THURSDAY, NOVEMBER 23, 1916.

SIR HENRY ROSCOE.

The Right Honourable Sir Henry Enfield Roscoe. A Biographical Sketch. By Sir Edward Thorpe. Pp. viii+208. (Longmans, Green and Co., 1916.) Price 7*s.* 6*d.* net.

JUST over ten years ago "The Life and Experiences of Sir Henry Enfield Roscoe" was "written by himself." Now we have this "biographical sketch," a substantial volume, about half the size of the "Experiences," from the very competent pen of his distinguished former student and lifelong friend, Sir Edward Thorpe. Roscoe the chemist and the man is therefore shown as he appeared to himself on the one hand, and to his friends on the other. As for his enemies or detractors he had none, and therefore there is nothing further to be said. He has so recently been taken from us and his genial, kindly personality was so familiar that to the present generation this good man's memory will outlive his life so long as any who knew him remain. The present volume contains an excellent and characteristic photographic portrait of obviously recent date. For generations to come there are fortunately two good pictures which show him in the prime of life, one by Burgess in the Common Room at the Owens College, the other by Herkomer in the possession of the family.

Readers of the present volume are reminded that Henry Enfield Roscoe was born in London at 10 Powis Place, Great Ormond Street, on January 7, 1833. At the time of his death, December 18, 1915, he was, therefore, within a few days of his eighty-third birthday. His father died at the early age of thirty-eight, when the son was only four years old. The future chemist was brought up by his mother, to whose good sense he owed much in the encouragement she gave to his inclination towards scientific pursuits.

After working under Williamson at University College and taking his B.A. degree, he went to Heidelberg, accompanied by his mother and sister, and found a place in the laboratory of Bunsen, then at the height of his fame. The influence of the master served to emphasise Roscoe's natural bent towards what may be called operative chemistry, in preference to the theoretical or speculative aspects of the science. Returning to England after three years, having in the meantime secured his Ph.D., he set up a private laboratory in Bedford Place, Russell Square. But this venture was of short duration, for in the following year he was appointed to succeed Frankland, the first professor of chemistry in the newly founded Owens College in Manchester, and there he remained for thirty years.

From this time forward Roscoe was a diligent and successful investigator of chemical problems, and something over sixty papers stand in the catalogues to the credit of his name, alone or in association with some of his students. It is probable, however, that, interesting as were some of his subjects of inquiry, his name will be carried down to posterity less in connection with chemical discovery than with what must be regarded as the great achievement of his life, namely, the creation of the first provincial *school* of chemistry in this country. Previously to 1860 there had been great schools of medicine with which chemistry was associated in a subordinate position, and great individual professors, such as Graham, Williamson, and Frankland, but with the exception of Hofmann at the Royal College of Chemistry, they do not seem to have possessed that power of attraction which draws together a crowd of enthusiastic students. But this is what Roscoe did, for although not specially distinguished as a philosophical chemist, he had that remarkable gift of insight which enabled him to select for his students subjects of inquiry which always led to definite results. He had, moreover, some of the personal characteristics which belonged to Bunsen, his own teacher, of whom he speaks in glowing terms of respect and affection. As a man of science actively engaged in research Roscoe's career came practically to an end when he entered Parliament in 1886. As everyone knows, the remaining thirty years of his life were by no means idle or employed unprofitably, for he was busy in all sorts of educational movements, in the offices he held as treasurer and chairman of the Lister Institute and as Vice-Chancellor of the University of London, and in other directions in which he exercised his great influence to the benefit of science and of his country.

As to his home life, it is, indeed, true, as the author of the volume before us remarks, that "the hospitality of Woodcote is a treasured memory to numbers of Roscoe's friends." And there is one feature of his which is less noticed in the book than it deserves, and that is his quaint humour and love of a joke. It was great fun to hear him telling an amusing story to a certain lady visitor who, he knew quite well, would never see the point of it.

An incident may be mentioned which does not appear in the book. At the International Congress of Applied Chemistry in Rome in 1906 Roscoe was very naturally chosen as honorary president for the next meeting, to be held in London in 1909, Ramsay being the acting president. And being rightly recognised as the *doyen* of the English members of the Congress then in Rome, it was Roscoe who, among the King's guests at the Quirinal, had the honour of attending the Queen to dinner and sitting on her right hand. Moissan, the eminent French chemist, sat on her Majesty's left. W. A. T.

GROUP-THEORY.

Theory and Applications of Finite Groups. By Profs. G. A. Miller, H. F. Blichfeldt, L. E. Dickson. Pp. xvii+390. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 17*s.* net.

THE English student is fortunate in having, in his own language, a series of excellent treatises on the difficult theory of groups. The

present one is welcome as a record of progress, even in what may be called the elements of the subject, and as an original work by three distinguished experts. It is divided into three parts, for each of which one author is mainly responsible. Part i., by Prof. G. A. Miller, deals with the general properties of groups, beginning with substitution-groups, and going on to the abstract definition by generators; there are special chapters on Abelian groups, on groups of order p^m with p prime, on the polyhedral groups, on isomorphisms, and on solvable groups. Part ii., by Prof. H. F. Blichfeldt, is on linear groups, and a valuable summary of the present stage of that theory; in particular, there is a chapter on characteristics. Part iii., by Prof. L. E. Dickson, is on applications, and is naturally of a more elementary character; there are three chapters on the Galoisian theory of equations, one on rule and compass constructions, one on the inflexions of a plane cubic, one on the 27 lines of a cubic surface, and one which is a scrap on solutions of equations by a standard form $F(z, k)=0$, involving one parameter.

The outstanding novelty is the early proof of Sylow's theorem, which actually begins on p. 27. The proof is led up to by the definition and discussion of "double co-sets," which, it appears, were first used by Cauchy, and long afterwards taken up by Frobenius. In group-theory Sylow's theorem occupies a place something like that of the law of quadratic reciprocity in arithmetic; it is of a fundamental character, and each distinct proof of it marks an advance in the general theory. It may be noted, however, that the proof given by Prof. Miller assumes the group considered to be given in the form of a substitution-group; this is not a real limitation, because every group is isomorphic with a set of substitutions—a theorem proved on p. 63. We may, perhaps, be justified in thinking that the "genuine" proof of Sylow's theorem has yet to be discovered; that is to say, a proof based on the abstract definitions of a group, without using any special image of it, and also a proof which comes at the proper place in the sequence of the theory.

The authors give a considerable number of exercises, including some which are really easy. This is important, because every mathematical student ought to know the elements of group-theory; it is the only thing which gives unity to a host of scattered results in elementary algebra, trigonometry, and analytical geometry, and it is often a guide to us when we wish to estimate beforehand the complexity of a particular problem. In the case of some of the harder exercises hints are given to help the reader.

How far this treatise will suit a beginner, it is difficult to say. The subject is, for most students, a hard one, except in its very early stages, and Prof. Miller's contribution is concise as well as abstract. In any case, those who have made some progress in the theory, and wish to know its present condition, will find the work of great interest and value; a judicious skipper who begins at p. 321 or thereabout will perhaps enjoy himself more, and make more progress, than a conscientious plodder with a bookmark.

The treatise is appropriately dedicated to M. Camille Jordan, to whom the authors justly assign the credit of having mainly helped to establish group-theory as a leading branch of mathematics.

G. B. M.

AN INTERNATIONAL GEOGRAPHICAL EXCURSION.

Memorial Volume of the Transcontinental Excursion of 1912 of the American Geographical Society of New York. Pp. xi+407. (New York: American Geographical Society, 1915.) Price 3 dollars.

THE excursion of which this volume is a memorial was organised by Prof. W. M. Davis, of Harvard University, to celebrate two things—the sixtieth anniversary of the foundation of the American Geographical Society of New York, and the entry of that society into its new building in Broadway at 156th Street. The members of the excursion were mainly geographers invited from nearly every European country, and these were taken in a special train and by other means of communication over routes amounting in all to nearly 13,000 miles, first westwards through the northern tier of States to Seattle, thence south to San Francisco, and back through the middle States, but going so far south as Birmingham, Ala., in rounding the south of the Appalachians. Besides the European members of the party, there were about a dozen American geographers who went the whole round; and numerous other American geographers, geologists, and others capable of furnishing information about different parts of the United States joined the party for shorter or longer stages.

In the course of the excursion discussions were constantly being held with regard to the geographical features of the districts visited; and, seeing that Prof. Davis was the leader as well as the organiser of the party, it is only natural that those discussions should have frequently turned on the interpretation of the features according to the terminology which he has introduced so widely into geography. The contents of this volume are mainly made up of articles, written in German, English, French, and Italian, by members of the party, and it would have been interesting to find in one of these an example of the application of that terminology to geographical description, the purpose to which its author contends it is pre-eminently suited. But there is none. On the other hand, there are two or three in which the morphogenetic nomenclature of Davis is discussed, and more or less criticised, as by Prof. Ricchieri (pp. 63–5), Prof. Jaeger in his (somewhat maccaronic—intermingled German and English) article entitled "Bemerkungen zur systematischen Beschreibung der Landformen," and incidentally by Waldbaur in his "Bemerkungen über Stufenlandschaften" (bottom of p. 86, etc.). Even

where critical, however, all these contributors are more or less sympathetic.

All the articles except one (by Prof. Werenskiöld on "The Surface of Central Norway") are more or less connected with the United States. A good many come under the head of economic or economico-political geography. Such, for example, are Prof. Brückner's on "The Settlement of the United States as Controlled by Climate and Climatic Oscillations"; that by Prof. Demangeon on Duluth; that by Prof. Partsch on "Die Nordpazifische Bahn"; those by Profs. Nussbaum and Oberhummer on American towns, the latter on American towns as compared with the towns of Europe; that by Herbette on "The Harbours of the Pacific North-west of the U.S."; and that by Vacher on "Les Environs de Phœnix et le Barrage Roosevelt." Several discuss the origin of land forms, as Prof. de Martonne's on "Le Parc National Yellowstone," and that of Machatschek on "Ein Profil durch die Sierra Nevada mit einem Vergleich mit der Schollenstruktur in Zentralasien." There are some interesting "Observations sur deux Petits Geysers du Yellowstone," by Prof. Chaix, of Geneva; and Mr. E. de Margerie contributes an article written in excellent and even fascinating English on "The Debt of Geographical Science to American Explorers." Prof. Davis furnishes a brief note on the origin of the excursion, and its history is written by Prof. A. P. Brigham, of Colgate University, Hamilton, N.Y. In addition to a map showing the route, there are numerous photographic, diagrammatic, and other illustrations, and photographs of most of the European members of the party as well as of Profs. Davis and Brigham. The guests would have liked to see also the photographs at least of all those American members who went the whole round.

G. G. C.

OUR BOOKSHELF.

Mentally Deficient Children: their Treatment and Training. By Dr. G. E. Shuttleworth and Dr. W. A. Potts. Pp. xix+284. Fourth edition. (London: H. K. Lewis and Co., Ltd., 1916.) Price 7*s.* 6*d.* net.

THE mentally deficient are of considerable importance to the community; their behaviour may be offensive, they frequently exhibit criminal propensities, and they are a source of expense in that they need special care and are deficient as producers and wage-earners. The disability is of all grades, and frequently commences in childhood or may be congenital. The principal causes in children are maldevelopment of certain parts of the brain or retarded development of the brain and its functions from some intercurrent disease. The latter may be due to injury at or after birth, fevers, convulsions, epilepsy, and syphilis. There are also certain conditions of glandular inadequacy, as in the cretin whose thyroid gland is atrophied. Probably of children of school age some 1 per cent. or thereabouts are mentally feeble.

In this book the authors first detail the pathology of mental deficiency in childhood, its etiology, diagnosis, and prognosis. They then describe the methods to be adopted for the medical examination of mentally defective children, and devote considerable space to the medical treatment and educational, industrial, and moral training and recreation of mentally deficient children.

An important chapter deals with the results of treatment and training. Of the patients treated at the Royal Albert Institution about 50 per cent. do not improve or get worse, while of the remainder 10 per cent. become self-supporting, and the rest become of more or less value—surely a very encouraging record.

