, so far as they may be more beneficial to candidates than the provision made by this scheme.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, December 5.—Dr. J. W. L. Glaisher, vice-president, in the chair.—Dr. C. **Chree**: Electric potential gradient and atmospheric opacity at Kew Observatory. It has been the practice for many years at Kew Observatory at the ordinary hours of meteorological observation to record the most distant of a selected series of objects which is visible at the time. Separate notes are also made of the presence of mist or fog. Thus a large amount of information has accumulated as to the greater or less opacity of the atmosphere. The present paper utilises the data for a comparison of atmospheric opacity and the potential gradient of atmospheric electricity. It is found that even for the smallest amount of opacity which the observation scheme is able to disclose, the value of the potential gradient increases with the opacity. The effect of mist or fog on the potential gradients recorded in winter is great, and, there being a large diurnal variation in the incidence of mist or fog, there is consequently a noteworthy influence on the character of the diurnal variation of potential gradient.—E. **Nevill**: The value of the secular acceleration of the mean longitude of the moon. It is shown that where the observed errors of the tabular place of the moon are properly corrected for the observed errors in the values of the principal coefficients employed in Hansen's Lunar Tables, the residual errors are such as to show that the true value of the coefficient of the secular acceleration in the mean motion of the moon cannot differ sensibly from the value 6·2″ assigned to it by theory, so that it affords no evidence from observation of any tidal retardation in the rotation of the earth.—S. B. **Schryver** and Nita E. **Speer**: Investigations dealing with the state of aggregation. Part iv.: The flocculation of colloids by salts containing univalent organic ions. The theories dealing with the mechanism of the action of salts in flocculating colloids is discussed. According to one theory the adsorption of the discharging ion of the flocculating salt is the predominant action. If this is the case, it might be expected that salts which cause the greatest lowering of the surface tension of water would exert the greatest flocculating action where water is the dispersion medium. A series of salts containing organic ions was chosen, of which the normal solutions exhibit a wide range of surface tensions, and their flocculating action on a number of colloids was investigated. In general, no relationship was found to exist between this action and the surface tensions of the solutions. In one case, however (that of mastic), there was a marked parallelism. Attention is directed to the fact that two classes of suspensoid colloids might exist. The first class comprises those colloids which owe their charge to an ion of the salt from which the colloid is prepared, as, for example, the chlorine ion attached to a ferric hydroxide sol prepared by the hydrolysis of ferric chloride. The second class includes colloids in which the charge is due to a dissociated labile ion belonging to the colloid proper, held electrostatically to a less labile ion, as, for example, the mastic colloid, when a hydrogen ion (of the carboxyl radicle) is held electrostatically to a large anion. It is proposed to designate colloids of the first class *exionic*, and those of the second class *endionic*.—E. **Hatschek**: A study of the forms assumed by drops and vortices of a gelatinising liquid in various coagulating solutions. The paper describes a series of experiments in which drops of gelatin sol are allowed to fall into various solutions. Conditions can be so arranged that gelation takes place when any desired shape of the hanging drop or vortex thus produced has been attained. The result is permanent models of what are only transient forms when two liquids are employed, as in the experimental methods practised hitherto. If the solutions have a dehydrating effect on gelatin, a number of features not produced at all with liquids appear, such as radial ribs and membranes, or, generally speaking, cross-sections other than circular. The conditions can further be varied by the use of solutions, or of salts added to the gelatin sol, which leads to the production of permeable or semi-permeable membranes on the gelatin drop. By these means a further range of forms can be obtained, such as bi-concave discs of the shape of the human red blood corpuscle, hanging drops showing abnormal profiles and superficial segmentation, and vortex forms greatly modified by general shrinkage. Many of the forms obtained in these experiments show a close resemblance to those of the simpler organisms, both as regards general outline and secondary features.