The book gives an excellent summary of the subject, and should be of considerable service to the medical practitioner and to the school officer and teacher, by whom the lesser cases of mental deficiency will first be recognised, and early recognition and treatment are very essential if any good result is to be obtained. The book is illustrated with a number of useful plates.

The Indo-Aryan Races. A Study of the Origin of Indo-Aryan People and Institutions. By Ramaprasad Chanda. Part i. Pp. xiii+274. (Rajshahi: The Varendra Research Society, 1916.) Price Rs.6 8a.

THIS book, we are told in the preface, was intended to provide "a monograph on the origin of the Bengali people," a useful project which has been supported by the newly founded Varendra Research Society. But his "notes," as the author modestly terms them, have developed into a series of essays on the religion, history, and ethnology of Ancient India. All that is provided as part of the original project is a short series of head measurements, published without commentary, which is intended to settle the question whether certain groups of Bengali Brahmans are, or are not, descendants of a few Brahmans imported from Kanauj. So far as we can judge from these scanty statistics the legend is without foundation; but the subject demands much more careful treatment before it can be finally settled.

The essays, modestly written and creditable to the scholarship of the author, traverse well-trodden ground. The great "Vedic Index" of Profs. Macdonell and Keith has already collected practically all the information that the Vedic literature supplies on Early India. But the byways of Sanskrit writings can still furnish some facts, and much still remains to be done, for the interpretation of these materials.

The author might with advantage return in his next venture to the original problem of the origin of the Bengalis. He would probably discard Risley's theory of Mongoloid infusion in favour of some early entry of an Alpine strain. If he can establish this doctrine he would do useful service to Indian ethnology.

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.]*

War Organisation.

IN the article "'Preparedness': The American Way," in NATURE of November 2, the report of the Committee of the Naval Consulting Board, therein quoted, is in some respects open to criticism. That report says:—"Behind every man in the firing line in Europe, from three to five persons are employed to supply him with food, ammunition, and other needs." For the third step of the programme the committee lays it down that skilled mechanics in all lines of production must be kept from enrolment in the Army. Rather must bankers, clerks, shopkeepers, and professional men be sent. The skilled workers must be badged, and the only restriction imposed on them by the badge will be prevention of enlistment. Enrolment in the Industrial Reserve will be considered to carry with it honours equal to enrolment in the fighting forces.

From the above it appears that the American view is that, of the men of military age in the nation, one portion should work in safety and comfort while the other portion should do the fighting. To the latter would fall all the loss of life, disablement from wounds and sickness, and extreme hardship; meanwhile the former will live as in time of peace, and enjoy equal honours with the fighting group.

A scheme of preparation for war in which sacrifices and benefits are so unequally distributed does not appeal to one as being either just or admirable, and I shall show that it is not in the least necessary.

I will make the following assumptions, which are sufficiently accurate for the purpose of my argument:—

(*a*) I assume the best fighting age at from twenty to twenty-seven.

(*b*) I assume four supply workers as required for one soldier.

(*c*) Unskilled labour is necessary among the supply workers.

(*d*) Men will be efficient as supply workers and for the necessary subsidiary duties certainly up to the age of fifty.

(*e*) It is apparent that there will be at least three men above fighting age available for supply work for each man of fighting age; assume that this is so.

Let N be the number of men between twenty and twenty-seven: we cannot take all of these, for above that age only 3N workers are available. Let x be the number of men we *can* take; then $x(1+4)=4N$, therefore $x=0{\cdot}8N$. Hence if we take *all* men up to twenty-five and a half as soldiers we shall have enough workers to keep them supplied. Doing this, we shall use some skilled workers in the ranks, but skilled work is also required at the front, and this is now provided for.

If to this proposition a clause be added whereby he who, either physically or mentally, is unfit to fight shall be held as unfit to vote, we shall have a scheme fair to all, which also does not offer the glorious opportunities for undue influence and shirkers so thoroughly provided in the report.

J. C. L. CAMPBELL.

Achalader, Blairgowrie, Perthshire.

Farmers and Wheat.

IN your review of Messrs. Gray and Turner's "Eclipse or Empire?" (November 9, p. 185) the following passage occurs:—

"The third chapter, on 'The Slackening of Momentum,' shows by telling figures and statistics how serious has become our competition with better organised or more hard-working nations. . . . British production has increased at a far less rate than that in Germany or in the United States. As regards home-grown wheat, it has fallen by 20 per cent. in the last thirty years in England, and increased in Germany by 50 per cent."

Turning to p. 190 in the same number, I read:—"... Without heavy protective duties, the chemical industry of the finer products, including dyestuffs, cannot possibly be built up and firmly established in this country."

The first of these quoted passages seems to impute the fall in production of wheat to "slackening of momentum," implying indolence, or at least want of spirit, on the part of British farmers. But what, it may be asked, might have been said of their intelligence if, instead of diverting their "momentum" to dairy farming and stock-feeding, they had persisted in growing wheat at a loss after it had fallen to 23*s*. a quarter? And how would it be consistent with prudence now to break up land for wheat-growing in the absence of any guarantee against a prospective ruinous fall in prices? We do not ask for the promise of "heavy protective duties," such as your correspondent describes as indispensable, as doubtless they are, for the establishment and maintenance of the finer chemical industry, but we do claim that, before investing heavily in wheat production, some assurance may be obtained against the farming industry being wrecked by indiscriminate freedom of imports.

HERBERT MAXWELL.

Monreith.

Greek as a Specialised Study.

As you have done me the honour of commenting (NATURE, November 16, p. 221) upon what would seem to have been an abbreviated report of what I said at the Hellenic Society's meeting on November 14, perhaps you would allow me a few lines to remove a misapprehension to which that report seems to have given rise.

It is quite true that I deprecate the study of Greek at preparatory schools, as I do not think the language can be begun before thirteen or fourteen years of age without narrowing unduly the basis of general education; but I did not in the least wish to suggest, nor do I think, that it need not be studied at public schools. To abandon it there would be, in my judgment, to abandon the finest part of that humane training which has created all the great traditions of English public life.

I contended, indeed, that students of special ability who had been thoroughly trained in Latin could study Greek fruitfully during their university course if that course extended above four years and were wholly devoted to classical work. This I urged as a reason for allowing clever boys from municipal schools a free choice of the subjects which they are to study by the aid of municipal leaving scholarships. But I believe it would be a national misfortune if the study of Greek in this country were confined to this comparatively small class of students. The affection felt for the study by those who know what it is, is so keen that I do not think there is much danger of this result.

I said nothing on the subject of compulsory Greek, but as my silence has been taken to imply complete assent to its abolition, let me say that while I have voted, and shall vote, against enforcing the study upon candidates for degrees in mathematics or natural science, I am convinced that the quality of any literary, historical, or philosophical study, whether in modern or ancient fields, is gravely injured wherever it is undertaken without a knowledge of Greek.

Manchester, November 20. R. S. CONWAY.

The Preservation of Natural Colour in Plants.

IN NATURE of November 9 Dr. Rendle directs attention to a method of producing compounds of chlorophyll and copper similar in colour to that of the natural pigments of the leaf and of a comparatively stable nature. It may be worth while to point out that the chemical changes underlying the method are fairly well known, as a result of Willstätter's investigations of chlorophyll and its derivatives. The knowledge derived from Willstätter's work forms a very profitable basis for an investigation of the problem of preserving the colour of herbarium specimens.

The chromogen complex of chlorophyll contains magnesium bound to nitrogen in a complex way. The chromogen group of chlorophyll *a* may be represented by the formula, $C_{32}H_{30}ON_4Mg$. The magnesium is easily removed by the action of acids, and the derivatives thus obtained, phæophytin, phytochlorin, etc., containing the group $C_{32}H_{32}ON_4$, have optical properties different from those of chlorophyll; in solutions they are of a yellowish-olive green colour, and they exhibit characteristic absorption spectra.

It is possible in many cases to introduce a metal into these magnesium-free derivatives whereby compounds with optical properties similar to those of chlorophyll are produced. A full discussion of the various methods for introducing the different metals is out of place here, but it may be pointed out that magnesium can be reintroduced into the chlorophyll molecule by treatment with methyl magnesium iodide. Some metals are very easily introduced—*e.g.* copper, zinc, and iron—by treating the magnesium-free derivative with the metallic acetates in acetic acid or alcohol; zinc acetate even acts in cold solution.

It is a remarkable fact that some of these metal compounds are more stable—for example, in relation to acids—than the original magnesium complex. It is possible to arrange the metals in a series according to the stability of the compound; the extremes of this series are potassium (very unstable) and copper (very stable). Magnesium occupies an intermediate position.

The procedure in the treatment of a specimen is thus the following:—

(1) *The Magnesium is removed from the Chlorophyll.*—This can easily be done in the case of plants with an acid cell-sap (*e.g. Oxalis acetosella*) by dipping them into boiling water. In other cases the tissues can be made permeable by treatment with alcohol or acetone (in such a concentration that chlorophyll is insoluble, *i.e.* 10–60 per cent.). Subsequent treatment with dilute acid removes the magnesium.

(2) *The Metal is introduced.*—It must be remembered that zinc, although a little less stable than copper, can be introduced without heating, and thus without the risk of injuring the specimen. The shade of colour obtained varies with the different metals.

Investigations on these two points will no doubt add to our knowledge of the most suitable methods of preserving the colours of museum specimens of plants. INGVAR JÖRGENSEN.

Department of Plant Physiology and Pathology,
Imperial College of Science and Technology,
London, November 14.

Artillery and Rainfall.

THE following quotation may help to settle the question as to the effect of artillery on the rainfall, at any rate so far as the present generation of your readers is concerned.

It is taken from a translation of "Plutarch's Lives," by John and William Langhorne, and occurs in the life of "Caius Marius," where Plutarch comments on a battle fought against the "Teutones" in 102 B.C.

"It is observed, indeed, that extraordinary rains generally fall after great battles; whether it be that some deity chooses to wash and purify the earth with water from above, or whether the blood and corruption, by the moist and heavy vapours they emit, thicken the air, which is liable to be altered by the smallest cause."

Now, since the battles and rainfall referred to occurred some 1500 years before artillery was invented, it is clear that artillery cannot be the cause of the rainfall. MORITURUS.

GOVERNMENT CONTROL OF FOOD SUPPLIES.

WHATEVER difference of opinion may exist in regard to the stimulus which has moved the Government to take control of our food supplies, all are agreed that it has not come about a moment too soon, and most will admit that we should now be much better off had it been taken in hand more than a year ago.

The provisions outlined will empower the Food Controller to take measures both preventive and regulatory; the former to prevent waste, the improper use of food, such as giving to animals food that ought to be reserved for human beings, and market manipulation, cornering, or holding up of food supplies. The regulatory measures apply to the production of flour from grain, the sale and distribution of articles of food, and the fixation of prices.

If properly and intelligently applied, the scheme ought to work well. There can be no doubt that a great deal of food is still wasted, not alone by sections of the population who are earning more money than they have ever handled before, but also by public institutions; and many still believe in the catering for the Army, although this last has been improved. Nothing short, however, of some measure equivalent to "food tickets" will prevent over-consumption and waste on the part of those who, owing to the war, are better off than in normal times. But by a strict system of inspection it ought to be possible to reduce or abolish waste in public institutions and in the Services.

It is, perhaps, in respect to the application of the regulatory provisions that the public may harbour some misgivings, and particularly in respect to the manufacture of wheat-flour—a subject which is dealt with elsewhere in this issue.

The control of sale and distribution is certain to prove a difficult undertaking, but with suitable organisation it can in time be satisfactorily attained. The most delicate problem of all is, however, the fixation of prices, and here expert knowledge of food values will be indispensable if approximately the same amount of nourishment

is to be obtained in different foods for a given sum of money. This applies in particular to staple articles of diet, such even as bread and potatoes. Thus, for instance, with bread at 3*d.* per lb., potatoes to yield an equal amount of nourishment should not exceed 1*s.* per stone.

But Government measures cannot stop with the mere regulation of food supplies. Powers must be taken to compel a greater production of home food and to ensure a larger acreage of wheat. Objection may be raised to the shortage of labour, but what adequate effort has been made to organise and instruct women to take part in agricultural labour, or to feed them properly when so employed? What effort has been made to increase tillage in Ireland, where the Military Service Acts do not apply? Lastly, why should prisoners of war not be utilised to the fullest degree possible in raising the home production of food? No considerations, political or otherwise, should be allowed to stand in the way of carrying any or all of these measures into effect without further delay.

STANDARD BREAD.

THE decision of the Government, which appears likely to result in the general consumption of "standard bread," will no doubt be received with varied feelings by various sections of the community. In view of the certainty that such differences of opinion are likely to arise, the following brief sketch of the facts of the case so far as they are known may be of general interest.

Under normal conditions at the present time the average practice of roller milling results in the recovery from cleaned wheat of rather more than 70 per cent. of its weight of flour, the remaining 28 or 29 per cent. of the wheat, consisting of various grades of "offals," being sold for feeding stock.

The changes announced last week would make it compulsory to recover 80 per cent. of flour from wheat, which would increase the amount of flour by about 8½ per cent. and decrease the amount of offals for stock-feeding by a like proportion, the percentage in both cases being calculated on the amount of cleaned wheat available for milling.[1]

On the basis of the amount of flour produced in the United Kingdom for home consumption in the years immediately before the war, the change announced would increase the amount of flour available for bread-making by very nearly 600,000 tons, which would provide an extra 2-lb. loaf for every inhabitant of the United Kingdom every three weeks, or seventeen extra 2-lb. loaves per head of the population per year. This is by no means a negligible increase in the bread supply, and it is doubtless considerations of this kind that have induced the Government to take action.

If, however, we examine the result rather more closely, we find that the increase in the nation's food supply may not be so great as the above figures indicate. In spite of repeated statements to the contrary, bread made from 80 per cent. flour is not so nutritious, weight for weight, as bread made from 70 per cent. flour—at any rate, for the supply of protein and energy for the general population. Although 80 per cent. bread contains on the average rather more protein than 70 per cent. bread, the digestibility of the protein in the former is rather lower, so that the actual weight of protein digested by the average individual from 1 lb. of 80 per cent. bread is rather less than the amount digested from 1 lb. of 70 per cent. bread. Again, the energy value of 80 per cent. bread is rather lower than that of 70 per cent. bread. Still one more correction must be made in order to arrive at the actual increase in the national food supply which will result from the general adoption of a milling standard of 80 per cent. It is pointed out above that the recovery of 80 per cent. of flour from cleaned wheat entails a decrease in the supply of the finer wheat offals for stock-feeding to the extent of about 600,000 tons. These finer offals are largely used for feeding pigs. Their transference to human consumption would therefore decrease the production of pork and bacon, and this must be allowed for in estimating the total effect of the proposed alterations in milling. After applying all these corrections it appears that the general adoption of an 80 per cent. standard would undoubtedly give a substantial increase in the amount of digestible food for the supply of protein and energy for the population of the United Kingdom.

The possibility that the food value of bread would be substantially increased by the adoption of the 80 per cent. standard, because the content of the mysterious constituents known as vitamines would be increased by the inclusion of a greater proportion of the germ and of the outer layers of the grain, is perhaps scarcely worth discussing in this connection. Such constituents are supplied by other items comprised in an ordinary mixed diet, so that the vitamine content of bread can have little practical significance except in the very few cases where bread forms the whole, or very nearly the whole, of the diet.

The price of wheat offals for feeding stock is now so high that the adoption of the 80 per cent. standard cannot be expected to make any considerable reduction in the price of bread. Even the compulsory admixture of a considerable proportion of other cereals, such as maize, oats, or barley, with wheat for bread-making would not greatly cheapen the loaf, because these cereals are not very much cheaper than wheat. The important point in raising the milling standard and in including other cereals among the breadstuffs is that it would widen the sources from which the national food supply is derived—a most desirable end under existing conditions. To summarise, the result of a compulsory 80 per cent. standard would be neither better bread nor cheaper bread, but more bread.

[1] The values here given require modification in the light of the Order just made by the Board of Trade (see p. 232).

PROF. PERCIVAL LOWELL.

BY the death, on November 12, of Percival Lowell, who equipped the Observatory at Flagstaff, Arizona, and planned its work with such conspicuous success, astronomy loses one of its most ardent disciples and enthusiastic observers. Prof. Lowell was born in Boston on March 13, 1855, and took his degree at Harvard in 1876. He lived in Japan at intervals from 1883 to 1893, and in the former year was appointed Counsellor and Foreign Secretary to the Korean Special Mission to the United States. His experiences of Eastern life were described in several memorable volumes, namely, "Chosön: a Sketch of Korea," "The Soul of the Far East," "Noto: an Unexplored Corner of Japan," and "Occult Japan." His other publications include "Mars," published in 1895, "The Solar System," "Mars and its Canals," "Mars as the Abode of Life," "The Evolution of Worlds," and several fine volumes of "Annals of the Lowell Observatory." In 1902 he was appointed non-resident professor of astronomy of the Massachusetts Institute of Technology, and in 1904 he received the Janssen medal of the French Astronomical Society for his researches on Mars. He had many admirers in this country, and was always ready to assist enterprises having the advancement of knowledge as their object. An illustration of this characteristic was the support which he gave to the Hill Observatory, Sidmouth; and he had the distinction of being the only one outside Great Britain who contributed financially to the endowment of this new observatory.

Prof. Lowell's energy and confidence were infectious; he inspired many amateurs with worthy ambitions, and encouraged a wide interest in the results of observation. For the last twenty-five years he had given undivided attention to astronomy, and made a well-recognised reputation by his researches on planetary markings and by his insistence on the bold deductions that he considered his observations warranted. Whatever opinion may be held as to the deductions and interpretations to which he was led, astronomical science has benefited by the unflagging zeal with which he pursued his investigations, the undoubted sincerity which inspired his work, and the care he exercised to guard himself against self-deception.

Foremost among these precautions may be noted his care in selecting a suitable site for his observatory. He planned reconnoitring expeditions furnished with adequate and identical optical equipment to various continental and insular stations where favourable conditions might be anticipated, and worked for some time on the arid plains of Mexico before deciding that a somewhat inaccessible peak in Arizona, about 7000 ft. high, offered the ideal conditions for which he was in search. There he erected a 24-in. refractor, and began that series of observations on the surface of Mars and of other objects the critical examination of which offered great difficulties on account of minuteness or lack of definite detail. The interest awakened by these inquiries has only been equalled by the controversies to which they have given rise. The study of the surface of Mars in particular was rewarded by the confirmation of Schiaparelli's discovery of a canal system and by the existence of a complicated network of watercourses that assumed various distinct and regularly recurring appearances, depending on the seasonal conditions that obtained. Sometimes the tracks were duplicated, at others they revealed thickened patches, conjectured to resemble the fertile spots known to us as oases. A complete system of planetary meteorology was worked out, the migration of the heat equator was traced with great exactness, and the interchange of wind between the poles and the equator giving rise to cyclonic storms and diurnal effects was discussed with unusual fullness of attractive interpretation.

The ill-defined markings on Mercury and Venus were submitted to a scrutiny not less searching than those of Mars, and Prof. Lowell not only produced substantial evidence that these planets rotate once only in the course of their orbital motions about the sun, but he also determined with some accuracy the position of the axis of rotation, and constructed a trustworthy map of the topographical features of that hemisphere of Venus which is visible to us. The minute discs of Uranus and Neptune, as well as of the satellites of Jupiter, were alike made subjects of the closest study, and much interesting detail was collected. These, with other, researches were carried out with the 24-in. refractor, but quite recently Prof. Lowell added a 40-in. reflector to his observatory equipment, and with the larger aperture was able to confirm the accuracy of much of his previous observations. He was one of the most successful as well as one of the most indefatigable of observers, and we trust that those who have been so happily connected with him in the conduct of the Lowell Observatory will be able to carry on its activities and add fresh lustre to its history.

PROF. LOWELL'S CONTRIBUTIONS TO ASTRONOMICAL SPECTROSCOPY.

THE work at the Lowell Observatory has by no means been restricted to the planet Mars, as may have been popularly supposed. Prof. Lowell provided the observatory with an equipment of the highest class for spectroscopic investigations of the heavenly bodies, and, with the capable co-operation of Dr. Slipher, some important contributions to the advancement of astrophysics have been made. Besides taking part in the general study of the radial velocities of stars, several new and difficult investigations of great interest were undertaken. One of the first problems attacked —in 1903—was that of the rotation of Venus, and although the actual period could not be assigned, the evidence was decidedly in favour of a period much greater than twenty-four hours. More recently the first authentic value of the rotation period of Uranus was determined by Lowell and

Slipher, the spectra in this case indicating rotation in 10h. 50m., in a direction contrary to that of the planets nearer the sun. Much attention was at one time given to the search for evidence of absorption due to water vapour in the atmosphere of Mars, first by Doppler effects due to relative motion of the earth and planet, and alternatively by observations of the relative intensities of the atmospheric bands in Mars and the moon. Although measurements of the plates suggested slight displacements, tending to prove the existence of a Martian atmosphere, Lowell frankly confessed that he could place no reliance on this result. On the other hand, Mr. Very's discussion of the intensities of the bands decided in favour of a Martian atmosphere containing water vapour, but this conclusion was not accepted by Campbell.

A further notable contribution to the spectroscopic study of planets was made by a beautiful series of photographs of the spectra of the major planets, showing the progressive increase of intensity of the characteristic planetary absorption bands in passing from Jupiter to Neptune. No satisfactory interpretation of these bands has yet been given, but the photographs provide very definite data for guidance in experimental research relating to them.

The spectroscopic investigations of comets undertaken at Flagstaff have been of more than ordinary interest in consequence of their inclusion of the red part of the spectrum, of which but little was previously known. Much remains to be done in connection with the interpretation of these observations, and in order to facilitate this work Lowell very generously placed copies of the photographs at the disposal of those who were in a position to undertake the necessary experiments. One important result obtained by Lowell, following from simultaneous photographs of the forms and spectra of comets, was that gaseous masses could in some cases be proved to be moving away from the head. This point deserves more attention than it has received. As Lowell put it: "As the incompetency of light-pressure to repel molecules in a comet's tail has been widely published, this observational proof that molecules in such a tail are repelled—whether they can be or not theoretically—is of considerable interest."

Spectroscopic investigations of the spiral nebulæ are extremely difficult and laborious on account of the feeble luminosity, but the Flagstaff observers provided themselves with well-designed instruments and boldly attempted to determine the radial velocity of one of these objects. In the first instance, the Andromeda nebula was found to be approaching the solar system with a velocity of 300 km. per sec., and the suspicion that spirals as a class have much higher velocities than stars has since been abundantly confirmed. The nebula N.G.C. 4594 was, in fact, afterwards found to be not only receding at the immense speed of 1100 km. per sec., but also to have a motion of rotation such that at a distance of 20″ from the nucleus the velocity is 100 km. per sec. These results are clearly of fundamental importance, and would seem to favour the view that the spiral nebulæ are to be regarded as stellar systems outside that to which the sun belongs.

Another difficult investigation undertaken at Flagstaff was that of the constitution of the extremely faint nebulæ surrounding the stars of the Pleiades. It was found that the characteristic lines of gaseous nebulæ were absent, and that the spectrum was identical with that of the associated stars, leading to the conclusion that the nebula shines by reflected starlight. A similar conclusion has since been reached from an investigation of the nebula about ρ Ophiuchi.

Those who have had the privilege of a visit to the Lowell Observatory cannot fail to have been impressed by the ample provision for a wide range of astronomical inquiries, and by the fine display of transparencies representative of the successful results which have rewarded the skill and patience of the observers. The inspiring enthusiasm of Lowell will doubtless be sadly missed in the future, but it is sincerely to be hoped that some means will be provided whereby the activity of the observatory may be maintained. A. FOWLER.

NOTES.