Geological Society, December 4.—Mr. G. W. Lamplugh, president, in the chair.—Lt.-Col. Wheelton **Hind** and Dr. A. **Wilmore**: The Carboniferous succession of the Clitheroe province. The tectonic structure of the province consists of three dissected parallel anticlinal folds in beds of Carboniferous Limestone, Pendleside, and Millstone Grit age. Dissection has exposed the lower beds of Z, C, and S age, as the tectonic axes and beds of D, P, and Millstone Grit age occur on the flanks. The authors give the following table of Goniatite zones :—

	"Middle" Coal Measures	*Gastrioceras carbonarium*, von Buch
	Lower Coal Measures	*Gastrioceras carbonarium*, von Buch
	Upper Millstone Grit	*Gastrioceras listeri*, Martin
	Sabden Shales	*Glyphioceras diadema*, Beyrich
Zones of the Pendleside Series	Shales below Millstone Grit	
	Bowland Shales	*Glyphioceras bilingue*, Salter; *Glyphioceras reticulatum*, Phillips; *Glyphioceras spirale*, Phillips; *Glyphioceras striatum*, Phillips
	Posidonomya becheri Shales	*Nomismoceras rotiforme*, Phillips; *Prolecanites compressus*, Sowerby
	Carboniferous Limestone, P_2	*Glyphioceras crenistria*, Phillips

Linnean Society, December 5.—Sir David Prain, president, in the chair.—Prof. W. A. **Haswell**: The Exogoneæ. The author gives a detailed account of the species occurring at Port Jackson of this group of small Polychæte worms, belonging to the family

Syllidæ. After discussing the histology of the muscular gizzard, the author describes the reproductive organs, the modification of the nephridia at maturity, and the fixation of the ova on the ventral or dorsal surface of the mother, where they undergo development. One species, *Grubea pusilloides*, is described as hermaphrodite. The paper closes with an account of the early cleavage of the ovum and the later development.—C. D. **Soar**: Coloured drawings of British mites. The drawings illustrate the whole of the Hydracarina found and recorded for the British area. In all, there are 246 species, representing forty-two distinct genera. More than forty species and four genera were figured and described for the first time as British, and of these only four or five have since been recorded on the Continent.

Mathematical Society, December 12.—Mr. J. E. Campbell, president, in the chair.—G. H. **Hardy** and J. E. **Littlewood**: Applications of the method of Farey dissection in the analytic theory of numbers:—(1) A new solution of Waring's problem. (2) Proof that every large number is the sum of at most thirty-three biquadrates. (3) The Riemann hypothesis and the expression of a number as the sum of a stated number of primes.—N. M. **Shah** and B. M. **Wilson**: Numerical data connected with Goldbach's theorem.—Prof. M. **Fréchet**: Integrals in abstract fields.

MANCHESTER.

Literary and Philosophical Society, November 26.—Mr. W. Thomson, president, in the chair.—Prof. H. **Lamb**: The movements of the eye. The theory of the movements of the eye, as developed by Helmholtz, includes some results of great interest to mathematicians as well as to physiologists. Unfortunately, they have scarcely become familiar to mathematicians, who have been apt to regard the whole matter as outside their province. The analytical investigations of Helmholtz are, moreover, long and intricate, and have doubtless been an obstacle to mathematicians and physiologists alike. The author had found that with the help of one or two propositions in the theory of rotation, now well known, the whole question can be treated in a simple and purely geometrical manner, without the use of a single mathematical symbol. The paper consisted of an exposition of the subject from the above point of view. By the aid of diagrams the classical theorems of Euler and Sir W. Hamilton on rotation were explained and used to illustrate Listing's law, which governs the positions of the eyeball when the gaze is directed to various parts of the field. Finally, the apparent distortion of straight lines and the theory of those lines which are *apparently* straight were considered. The eye is necessarily imperfect in these respects, and in obeying Listing's law effects a compromise, which is probably the best admissible.

DUBLIN.