UNDER the new regulations recently made with a view to the control of food supplies, the Board of Trade issued on Monday the following Order as to the milling of flour:—The Milling Order, 1916, fixes for the United Kingdom the percentages of flour that must be extracted from wheat of various qualities according to the following schedule:—English, 76; Choice Bombay, 78; Australian, 78; Blue Stem, 76; Walla Walla, 75; No. 2 Red Western, 76; No. 2 Red Winter, 74; No. 2 New Hard Winter (1916), 76; No. 1 Northern Duluth, 75; No. 1 Northern Manitoba Old Crop, 76; No. 2 Northern Manitoba Old Crop, 75; No. 3 Northern Manitoba Old Crop, 73; Choice White Karachi, 75; Soft Red Karachi, 75; Rosafe, 62 lb., 73; Baril, 61½ lb., 74; Barletta-Russo, 61½ lb., 74. The Order comes into force, as regards milling, on November 27 next; that is to say, on and after that date no wheat may be milled except in accordance with this schedule. On and after January 1, 1917, only flour milled in accordance with the schedule may be used for making bread or any other article of food. A subsequent Order will be issued requiring periodical returns of stocks of wheat received and of flour and offals milled and of all stocks in hand on the date of the Milling Order coming into operation—*i.e.* November 27.

THE statistics given in the half-yearly Review of the Movement of Fertilisers and Chemical Products just issued by the International Institute of Agriculture show very clearly the effects of the war on this branch of industry. Shipments of natural phosphates are diminishing both on account of the scarcity of labour and the high rates of freight. As regards superphosphate of lime, the small supply of raw phosphates and the ever-increasing demand for sulphuric acid for munitions of war have depressed the output in all countries, notably in France, where the latest figures show a decrease of 70 per cent. on the production of 1913. The increase in the exports of Chilean nitrate, which began in the latter half of last year, has continued, so that the figures are now much

nearer to the normal than was the case earlier in the war. France is now importing three times as much nitrate as in 1915, and the same applies in various degrees to all the importing countries, but the increased demand is entirely for industrial purposes. The manufacturers of synthetic nitrogenous fertilisers have almost everywhere augmented their output considerably, either by development of existing plant or by new construction. Very little, if any, of the extra supplies are available for agricultural purposes; in some countries the State requirements absorb the whole output. The review includes a useful bibliography of the literature published during the first six months of 1916.

THE issue of the reports containing the scientific results of the Australasian Antarctic Expedition, 1911–14, under Sir Douglas Mawson, has been seriously delayed owing to the war and its effect upon assets, such as the popular book, film, and lectures which it was anticipated would realise sufficient to defray the cost of publication. We are glad to learn, therefore, that the Government of South Australia has come to the assistance of the expedition, and agreed to execute the printing at the Government Printing Office, Adelaide. The New South Wales State Government has also generously agreed to reproduce certain illustrative matter. The production will appear in royal quarto size, similar to like publications of other British Antarctic expeditions. The completed work will be voluminous, and several years must elapse before all is passed through the press. The plan of publication is to divide the subject-matter into the three series, as follows:—Series A, geography, geology, etc.; Series B, physical subjects; Series C, biology. Each series will be subdivided into volumes and parts. Prof. W. A. Haswell, of Sydney University, who organised the programme of the biological section of the expedition, is editing Series C, and has already made arrangements for the working out of most of the groups collected. Three parts, namely, Fishes, Mollusca, and Cephalopoda, are expected to appear this year.

THE death of Mr. Charles Smith, master of Sidney Sussex College, removes a well-known figure from Cambridge, and will be widely regretted. Mr. Smith was born in Huntingdon, and entered Sidney Sussex College as a scholar in 1864, graduated as third Wrangler in 1868, was elected a fellow of the college in the same year, and held the office of tutor from 1875 to 1890, in which year he was elected master on the death of Dr. Phelps. From 1896 to 1909 he was a governor of Eton College. During his tutorship Sidney Sussex increased greatly in numbers, and the influence of his teaching was seen in the successes of his pupils in the Mathematical Tripos. He was indefatigable in his efforts to promote the interests of his college. To him the erection of the new block of buildings there was due, and it was his ambition, unfortunately not realised, to complete the new court by the addition of a further range. To the general public he was best known as the writer of a series of text-books on mathematical subjects remarkable for their clearness of exposition. His books on conic sections and algebra in particular are probably known to most English mathematical students. They appeared at a time when a more thorough, and, at the same time, a more attractive, style of elementary mathematical teaching was greatly needed, and had immediately a large success. In private life Mr. Smith was a great lover of flowers, especially of delphiniums, roses, and chrysanthemums, which he grew in great profusion and with much success in his charming garden at the Master's Lodge.

AN exhibition and sale of water-colour sketches by the late Prof. Silvanus P. Thompson will be held (by permission of the Alpine Club) at the club rooms, 23 Savile Row, W., from November 27 to December 10.

THE Bradshaw Lecture of the Royal College of Surgeons of England will be delivered on December 15 by Col. C. J. Symonds upon "Gunshot Injuries of the Spinal Cord."

THE death on November 18 is announced in the *Morning Post* of November 20 of Mr. J. H. Merivale, the North of England mining engineer, who was secretary to the North of England Institute of Mining and Mechanical Engineers, and formerly professor of mining at Durham College of Science.

Engineering for November 17 contains an interesting article by Prof. Luiggi on the utilising of volcanic heat for power-production purposes. In Central Tuscany, near Volterra, there are numerous cracks in the ground from which powerful jets of very hot steam spout high in the air with great violence and constancy. Early experiments on the use of this steam for driving engines showed that the borax salts, sulphuretted hydrogen, and sulphuric acid present in the steam necessitated frequent repairs on account of the corrosive action. This difficulty has been overcome by applying the steam, not directly in the engine, but to a boiler instead of fuel; steam is thus produced in the boiler at a pressure of two atmospheres, then passed through a superheater, and so to the steam turbine used for driving electric generators. Prince Ginori-Conti, who has financed the undertaking throughout, has been responsible for three large installations on this system. One of the 3000-kw. units has been at work since January, 1916, the second since April, and the third has just been started. So far the first two groups have worked quite successfully, and have been a great boon to the industries of Tuscany, greatly crippled by the scarcity and high price of coal. Since the region available extends for many square miles around Larderello, there is nothing to prevent the system being developed to the production of hundreds of thousands of horse-power.

CAPT. W. B. GOURLAY writes us, from "somewhere in France," a brief but extremely interesting note on a phosphorescent centipede. He discovered the creature in a very unexpected manner, inasmuch as he was putting coals on a dying fire in an unlighted room when he immediately noticed on the coals a gleaming, wriggling object, which proved, by the light of a match, to be "a small yellow centipede." The fact is worth placing on record, since the occurrence of phosphorescence in this group is by no means generally known. Even by specialists, indeed, nothing seems to be known of the matter save that two species of Geophilus possess the power of emitting phosphorescent light; the source and use of the light are yet to be discovered. In one of these, *G. electricus*, the light has been described by Mr. G. S. Sinclair as brilliant, the creature emitting it leaving a trail of bright light behind it which lasts for some time. Of the other species, *G. phosphoreus*, still less seems to have been recorded. It was described by Linnæus on the authority of a Swedish sea-captain, who asserted that it dropped, shining like a glow-worm, upon the deck on his ship when he was sailing in the Indian Ocean a hundred miles from land. From this we may infer that it had been taken on board at the last port of call, and remained concealed, either on the deck or in the rigging, until it at last revealed itself as a "stowaway."

ONE of the most interesting phases of the work which the Young Men's Christian Association is

undertaking on behalf of the general welfare of the men of his Majesty's Forces received Royal approbation on Friday, November 17, when H.R.H. Princess Christian opened a microscopical demonstration and conversazione at the Y.M.C.A. headquarters, in Tottenham Court Road. Fellows and members of the Royal Microscopical Society, the Quekett Microscopical Club, and the Photomicrographic Society were present with eighty-six microscopes, and the large reading-room, lounge, and drawing-room were filled during the evening with a constant stream of men desirous of viewing interesting objects displayed. In addition, there was a series of lectures and kinematograph displays of living micro-organisms, Mr. F. Martin Duncan lecturing on "Some of Nature's Fly-traps," and Dr. G. H. Rodman giving a talk on "What the Microscope Reveals in a Few Objects of Everyday Occurrence." In introducing her Royal Highness, Col. Sir T. Sturmy Cave said the experiment of microscopical exhibitions was originated by Mr. J. W. Ogilvy, one of the Y.M.C.A. honorary secretaries, and the experiment had been a decided success. Princess Christian then declared the proceedings opened, expressing therein hope that they would be very successful. She afterwards made a tour of the various exhibits, spending more than half an hour among the microscopes, and showed particular interest in the apparatus demonstrating the process of photographing microscopic objects. It is interesting to note that a large number of exhibitions have already been given at the Y.M.C.A. huts in the Home Counties area, and even as far as Salisbury Plain. Great interest is invariably evinced in these as a variation from musical entertainments or kinema shows. The demonstrations deal with germ enemies to be guarded against, and, at the special request of a number of soldiers, special attention has been given to the question of venereal diseases.

A LARGE and enthusiastic meeting was held on November 9 in the University of Sheffield to discuss the formation of a Society of Glass Technology. The widespread interest in the scheme was demonstrated by the presence of representatives of cities as far apart as London, Edinburgh, and Cardiff, whilst every glass-manufacturing district was well represented. Mr. W. F. J. Wood, of Messrs. Wood Bros., Ltd., Barnsley, was elected to the chair, and the meeting opened with a cordial welcome from the Vice-Chancellor of the University, Dr. H. A. L. Fisher, who remarked that Sheffield had cause for legitimate pride in the knowledge that its University had been proposed as the headquarters of a society representing such an important industry. He emphasised the fact that this industry, among others, had suffered in the past owing to its detachment, wholly or partially, from its scientific aspects. The formation of the Department of Glass Technology in the University was serving to remedy this state of affairs, and the inauguration of this society was a distinct step in the same direction. Dr. W. E. S. Turner outlined the steps that had led up to the formation of the society, and spoke of the remarkable response from those interested in glass. Expressions of warm approval and promises of support had been received from all over the country. Dr. Turner pointed out that there was no intention of making the society a local institution, but that it was in every way a national one. The report of the Provisional Committee was adopted, and a formal resolution giving actual being to the society was passed unanimously. The following officers were then elected:—*President*, Mr. W. F. J. Wood; *Vice-Presidents*, Mr. S. B. Bagley, Mr. F. J. Cheshire, Sir William Crookes, Mr. A. S. Esslemont, Prof. H. Jackson, Mr. S. N. Jenkinson, Mr. H. J. Powell, Dr. W. Rosenhain, F.R.S., Mr. H. J. Stobart, Dr. M. W. Travers, F.R.S., Mr. Duncan Webb, and Mr. H. S. Williams-Thomas; *Council*, Mr. J. E. Barker, Mr. W. R. Barker, Dr. P. G. H. Boswell, Mr. F. W. Branson, Mr. W. Butler, Mr. F. G. Clark, Mr. J. Connolly, Mr. J. B. Coppock, Mr. J. H. Davidson, Prof. W. G. F. Fearnsides, Mr. J. James Hirst, Mr. F. Swann, Mr. F. P. Wainwright, Mr. A. D. Young; *Treasurer*, Mr. F. Sweeting; *Secretary*, Dr. W. E. S. Turner; *Assistant Secretary*, Mr. C. J. Peddle. It is hoped that the society will receive the support of all those interested in glass, either directly or indirectly. Information upon any points will be gladly supplied by Dr. W. E. S. Turner, the University, Sheffield, who will welcome inquiries and suggestions.

THE tendency to ascribe mechanistic principles to animate nature on the evidence of their applicability to inanimate nature, or to postulate a dualism which marks off the animate and the inanimate as lying in two separate realms, is subjected to a searching criticism on scientific grounds by L. M. Passano in an article entitled "Being and Becoming" (*Mind*, N.S., No. 100). He develops a scheme whereby he brings into relationship an atom and an act of will. He contends that the atom implies energy, and that mass is energy or a store of energy due to motion. Energy is life, and to live is to liberate stored-up energy, the liberation of energy being a subjective act. All things are living, the lowest form of life being gravitation. The descending scale of liberation of energy from man to the lower animals, to plants, to radio-active substances, to chemically active substances, to inert substances, the last possessing at least the energy of gravitation, is nowhere delimited. The materialism of W. K. Clifford depends upon his being unaware of radio-active substances, which activity and the facts of chemical affinity render, according to the writer, this point of view untenable. The paper is one involving the fundamental principles of several sciences, and will be interesting to many thinkers.

THE *Pioneer Mail* of September 2 gives an account of the Calcutta Health Officer's proposals for the future. We are strongly of the opinion of those who hold that before antimalaria measures are carried out we should determine exactly the malarial or endemic index of the district: (*a*) the anopheline carrier, (*b*) its distribution as shown by a spot map of the occurrence of larvæ. It would then be known what there is to undertake, viz. the eradication of malaria-carrying anophelines. It is difficult to agree with those who prefer to proceed against all mosquitoes. If time and money were no object this method might be permissible, but in Calcutta the proposed outlay for antimalaria measures for 1915–16 is only about five hundred pounds. It is evident that a small sum like this must be spent in a rational way, and not in endeavouring to destroy mosquitoes in "the many scores of miles" of breeding-places in Calcutta. It appears that it was only last year that it was proposed to obtain some of the necessary information to which we have alluded above. With the money available it would seem most practical to treat one area only in which the conditions are fully known and suitable. If the results are successful we believe that the path of the sanitary officer would be a happier one in the future. So far Calcutta has not distinguished itself in this matter.

ONCE more the formation of a Red Cross Museum is being seriously discussed. The need for such an institution, and the scope of its activities, are briefly and clearly set forth in the *Museums Journal* for November. Such a museum, of course, would appeal only to the expert. But it would provide him with a

source of inspiration, and do much towards that standardisation of methods and equipment which is, in regard to many aspects, very urgently needed. A case in point is furnished by the different sizes adopted at the present time for stretchers and for ambulances, so that a stretcher that is brought up to place in an ambulance often cannot be taken in. If a standard gauge could be agreed on the work of handling the wounded would be greatly facilitated, and this agreement would be the more fruitful if such standardisation could be international. Where and by what body such a museum should be erected and controlled is a matter for debate. It has been suggested that the Royal Army Medical College might well undertake the task, as the French Army Medical Service has already done for France. The *Museums Journal* suggests that such a museum might well form an appendage to the Wellcome Medical Museum, or the Royal United Service Museum, Whitehall. But as the whole scheme is still very much in the air, the problem of housing can scarcely be said to have arisen, so much depending on the range of the activities which are to be undertaken.

THE old-fashioned plan of exhibiting stuffed birds in museums has, it is to be hoped, gone for ever. In place of it has come the practice of mounting selected types amid their natural surroundings during the breeding season. In some of the American museums it has become the custom to reproduce not merely the immediate surroundings of the nest, but, by the aid of skilfully painted scenic backgrounds and cunningly concealed artificial lights, also large areas of the general environment. Miles of landscape are apparently surveyed, and the teaching value of the exhibit is thus immensely increased. But the use of these spectacular effects must be strictly limited to this particular purpose, or there is a grave danger of our natural history museums degenerating into peep-shows. An example of the reality of this danger has just been furnished by the Brooklyn Museum, N.Y., where, according to the *Brooklyn Museum Quarterly*, vol. iii., No. 2, half a dozen Cape pigeons and three "whale-birds" have just been mounted as in full flight, and as seen from the deck and through the rigging of "some sailing vessel, off-shore, beating against a fresh Atlantic wind. Models of others, reduced to give the proper perspective, carry the vista back towards the faint sky-line." This is all very pretty, but it is of doubtful value from a scientific point of view. All the information the public will gain from such an exhibit is that petrels fly over the sea!

A PAMPHLET entitled "The Nicolson Observatory Bee-Hive, and How to Use It," by Mr. J. Anderson, issued by the North of Scotland College of Agriculture, is before us. The elephant and the sheepdog might smile sarcastically could they be confronted with Maeterlinck's opinion that the Hymenoptera, "of all the inhabitants of this globe, possess the highest degree of intellect after that of man." When the famous beemaster mentions "the intelligent substitution of flour for pollen, and of an artificial cement for propolis," one is tempted to think of the intellectual vegetables which also readily avail themselves of man's auxiliary devices. Apart from controversy, however, observation of the hive will always make a strong appeal to the curious for its own sake, to the teacher for its value as a lesson in biology, to men of research for the unknown possibilities of suggestiveness. Mr. Anderson's observatory hive claims, apparently with good reason, to make the business of the spy as little objectionable as possible, allowing the bees to perform their various tasks in a perfectly normal way while actually unconscious that they are being observed. His pamphlet describes the latest improvements, with all that is required in the way of superintendence. Among other things, "it is essential that the possessor of a Nicolson observatory should have charge also of one or more full-sized hives."

FOR several years experiments on the effect of overhead electrical discharges on crops have been carried out at Lincluden Mains, Dumfries, by Miss E. C. Dudgeon, with the scientific co-operation of Prof. J. H. Priestley and Mr. I. Jörgensen. The results obtained in 1915 with an oat crop on adjoining plots of 1½ acres each are briefly summarised by Mr. Jörgensen in the October issue of the *Journal of the Board of Agriculture*. The leakage of discharge over the control plot was largely, but not entirely, prevented by the interposition between the plots of a well-earthed wire screen reaching 3 ft. above the level of the charged network. Despite this leakage, the electrified plot showed the remarkable increase of 30 per cent. in grain and 58 per cent. in straw as the presumptive effect of the discharge, which was applied on the average five hours daily for 108 days. The crops were not heavy, but the superiority of the crop on the electrified plot was marked from the earliest stages of growth, and it suffered less from the dryness of the season.

DURING recent years trichloroethylene has been used to a limited extent for the extraction of the oil from soya beans. The residual extracted meal has been disposed of as food for stock, and as trichloroethylene is not poisonous when given in comparatively large doses to cattle little risk would appear to be involved in the use as food of the extracted meal. Cases of poisoning of cattle attributed to soya meal have, however, been brought to the notice of the Board of Agriculture, and the results of their investigations, which are summarised in the October issue of the *Journal*, throw strong suspicion on the meal obtained by the use of trichloroethylene. The cases of poisoning, both on the farms and in the investigations, were limited entirely to cattle, and in no case was a sudden effect produced. Experience with soya extracted with naphtha makes it very improbable that the poisonous principle could have been inherent in the meal. It would appear more probable that it was either a non-volatile impurity present in the trichloroethylene or a product of interaction between the trichloroethylene and some ingredient of the soya beans.

La Nature of October 21 contains an article by M. Alfred Renouard directing attention to the interesting renaissance in the use of natural dyestuffs which the war has brought about. Certain of these dyestuffs, such as indigo, old fustic, logwood, red sandal wood, sapan wood, etc., have continued to be used, some of them in large quantities, in spite of the severe competition of synthetic dyes, and this use has increased greatly owing to the war. Most of the increase is due directly to the war, indigo being required for the cloth for naval uniforms, fustic for khaki, and logwood for black cloth. The area under indigo in India has increased, and special efforts are being made in the British West Indies and elsewhere to increase the output of fustic and logwood. Extremely high prices are being obtained for these dyestuffs, but the producer probably benefits but little from this increase owing to the enormous rise in freight rates. M. Renouard expresses the hope that some means will be found of retaining this increased trade in natural dyestuffs after the war.

AN interesting article in the issue of the *Engineer* for November 10 deals with the new water supply for Guayaquil, chief port and most important city of the Republic of Ecuador. The port stands upon an

alluvial plain, on the banks of the river Guayas, and is frequented by ocean-going vessels up to 28 ft. in draught. The absence of a proper system of water supply, combined with ineffective drainage, has militated hitherto against the development of the town, but now that the Government has taken both these matters in hand there is every prospect, despite certain climatic disadvantages, of the attainment of a very serviceable degree of civic sanitation. The total estimated outlay is in the neighbourhood of 2,000,000*l.*, and the work is being carried out progressively, in instalments. A fresh system of water mains is already laid, and a storage reservoir of 6,600,000 gallons capacity is nearing completion. It has not yet been definitely decided whether the source of supply shall be the Daule river, with an intake some twenty miles upstream, or a group of mountain streams in the forests of the Cordillera de los Andes, some sixty miles distant from Guayaquil. The drawbacks in the former case are the pollution arising from settlements along the banks of the river, the high percentage of suspended matter in the water, and the low gradient, which would necessitate pumping. The mountain streams would readily admit of a gravitation supply, and are less likely to be polluted, but the construction of the pipeline would be a heavy initial expense. The Government has both schemes under consideration, and data and statistics are being obtained with a view to an early decision.

OUR ASTRONOMICAL COLUMN.

THE LEONIDS OF 1916.—With the parent comet (1866 I, Tempel) near aphelion an abundant shower of Leonids was not expected, but it was important to ascertain whether the display returned even in a minor character. Mr. Denning writes that on the morning of November 15 he saw only one Leonid in a watch of about an hour between 4 and 5.30 a.m. The next morning was overcast, but on November 17, between 3 and 6.15 a.m., notwithstanding wintry conditions and one of the keenest north-easterly winds experienced in recent years, Mrs. Fiammetta Wilson, of Totteridge, recorded fifteen meteors, including some brilliant objects. There were seven Leonids from a radiant point very sharply defined at 150°+22°. This position appears to be identical with that usually found on the mornings of November 14 and 15, and apparently favours the view that there is no perceptible change in the place of radiation. But more exhaustive data are required in settlement of this interesting feature.

The brightest meteor seen by Mrs. Wilson was at 3h. 33m. a.m. (November 17). It was equal to Venus, and shot from 215°+58° to 245°+57¼°—evidently a fine Leonid. Bright meteors of the same shower were seen at 4h. 50m. and 5h. 42m. At 3h. 16m. a large Taurid, comparable with Jupiter, travelled from 188½°+57° to 204°+48°. If duplicate observations of any of these objects were obtained at other stations, the records would be valuable for comparison.

THE SOLAR APEX DETERMINED BY MEANS OF BINARY STARS.—The method of determining the solar apex proposed by Bravais in 1843 has until lately not been used by any other investigator, no doubt because it assumes the distances of the stars to be known, and nobody has been inclined to follow Bravais in making them all equal. Some years ago Weersma applied the method to 3616 stars, taking the distances from Kapteyn's tables of mean parallaxes. His result, 267·7°+31·4°, was in good accordance with the best previous determinations, though the velocity, 14·9 km., was smaller than the spectroscopic result. In a paper recently published in the Proceedings (*Oversigt*) of the Royal Danish Academy of Sciences, M. Luplau Janssen has applied the method to 180 double stars, the proper motions of which are given in the Preliminary General Catalogue of Boss. Assuming the mass of a binary star equal to that of the sun, well-known formulæ give a value of the parallax called the "hypothetical parallax." Hertzsprung has shown (*Astronomische Nachrichten* 4543) that where the annual change of position angle and distance is known, it is possible to find a minimum value of this hypothetical parallax of a binary star. From a comparison of thirty-six values of parallaxes actually measured with the computed values of the minimum hypothetical parallax M. Janssen finds that the latter may be put equal to half the real parallax. On this assumption he finds the apex to be 264·5°+26·1°, and the velocity equal to 17·15 km. per sec. This result is in surprisingly good accordance with the best recent determinations, and this shows at any rate that the hypothetical minimum parallax is a quantity which is not without some value where there is no satisfactory value of the parallax resulting from measures.

SPECTRUM OF THE NEBULA ABOUT RHO OPHIUCHI.—At the Lowell Observatory, Dr. V. M. Slipher has lately attempted to photograph the spectrum of the remarkable nebula in the region of ρ Ophiuchi (*Popular Astronomy*, vol. xxiv., p. 542). A single-prism spectrograph of high light-power was used, and an image was formed on the slit by a simple lens of 20 cm. focal length. The total exposure, on four nights, was twenty hours, and by comparison with the exposures for direct photographs given by Barnard, it was estimated that this would give a good record of the spectrum if of the bright-line type, or would give a weak impression if the spectrum were continuous. The plate obtained was of the latter type, the spectrum of the nebula appearing faintly on either side of that of the star. So far as can be judged from the photograph, the spectrum is like that of the star about which the nebula clusters, and Dr. Slipher regards this as an indication that the nebula shines by reflected light, as he previously found reason to believe to be the case with the nebulæ in the Pleiades. In both these regions of the sky faint stars are conspicuously deficient in number, and it is suggested that their apparent scarcity may be due to their obscuration by nebulæ which may be otherwise invisible.