Royal Irish Academy, November 30.—H. **Ryan** and P. **Ryan**: The action of nitric acid and nitrous acid on diphenylamine. The action of the oxy-acids of nitrogen on diphenylamine in carbon tetrachloride solution is similar to that which takes place between the same bodies in acetic acid solution. The products isolated in the various stages of the reaction at the ordinary temperature and at low concentrations of the interacting substances were: Diphenylnitrosoamine, 4-nitrodiphenylamine, 4-nitrodiphenylnitrosoamine, 4 : 10- and 2 : 10-dinitrodiphenylnitrosoamines, 4 : 10-, 2 : 10-, and 2 : 8-dinitrodiphenylamines, 2 : 4 : 8-trinitrodiphenylamine, and 2 : 4 : 8 : 10-tetranitrodiphenylamine.—H. **Ryan** and W. **O'Riordan**: The action of bromine on some derivatives of diphenylamine. Diphenylamine is generally estimated by converting it by means of bromine into its tetrabromo-derivative, and either weighing this or determining the amount of bromine absorbed during the reaction. The assumption that the only product formed from diphenylamine by interaction with a cold solution of bromine is tetrabromodiphenylamine is not entirely justified, inasmuch as hexabromodiphenylamine is also formed. In this connection the action of bromine on some nitro-derivatives of diphenylamine was also examined. Bromine reacted with 4-nitrodiphenylnitrosoamine, forming a dibromo-4-nitrodiphenylamine melting at 216° C., with 2 : 4-dinitrodiphenylamine giving a dibromo-2 : 4-dinitrodiphenylamine melting at 195·5° C., with 2 : 10-dinitrodiphenylamine or 2 : 10-dinitrodiphenylnitrosoamine forming a dibromodinitro-derivative melting at 185° C., and with 4 : 10-dinitrodiphenylamine or 4 : 10-dinitrodiphenylnitrosoamine yielding a dibromo-4 : 10-dinitrodiphenylamine melting at 247° C. At the ordinary temperature bromine did not react on a solution of 2 : 4 : 8 : 10-tetranitrodiphenylamine.

EDINBURGH.

Royal Society, December 2.—Dr. John Horne, president, in the chair.—Prof. J. **Stephenson** and Dr. Baini **Prashad**: The calciferous glands of earthworms. The simplest condition of these calciferous glands is that in which there occur slight segmental bulgings of the œsophageal canal, within which are a number of transverse folds of the epithelium. In many forms these bulgings become diverticula, such, for example, as in *Octochaetus barkudensis*, where the glands are large lobed sacs communicating with the œsophageal canal only by a narrow neck or "duct." The condition in Eutyphœus may be considered as having arisen from the fusion, along their edges, of a series of parallel epithelial lamellæ. In the Lumbricidæ the condition originated in a series of longitudinal lamellæ. The mode of evolution has been similar to what has happened in Eutyphœus, the inner edges of the lamellæ having fused. The epithelium of the glands is in all cases continuous with that of the œsophagus, and comparative anatomy shows that the various forms of glands are essentially due to various forms and degrees of complexity of the epithelial folds. The glands are, therefore, not mesodermal in origin, and are not merely the walls of blood-vessels, as has recently been contended.—Prof. J. **Stephenson** and H. **Ram**: The prostate glands of the earthworms of the family Megascolecidæ. Typical examples of the lobate and tubular prostates of the Megascolecidæ have been studied in detail. In both, the cells of the gland disintegrate to form the secretion, which takes the form of granules; in the functioning gland, therefore, cell outlines are largely lost. Regeneration takes place in both by the formation of discrete cells at the periphery of the gland. In the tubular form all the cells probably reach the lumen of the gland, and discharge directly into it. In the lobate form it appears that a large number of cells never reach the lumen of the intralobular ductule. Evidence of various kinds was supplied in proof of the fact that the glandular mass is in neither case an invagination from the surface, but is derived from tissues of mesoblastic origin.—Dr. A. M. **Williams**: The adsorption isotherm at low concentrations. It was shown that for very small adsorptions the adsorption law, both for gases and solutions, may be expressed in the form $\alpha=\alpha_0 c$, where α is the amount adsorbed and c the equilibrium concentration. The general form of the adsorption curve for solutions was deduced from the above conclusion and found

to agree with the results of different observers.—Lieut. J. **Logie**: The origin of anticyclones and depressions. In this paper importance was laid on radiation as the chief cause of the differences between cyclones and anticyclones. Cyclones are caused by the local cooling of the air, and anticyclones by heating, and not the reverse, as commonly believed. These facts were in harmony with the theory presented, which was developed in mathematical form in accordance with the ordinary gas laws. It was found that the entropy of the air would be increased in the region of origin, which, from the data as to upper-air temperatures provided by Mr. W. H. Dines, was estimated as being at a height of four to six kilometres. The effect of differing density of the air under the same pressure gradient was shown to intensify the pressure differences. The radiative effect might be obtained by the movement of air from equator to pole, by changes of diathermancy due to formation of thin haze, or by the covering of a large tract of country by cloud, and these causes were considered adequate in giving the variation of radiative effect required.