BRITISH INDUSTRY AND THE WAR.

THE advice of a recent ex-Minister of State that we might well leave after-the-war conditions to take care of themselves finds little response in the world of industry, whether in regard of employers or employed, who are alike viewing with deep concern the industrial and commercial problems that will surely arise on the advent of peace. This finds clear expression in a valuable memorandum issued in June last by the Garton Foundation entitled "The Industrial Situation after the War," which is fully and sympathetically further considered in the *Quarterly Review* for October by a member of the group which prepared it. This highly important memorandum has been drawn up by a group of men representative of the capitalist and employing classes, of organised labour, as well as by men familiar with finance, economics, and administration. It has further been circulated to, and discussed in draft by, large employers, trade union officials, and experts on social and economic questions with a view to their criticisms and suggestions. It is now published in the hope of stirring both employers and employed to action. The industrial problem, it declares, was with us before the war. The dangers of labour unrest and the cry for increased efficiency are

familiar to all. But the war has profoundly affected both the circumstances and the minds of men, and has gravely accentuated the complexities of the situation and the peril in which our industries stand. It is strongly urged, since industry as a whole is inextricably interwoven with the social and political life of the nation, that we cannot too soon bring to bear upon the various intricate questions involved the best intelligence and experience at our command with the object of formulating a policy based upon a comprehensive survey of all aspects of industrial conditions.

A further article appears in the *Review* dealing with British trade and manufactures and the necessity for better organisation and more efficient methods of production if we are to succeed in maintaining not only our position in the markets of the world, but also our ability to meet the vast expenditure which the war has entailed. We have failed, says the writer, as compared with America and Germany, in our methods of production, transport, and marketing, in the neglect of co-operative effort, in fertility of design and invention and in adaptability to the needs of the foreign consumer, in our provision for commercial education, and, finally, in the support of the Government in aid of trade. Before the war German goods were extensively sold in this country, and the foreign trade of Germany, whilst not so large as our own, was extending much more rapidly. It is stated that there is not the slightest doubt that we have fallen behind Germany in efficiency of manufacture of certain products in respect of both design and price, and that in order to achieve success we must produce better and cheaper goods. So far as our home trade is concerned we may exclude German goods by high tariffs, but that will not help us in foreign markets, nor is it the true remedy, which can be found only in better provision for education and a higher standard of efficiency. A strong plea is put forward for the establishment of a Ministry of Commerce, the duty of which it shall be to foster and assist British trade both at home and abroad.

BOTANY AT THE BRITISH ASSOCIATION.

THE president in his address struck the economic note, which was sustained throughout the meeting, probably the most notable contributions being the discussions on plant disease; on the utilisation of waste lands; on the botanical aspects of coal; and on the medicinal plant industry.

The discussion on plant disease was opened by Prof. Potter, of Newcastle, who laid stress on the enormous importance of the subject in relation to the world's food supply and to many other commercial products. He stated that, on an average, about one-third of these crops are lost by disease, and that a loss of two and a half millions sterling occurred in Australia one year through "rust" of wheat alone. The destruction of timber, as of many Colonial products, such as sugar, rubber, coffee, etc., is very serious. He showed how manifold are the problems underlying the treatment of plant disease, and dwelt upon the importance of various aspects demanding investigation, not alone in mycology, but in the associated physiological and pathological relations of host and parasite, and host and soil. Prof. Potter suggested two desiderata: (1) the improvement of the training of the investigator; (2) the establishment of a British Central Institute for the supply of pure cultures, which, with aniline dyes and optical glass, ceased at the outbreak of war.

Mr. Brierley, in a separate contribution, elaborated a suggestion for the formation of an Imperial Bureau of Mycology comparable with that recently established in entomology, but providing, in addition, facilities for research and supply of pure cultures.

Mr. Ramsbottom alluded to the backward condition of British phytopathology, and spoke strongly of the lack of adequate training and subsequent support given to our investigators. He advocated a central station for research and advice.

Mr. Salmon and Dr. Eyre struck a hopeful note with regard to the readiness of farmers to make use of scientific results, which it therefore behoves us to produce. They referred to the necessity for co-operation between botanist, mycologist, and chemist for the elucidation of the very complex problem of plant disease and its treatment.

The discussion of the botanical aspects of coal was opened by Dr. Marie Stopes, who urged the importance of co-operation between palæobotanist, chemist, and ecologist for the discovery and right application of our coal resources. While Prof. Seward, who spoke later, was a little doubtful as to the great utilitarian value of botanical examination, the opener suggested that researches already indicated the possibility of association between the *parts* of plants making up the bulk of the coal and the particular by-product which it yielded. She pointed out the danger of confining investigation to Carboniferous fossils in view of the fact that the coal of India, for example, is for the most part Tertiary.

Prof. Weiss spoke of the correlation which had been demonstrated between the presence of spores and the chemical nature of the seams.

An interesting series of papers on utilisation of waste land was introduced by Prof. Oliver, who also gave a paper on the possibilities inherent in maritime waste land. He illustrated his remarks by special reference to sand dunes and to salt marshes, and showed that in both cases there are two modes of utilisation available: (1) to take advantage of the natural product; (2) to convert or reclaim, so that the land is available for more general purposes. In both habitats the natural product may be a grass capable of being cultivated at a profit for paper-making. But if capital and labour be spent on their reclamation, sand dunes add profitably to our timber area, and salt marshes are known to give very fertile soil. It might well be that in the time immediately following the war this would afford excellent transitional labour for our soldiers.

Mr. Martineau, of the Reafforesting Association, demonstrated by means of lantern-slides the success of the society's planting on pit mounds in the Black Country, and gave every reason to suppose that it would prove a sound financial undertaking.

Dr. W. E. Smith developed in some detail the complexity of the problem of improvement in utilisation of mountain and heath land. He showed, however, that improvement could be effected by more frequent burning, as recommended by the Grouse Committee, by inclusion of more cattle with sheep grazing, as well as by the more drastic measure of restriction of deer forest and grouse moor to the more inaccessible uplands.

The possibility of converting moorland into food-bearing soil by means of the application of bacterised peat was brought forward by Prof. Bottomley, who quoted successful laboratory and field experiments in support. He stated that at Entwistle, in Lancashire, the yield of oats and mangolds had been doubled by its application.

The discussion on the collection and cultivation of medicinal plants was opened by Prof. H. E. Greenish, of the Pharmaceutical Society of Great Britain, who outlined the steps that had been taken during the last two years to make good the shortage of drugs consequent upon the war, and to establish a permanent

British industry. At the present moment a scheme which had every chance of success was being put forward by a Federation of the Central Committee of National Patriotic Organisations, the Herb Growing Association, and the Agricultural Organisation Society. Mr. Holmes, also of the Pharmaceutical Society, brought forward some interesting suggestions for the scientific improvement of medicinal plants.

Sir Sydney Olivier, the secretary of the Board of Agriculture and Fisheries, pointed out how essential it was to success that the industry should be established on such lines that it took its place in the commercial world as a specialised market-garden crop, with the prospect of reasonable remuneration.

Dr. E. N. Thomas raised the question of the relative merit in certain cases of the extraction from fresh and from dried leaves.

Among the other contributions to the section was a very interesting paper by Sir John S. Stirling-Maxwell on afforestation after the war. He advocated that the British Empire, as a whole, should aim at becoming self-supporting in the matter of timber. Dr. Borthwick, in the subsequent discussion, laid stress on the necessity for the training of those engaged in forestry in adequately staffed and equipped institutions.

Miss E. R. Saunders presented a report on means of bringing into closer contact those engaged in scientific breeding experiments and those commercially interested in the results. She suggested that the trades concerned should be encouraged to organise research departments, while the scientific workers might well unite to form a genetics association. She further advocated the issue of a new and readily accessible vehicle for the publication of literature on genetics and the establishment of a sub-section of genetics to the British Association.

The first of these proposals was warmly supported by Prof. Bateson, who saw difficulties, however, with regard to a new publication, which he did not consider was needed.

As the result of these discussions a committee was appointed from Section K to consider provision for plant pathology, and a joint committee from the Sections of Botany, Zoology, and Agriculture to consider provision for the application of genetics.

The meetings of Section K were terminated by a very pleasant and instructive expedition on Saturday, September 9, to the salt marshes at Alnmouth.

E. N. THOMAS.

THE BRITISH ASSOCIATION AT NEWCASTLE.

SECTION L.

EDUCATIONAL SCIENCE.

OPENING ADDRESS (ABRIDGED) BY THE REV. W. TEMPLE, M.A., PRESIDENT OF THE SECTION.

THE spiritual side of human nature, the capacity for fellowship and for devotion, is best trained by the life of membership in a society. No instruction or study can take the place of this. This is the great inheritance that comes down to us, in England at any rate, from the Middle Ages. The side on which those great private institutions which are called public schools, and the older universities, are particularly strong is the social life which is their most leading characteristic. As the personality begins to develop it requires some society of which it may be a member other than the home on one side and the nation on the other. The nation is clearly far too big for the child to realise, or indeed to possess any effective membership in it; and the home, though not too small, is yet unsuitable in one respect, namely, that it is bound to be too much under the direction of the parents. Where life in a school-room is possible, and where there is a large family to share that life, some of the conditions which we require are present, but what is needed is a society which shall indeed be under general supervision, but of which the members actually determine the character and life, so that each feels that he is a member of this community in the fullest sense, that its welfare depends upon his loyalty, while his welfare depends upon its general character. I confess that I doubt the possibility of securing this fully realised membership otherwise than in a boarding school, but here I speak with great ignorance; at any rate I am sure that for the spiritual development of the rising generation we urgently need that corporate life in schools which the so-called public schools possess in so large a measure. Every member of one of these schools, or of one of our older universities, knows quite well that what has been most valuable to him in his training has been the whole life of the place, and not the specific teaching of the class-room or laboratory. It is probably true that the educational institutions which have especially cherished this ideal have tended to be slack, as they have certainly been amateurish, with regard to the intellectual or scientific life; but they have maintained this fundamental principle, that the spiritual nature is best developed through life as a member of a society, and that a society of such a kind that the membership can be real and effective.

Now, one main activity of a society composed of children or adolescents will necessarily be found in games. This is partly because physical growth is one of the main businesses of life at that stage, and it is right that the growing boy or girl should delight in developing and exercising the physical faculties. But it is also because a game is felt to be more communal than school work. With work arranged as it now is, it inevitably follows that school work is regarded as being done for one's own sake, while the boy who plays hard is regarded as serving the community; he does it for his house or the school as much as for himself. I shall suggest in a moment that experience shows that by changes, which are otherwise desirable, with regard to school work itself a good deal of this difficulty may be overcome, but it will still remain true, at any rate with boys, that games are the dominant interest, and athletic heroes more admired than boys of intellectual promise; and I desire to insist that this is a perfectly right thing provided only that the elders, whether parents or teachers, do not themselves adopt the boy's standard, and so fix it in the boy's mind, but while sympathising with the boyish interests, yet constantly lead the mind forward to a truer perspective.

We give too exclusive a place to books in school education. Many boys, not at all really stupid, are failures at school because they are bad at books. If manual work is given a larger place, it can be so arranged that the great moral difficulty about school work is removed—namely, its individualistic and competitive character. Co-operation cannot be carried far in book work. Learning from books must be done by each for himself. But manual work can be done in teams, so that a large co-operative element comes in, which is of great value as a training for citizenship.

It is possible to do something of this sort with regard to book work. At Repton a challenge-shield is at this time being presented, to be held by the house whose members together gain most marks according to a scheme which allots so many marks to a form prize, so many to a school prize, and so forth. This in so

far as it is successful in its aim will bring the communal and co-operative spirit into the school work.

In discussing the general atmosphere in which teaching is given, and the effect which by its constant, though often unnoticed, influence it produces upon the character, something must be said about the suggestion implied and offered by our present educational system, and the changes which are needed to remedy its evils. In the first place it is clear that the system rests on the belief that for most people all that is really required is a beggarly minimum. This is most of all apparent in that curious regulation which permits clever children who might profit by continued education to leave school earlier than others, while those who are more slow-witted and less likely to profit by prolonged education are kept at school for the full time. Clearly this regulation rests on and suggests the belief that there is a definable minimum to which all citizens should attain, but beyond which there is no vital necessity that they should pass. The point selected is unfortunate in the last degree, and that in two ways. First, it releases children from the discipline of school just at the moment when discipline begins to be most essential. Down to the beginning of adolescence what we need is something that may more fitly be called supervision, and for myself I have great sympathy with those who hold that under a general supervision there should be the utmost possible freedom for the child. But with adolescence there comes a temporary chaos in the psychological make-up, and during that period there is an urgent need, not only for supervision, but expressly for discipline as that word is commonly understood, namely, the imposition of restraint, forcible if need be, in order that certain impulses may not break loose and destroy the harmony of the whole nature. But the school-leaving age is unfortunate in another respect also. We teach the child to read, and then send him away from school at a time when it is too early to have begun the training of his taste and judgment. We have made him a prey to all manner of chance influences, but have not supplied him with the power of selection between these, or the means of resisting those which his better judgment condemns.

Something no doubt can be done by means of continuation classes, provided that the time for them is taken out of the hours of employment, and not added on to these; but nothing will really meet the case except an all-round raising of the school-age. And even then we still need to get away from the conception of a necessary minimum. What we have to aim at is the maximum attainable by each scholar, not the minimum that will make him a tolerable member of a civilised community. If we aim at a minimum, that will be what most of the scholars also aim at. But how are we to make this change? The obvious method is a large system of exhibitions, maintenance grants, and the like. But here, again, we come to another false suggestion. Any system of scholarships and exhibitions is false in principle, because it inevitably suggests to the child that it is to pursue its studies for the sake of its own advancement; the whole system coheres with the ideal of the educational ladder, by means of which men and women may climb from one section of society to another. Now it is undoubtedly true that the State is bound to secure for its own interest that brain-capacity wherever found shall be fully developed, and that if a child of a dock labourer has capacities fitting him to be a great statesman or a great artist it is for the public interest that these capacities should be fully developed. But we have also to remember that when by education you lift a child from one section of society to another, you expose him to one of the most insidious of all temptations, the temptation to despise his own people. And if once his native sympathies are thus broken up, it is unlikely that he will grow any more. An educational system which depends upon the ladder is in a fair way to train a nation of self-seekers. Our demand, and here I know that I am speaking for the whole community of labour, must be for the educational highway. Our aim must be, not chiefly to lift gifted individuals to positions of eminence, but to carry the whole mass of the people forward, even though it be but a comparatively little way. We want the whole system to be all the while suggesting that the child's faculties are being trained, not for its own advancement, but for the benefit which the community is to receive. And the right way to suggest this, while also securing for the community the maximum benefit, is, as it seems to me, nothing less than a system of free education from the elementary school to the university, which, instead of offering exhibitions to enable those who are capable to proceed, will on the contrary exclude at certain wisely chosen stages those who are unable to benefit further by school education. At each of such stages there should be for those who are excluded from further advance some form of apprenticeship, and if the stage comes early this should be conducted so far as possible according to the principles of school life, with all its discipline as well as supervision.

The tutorial-class movement, which owes its origin to the Workers' Educational Association, and for a full account of which I must refer to Mr. Mansbridge's book, "University Tutorial Classes," has made two important discoveries. The first is that there is a very great amount of literally first-class ability in the country going to waste for lack of opportunity. That many of us had formerly been convinced must be the case; it is now proved. The other discovery is this. A man who has had no secondary education at all can take up work of the university type when he is of full age if his mind has remained alert. I believe many continuation classes fail through ignorance or neglect of this fact. We always tend to restart the teaching process at the exact point which the student had reached when he left school. That is a mistake. The man or woman whose education ends at fourteen or thirteen, and who becomes desirous of more at twenty-one or later, has lost much in the way of knowledge; but if the mind has remained alert the development of faculty has gone on and the appropriate method of study is that of the university, not that of the secondary school. This is of the utmost importance. We shall not for many years to come secure such a raising of the school-age or such a remodelling of our system as shall guarantee the full development of every child and adolescent. Thousands will continue to be dropped by our educational system at fifteen, if not sooner. Of course, a healthy-minded boy who leaves school at fifteen means to have done with his books. He promptly throws them away unless he is Scotch, and then he sells them. But six or more years later he may wake up to his need for more knowledge and intellectual training. Our tendency has been to give him school teaching; that is wrong; he is of the age to which university teaching is adapted, and only in that will he find what he is wanting.

Provided there has been established such a social life as I have described there will be less harm than otherwise resulting from some degree of specialisation in secondary schools. The students of different subjects will be mixing with one another, and will learn from one another a great deal of those subjects which they are not themselves definitely studying. Certainly one of the great advantages of the college system at the universities is that it gathers together in very intimate

social intercourse students of different subjects. At the present time there is a great denunciation of the prevalence of classical studies and a demand for education in natural science. But it is worth while just now to insist that specialisation in mathematics or natural science, if divorced entirely from the more human studies, or from intercourse with those who are pursuing such studies, may be educationally disastrous in the last degree. Of course, it is sometimes suggested, as I remarked earlier, that the study of natural science produces a scientific type of mind. But this is one form of the confusion to which I alluded at the outset which results from our speaking of natural science by the general name of "science." The study of languages and history can be, and ought to be, just as scientific as the study of physics.

We may state the question perhaps in this way. In order that a man may live his life and discharge his responsibilities as a citizen he needs knowledge. What is the most important sort of knowledge to have? None can be put on a level with the knowledge of human nature. Whatever a man is going to do he will have to deal with his fellow-men and find his own place among them. This knowledge cannot be adequately obtained from books alone, and, as I have said already, training through membership in a social life is the best means to it. But it may be also fostered in a very high degree by what are called the humane studies: the study of the best that men have thought in philosophy, the study of their highest aspirations and deepest woes in literature, the study of their attempts and their achievements in history. This is the most serviceable of all scientific studies that a man can undertake. But it is no doubt true that we have allowed two evil things to happen. In the first place, we have not sufficiently recognised the value of natural science in education, and, still more disastrous, we have tended to identify the study of the humanities with the study of the classical languages.

The chief point that I wish to urge is that the classics are not the only available form of humane study. I should like to see an experiment conducted on the following lines. The staple of the school curriculum to be European history and English literature. At the bottom of the school there should be elementary Latin, which undoubtedly provides good mental gymnastics, and, of course, elementary mathematics and natural science. Perhaps also French, though of this I am more doubtful. Those boys who showed real facility in Latin should, if they so desired, begin to study Greek at about the age of sixteen or sixteen and a half. They should then have one term in which they do very little except Greek. Experiments suggest that in forms consisting only of boys who have already shown some aptitude for a classical language one term's concentrated study will bring them to the point reached by efforts of several years according to our present methods, and the devotion of a single term to this would not seriously interrupt the general course. There would not be a classical side and a modern side, for the staple study of the whole school would be history; but there would be, above the point indicated, divisions for Latin and Greek as there now are in classical schools for mathematics. These would have allotted to them all the hours on the time-table that were not required for the history and literature, for it is of no use, broadly speaking, to read classics after that time unless they are given almost the whole of the student's attention. The study of ancient civilisation, which is what the study of the classics ought to be, is itself something far too rich to come under any condemnation of specialism. Boys who do not take this classical course would take mathematics, science, and at least one modern language, the mathematics and the science being so far as possible combined; specialisation either in the linguistic or the scientific branch would be encouraged in the highest departments. There would also, of course, be opportunity for specialisation in history by means of divisions which would provide a course of study supplementary to that which formed the staple of the school curriculum.

Meanwhile there is one serious evil which could be remedied at once. It is the business of the universities to be the guardians and upholders of a true educational ideal against the natural utilitarianism of the man of affairs. By their scholarship system the universities exercise a far-reaching influence on secondary schools. They give far more scholarships for classics than there are deserving candidates; they do a good deal for natural science and mathematics; they do something, though absurdly little, for history; but they practically do nothing at all for modern languages. To this branch of study they give no encouragement such as might help the schools to treat it in a truly educational way. I want to see boys and girls who study modern languages reading the great literatures which constitute the value of those languages as boys at the top of a classical side read Æschylus and Plato. But we shall not reach that without help from the universities, and at present the universities refuse their help.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—A Grace has passed the Senate sanctioning the admission of women to the first and second M.B. Examinations under conditions similar to those under which they are admitted to the Previous Examination and the Tripos Examinations.

The Appointments Board has just issued its third quinquennial report. It gives ample evidence of the valuable services which the board is rendering to graduates of the University, as well as to firms and public bodies who are in need of highly trained young men. The report shows that a large number of firms have employed Cambridge graduates on the administrative side of their business, and some forty firms are in the habit of applying to the board for scientific assistants. Among the industries represented by these latter firms are chemicals, iron and steel, coal-mining, dyeing, brewing, and the manufacture of paper, drugs, explosives, soap, and glass. Geologists, agricultural chemists, botanists, and mycologists have also found technical employment. Satisfactory as this record is, the board hopes that after the war the range of employment may be greatly increased. The engineering students have been appointed to mechanical, electrical, and civil engineering firms, iron and steel and shipbuilding firms, firms manufacturing aircraft, chemical engineering works, railways, and a number of public works departments in different parts of the Empire. The agricultural students also obtain employment over a large area, including various British Colonies. Of the work of the board during the war it is not yet time to speak in detail.

LONDON.—At a meeting of the Senate held on November 15 the Rogers prize of 100*l.* for 1916, for an essay on "The Nature of Pyrexia and its relation to Micro-organisms" was awarded to Dr. J. L. Jona.

IT is announced that Messrs. Baldwins, Ltd., have given 10,000*l.* to the Swansea Technical College for the endowment of a chair of metallurgy.

MR. C. FENNER, principal of the Ballarat School of Mines, has been appointed superintendent of technical education in South Australia, a position created under the South Australian Education Act.

OWING to the increasing interest shown by the public in hygiene and public health, more especially in the national question of the saving of "child and infant life," the governing body of the Battersea Polytechnic has decided to open the Hygiene Department for public inspection on Saturday, November 25, from 3 to 6 p.m. The lecture-rooms and laboratories, together with an exhibition of apparatus and models used for teaching purposes, will be on view. No tickets of admission are required.

IN consequence of so many probable competitors for the Fairchild Scholarship and prizes of the Pharmaceutical Society having been called to the colours, the trustees of the scholarship have decided that the examination for the awards shall not be held in 1917. It has also been decided that an arrangement shall be made by which those who are on service who would be eligible for the 1917 scholarship may, if they shall so desire, be admitted to an examination after the war.

IN August, 1915, the Board of Education gave notice that after 1916 the Lower General Examinations would no longer be held in any subjects of science and technology, but that the Higher General Examinations would for the present be continued. It is now announced that no Lower Examinations will be held in 1917, but that the Board of Education hopes to hold next year Higher Examinations in accordance with its regulations and syllabuses of 1916. After 1917 no Higher Examinations will be held in pure mathematics, theoretical mechanics, heat, magnetism and electricity, organic chemistry, coal-mining, and metallurgy.

RECENT issues of *Science* have recorded a number of bequests to higher education in the United States. The more important of these are as follows:—Yale University has received some 137,000*l.* from the estate of the late Mr. J. S. Hotchkiss; under the will of Mr. W. W. Lawrence, of Pittsburgh, Princeton University will ultimately receive 125,000*l.*; under the will of the late president of the University of Pennsylvania Museum, Mr. E. B. Coxe, junior, the University was bequeathed 100,000*l.* as an endowment of the museum, and 20,000*l.* towards increasing the salaries of professors; Columbia University has received 20,000*l.* from Mr. J. N. Jarvie for the new dental school; and the University of California 14,000*l.* from Prof. G. H. Howison and his wife. The General Education Board of the Rockefeller Foundation has undertaken to provide 40,000*l.* to complete the 200,000*l.* endowment fund which Vassar College is raising.