MELBOURNE.

Royal Society of Victoria, October 10.—Mr. J. A. Kershaw, president, in the chair.—W. M. **Bale**: Further notes on Australian Hydroids. Part iv. In this paper the author describes several new species from Victorian waters. *Lytocarpus urens,* Kirchenpauer, from Moreton Bay specimens, is proved to be the female form of *L. phillipsinus,* K. Notes are added regarding the specific relationships of the Australian brown Hydras, generally referred to *H. oligactis* (*H. fusca*). It is possible that they belong to other, European and American, species, which further research will determine.

SYDNEY.

Royal Society of New South Wales, October 2.—Mr. W. S. Dun, president, in the chair.—R. H. **Cambage**: Acacia seedlings. Part iv. The author described the seedlings of twelve species, and pointed out that although bipinnate leaves are the dominant form in seedlings of this genus, yet one species, *A. alata*, so far as his tests had gone, did not appear to produce a bipinnate leaf at all, but had simply pinnate leaves and phyllodes. He stated that seeds of *A. melanoxylon* and *A. penninervis* had germinated after having been in sea-water for 469 days, and of *A. farnesiana* after 1375 days.

BOOKS RECEIVED.

Mnemonic Notation for Engineering Formulæ. Report of the Science Committee of the Concrete Institute. With explanatory notes by E. F. Etchells. Pp. 116. (London: E. and F. N. Spon, Ltd.) 6*s.* net.

Life of Frederick Courtenay Selous, D.S.O. By J. E. Millais. Pp. xi+387. (London: Longmans and Co.) 21*s.* net.

The Science and Practice of Manuring. By W. Dyke. Revised and enlarged edition. Pp. iv+157. (London: The Lockwood Press.) 2*s.* net.

British Rainfall, 1917. By Dr. H. R. Mill and C. Salter. Pp. 240. (London: E. Stanford, Ltd.) 10*s.*

Modern Chemistry and Chemical Industry of Starch and Cellulose (with Reference to India). By Prof. T. C. Chaudhuri. Pp. viii+156. (Calcutta and London: Butterworth and Co.) 3.12 rupees net.

Bureau of Education, India. Progress of Education in India, 1912–17. By H. Sharp. Vol. i. Pp. vi+215. (Calcutta: Supt. Govt. Printing, India.) 3.10 rupees, or 5*s.* 6*d.*

The Next Step in Religion. By Dr. R. W. Sellars. Pp. 228. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 1.50 dollars.

Wild Life of the World. By R. Lydekker. 3 vols. Vol. i., pp. xiv+472; vol. ii., pp. xii+440; vol. iii., pp. xi+457. (London: F. Warne and Co.) 4 guineas the three vols.

An Introduction to the Study of Biological Chemistry. By Prof. S. B. Schryver. Pp. 340. (London and Edinburgh: T. C. and E. C. Jack, Ltd.) 6*s.* net.

The Grasses and Grasslands of South Africa. By Prof. J. W. Bews. Pp. vi+161. (Pietermaritzburg: P. Davis and Sons, Ltd.) 7*s.* 6*d.* net.

Tables of Refractive Indices. Vol. i.: Essential Oils. Compiled by R. Kanthack. Edited by Dr. J. N. Goldsmith. Pp. 148. (London: Adam Hilger, Ltd.) 15*s.* net.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 19.

CHEMICAL SOCIETY, at 8.—Prof. F. Soddy: The Conception of the Chemical Element as Enlarged by the Study of Radio-active Change.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—P. Hunter-Brown: Carbon Brushes, Considered in Relation to the Design and Operation of Electrical Machinery.

ILLUMINATING ENGINEERING SOCIETY, at 8.—*Discussion opened by the President:* Summary of Progress in Photometry, with Special Reference to War Problems.

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