THE British Prisoners of War Book Scheme (Educational) makes an urgent appeal for books on natural history and scientific subjects generally, to meet actual requests received from British prisoners (soldiers, sailors, and civilians) interned in enemy or neutral countries. Among the special books asked for this week are:—"Cambridge Natural History"; "British Fresh-Water Algæ" (West); "Fungus Diseases of Trees" (Hartog); "History of European Fauna" (Scharff); "Mammalia" (Beddard); "Mammalia of India" (Blanford); and "Birds of India" (Jerdon). Books of a modern and advanced character are also needed in forestry, electrical engineering, motor engineering, telegraphy, wireless telegraphy, mineralogy, and veterinary science. Readers who may be able and willing to contribute one or more of the above works to this war charity are invited to forward to Mr. A. T. Davies, at the Board of Education, Whitehall, London, S.W., a list of the books they can offer. They will then be notified as to the acceptance of their gifts. Further particulars of the book scheme may also be had on application to Mr. Davies.

THE incidence of infant mortality, especially in urban districts, has emphasised the urgent need for greater efforts directed to the protection of infant life. Among the agencies for securing this aim systematic instruction in the hygiene of child-life occupies an important place. Voluntary societies exist through which much work has already been done, and the Local Government Board for Ireland has recently issued a circular letter outlining a scheme dealing with maternity and child welfare, in aid of which a grant of 5000*l.* has been made available. To ensure due co-operation between medical and other public officers on one hand and voluntary workers on the other, and to render the work of the latter efficient and effective, the Department of Agriculture and Technical Instruction for Ireland has prepared and circulated a syllabus of instruction in child hygiene. The Department is prepared to consider the recognition of classes in the syllabus conducted by local technical instruction, and other approved, committees, and in certain circumstances to pay grants in aid. The instruction must be under the direction of a qualified medical practitioner and a trained nurse, but recognition may be extended to other suitable persons. If desired, the Department is prepared to conduct an examination at the close of a course of instruction, and to award certificates of proficiency.

AN article on "Science in the School," in the *Times Educational Supplement*, by Sir Clifford Allbutt, may be commended to the thoughtful consideration of headmasters and others. The notion of some headmasters that it is sufficient to introduce science in a school as a "complementary" subject is unsparingly pilloried. The methods of science must permeate the curriculum, since, as the article urges, they pertain "to all spheres of knowledge and wisdom, natural and humane, a leaven rather than an ingredient." The cry of *what* is to be taught to boys is of less importance than the vision of *how* things are to be taught. In young boys "the brain-web is built, not by reflecting, but by doing." The qualities wanted of young men in the greater world are spontaneity, initiative, ready wits in tight places, all of which depend upon structures in the brain, organised, not by reading, but by former activities. Affirming these things, Sir Clifford Allbutt reiterates "science is a method, a method to inform, not our studies of material things only, but all studies, material, social, and spiritual." It is good to find the article insisting that before we can have good teaching we must have trained teachers; it would have been better if it had been added that we must have reasonably paid teachers. The suitable form of science teaching for various classes in the school is described, and altogether the essay should assist the anxious headmaster. It is a pity, however, that Sir Clifford Allbutt seems not to have acquainted himself with the work of the many secondary schools which have been developed since the Education Act of 1902. There at least the boys study mensuration in the practical way he suggests, and much work in experimental science of a sane kind is being accomplished.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, November 9.—Sir J. J. Thomson, president, in the chair.—W. M. **Bayliss**: Methods of raising a low arterial pressure. When the arterial pressure is low from loss of blood it cannot be brought back, except to a certain degree, by the injection of saline solutions into the veins in quantity equal to that of the blood lost. But if the viscosity of such solutions is made equal to that of blood, a return to normal height is possible. The effect of saline injections containing gum or gelatine is also much more lasting than

that of simple saline solutions. The difference in this respect is due to the osmotic pressure of the colloids added, by which loss of water by the kidneys or to the tissues is prevented. Solutions containing gum do not produce œdema in artificial perfusion of organs. When the fall of blood pressure is due to peripheral vasodilatation, then gum or gelatine solutions, although more effective than pure saline, produce a much less permanent rise than in cases of loss of blood.—A. J. **Brown** and F. **Tinker**: Selective permeability: the absorption of phenol and other solutions by the seeds of *Hordeum vulgare*. The paper deals with the concentrations in which solutions of various organic solutes diffuse into barley seeds across the semi-permeable membrane of the latter. It is found that the membrane and the starchy contents of the seeds act selectively towards the solutions in such a way that the concentration of an aniline or a phenol solution which enters the seeds is about three times as strong as the outside solution from which it has diffused. Somewhat similar results are obtained for the diffusion of acetic acid solutions into the seeds; but in this case it is found also that the "adsorbed" solution which enters the seeds becomes saturated at a concentration of 80 per cent. acid. The amount of solution which enters the seeds is determined by the relative concentrations of the solutions inside and outside. The research also brings out the fact that the permeability of the barley membrane is due to selective adsorption.—C. **Shearer**: The toxic action of dilute pure sodium chloride solutions on the meningococcus.—C. **Shearer** and H. W. **Crowe**: The *rôle* of the phagocyte in cerebro-spinal meningitis. Good evidence has been obtained for thinking that under certain conditions the meningococcus can be taken up by the leucocytes, but not killed by them. In the case of freshly isolated strains the leucocytes will not take them up at first. With old cultures, on the other hand, ingestion on the part of the phagocytes takes place with great rapidity. In a short time the germs are killed and completely digested by the leucocytes. This happens also with the majority of the nasal strains examined from chronic carriers, although they show great individual differences.—S. B. **Schryver** and Mary **Hewlett**: Investigation dealing with the phenomena of "clot" formations. Part IV.—The diphasic erosive action of salts on the cholate gel.—I. **Jörgensen** and F. **Kidd**: Some photochemical experiments with pure chlorophyll and their bearing on theories of carbon assimilation.

Zoological Society, November 7.—Dr. S. F. Harmer, vice-president, in the chair.—Dr. F. E. **Beddard**: Two new species of Cestodes. The first species was obtained from a slow lemur and was referred to the genus Linstowia; the second occurred in a black-headed partridge, and was placed in the genus Cotugnia.—Dr. J. F. **Gemmill**: The development of some starfishes. The species of which the development was traced are:—*Asterias glacialis, Cribrella oculata, Solaster endeca,* and *Stichaster roseus.*

Geological Society, November 8.—Dr. Alfred Harker, president, in the chair.—Dr. S. **Smith**: *Aulina rotiformis,* gen. et sp. nov., *Phillipsastraea hennahi* (Lonsdale), and the genus Orionastræa. A description of a new coral genus of colonial habit, Aulina, obtained from the highest limestone associated with the Lower Carboniferous—the Fell Top Limestone of Northumberland and its equivalent horizon in Teesdale, the Botany Beds.

Royal Meteorological Society, November 15.—Major H. G. Lyons, president, in the chair.—C. E. P. **Brooks**: A meteorologist in China. The work was described of the late Capt. L. H. Tamplin, who resided in eastern China from 1902 to 1915, and took very full and accurate meteorological observations, chiefly at Chinkiang, but for a time at Wuhu, and finally at Amoy. These observations are made the basis of a discussion of the climate of the coastal region of China and its controlling factors. In addition to his actual observations, Capt. Tamplin's close acquaintance with the Chinese enabled him to note some quaint weather superstitions, and he also made some important observations on the causes of flood and famine in China.—Lieut. A. E. M. **Geddes**: The storm of November 11–13, 1915, in its passage over the British Isles. This storm was remarkable for its close resemblance to a very severe storm which crossed the British Isles on November 11–13 in 1901. Both disturbances gave unusually heavy rainfall over Ireland and England, but in both cases there was very little precipitation over Scotland. All records available at the Meteorological Office have been examined, and from them weather maps have been constructed for intervals of two hours. From these maps the path of the centre of the storm has been traced with great detail. In this case the path skirted the southern coast of the British Isles, whereas in the case of 1901 it was from Galway to the Wash. The two-hourly maps have been used for working out the air circulation in the storm. Two distinct air supplies can be identified: (1) a supply of warm air from the south, and (2) a supply of much colder air from the east.

CAMBRIDGE.

Philosophical Society, October 30.—Annual general meeting.—Prof. Newall, president, in the chair.—C. T. R. **Wilson**: Methods of investigation in atmospheric electricity.—L. A. **Borradaile**: The functions of the mouth-parts of the common prawn. The author stated that food is seized by either pair of chelipeds or by the third maxillipeds, and by them placed within the grasp of the second maxillipeds, which direct it, according as it is finely divided or coarse, to the maxillules or to the incisor processes of the mandibles. By these two pairs of limbs it is further divided and passed into the chamber guarded by the lips, where the molar processes grind it still further. The first maxillipeds and maxillæ play subsidiary parts, if any, in the manipulation of the food.—J. T. **Saunders**: The growth of *Daphne pulex.* The author showed that at least two adult forms of *D. pulex* existed, differing only in size and fecundity. Both forms had embryos in the brood pouch, but the larger forms had more than the smaller. More than one adult form probably occurs in other Entomostraca, and this would account for the great difficulty, which is experienced in this group, of determining species.—W. A. D. **Rudge**: A self-recording electrometer for atmospheric electricity.—C. E. Van **Horn**: An axiom in symbolic logic.—S. **Ramanujan**: The expression of a number in the form $ax^2+by^2+cz^2+du^2$.—J. G. P. **Nicod**: A reduction in the number of primitive propositions of logic.

PARIS.

Academy of Sciences, November 6.—M. Camille Jordan in the chair.—The President announced the death of M. Léauté.—G. **Bigourdan**: The position and co-ordinates of the old observatory in the rue Vincenne. Important work was done at this observatory between 1666 and 1669, some details being given. The exact position of the instruments has been lost, but is now reconstructed by the author from old maps and contemporary documents.—M. Aries was elected a correspondant of the Academy in the section of mechanics in the place of the late M. Considère.—W. H. **Young** and Mme. Grace Chisholm **Young**: The normal frontier of a region or of an ensemble.—G. **Koenigs**:

A particular plane movement with two parameters.—Œ. de **Coninck** and M. **Gérard**: The atomic weight of lead. The method used was to determine the ratio of lead nitrate to the lead oxide obtained by ignition. For ordinary lead the value 206·98 is given, and for lead extracted from uranium minerals 206·71.—E. **Harlé** and J. **Harlé**: The continental dunes of the *landes* of Gascony.—R. **César-Franck**: The presence of forms of wind erosion in the Isle of Wight.—J. **Dedijer**: The traces of the Glacial period in Albania and New Serbia (upper basins of the Drim Noir and the Skumba).—C. **Sauvageau**: The plantules of some Laminaria.—L. **Daniel**: The effects of continual capillary watering. Various seeds and plants were kept continuously supplied with water by capillary siphons, the amounts of water required for each plant having been previously determined by studies of the transpiration of the plant and soil evaporation. The results were compared with ordinary intermittent watering, and showed distinct advantages for the capillary method.—L. **Roule**: The migration for spawning in lake trout, *Salmo fario lacustris*. The fish are shown to select streams in which the proportion of dissolved oxygen is highest.—L. **Boutan**: The plane of equilibrium or of least effort of Teleostean fish with swimming bladder.—A. **Paillot**: The existence of several varieties and races of Coccobacilli in natural septicemia of the cockchafer.—J. **Courmont** and A. **Devic**: The leucocytosis resulting from antityphoid and antiparatyphoid vaccination.—J. **Danysz**: The causes of intolerance to the arsenobenzenes and the means of avoiding or preventing them.—G. **Sanarelli**: The pathogeny of cholera. Experimental reproduction of the disease.

WASHINGTON, D.C.

National Academy of Sciences (Proceedings, No. 10, vol. ii.).—F. H. **Seares**: Preliminary results on the colour of nebulæ. Photographs of the spirals Messier 51, 94, 99 show that the nebulæ condensations have large negative colour indices. The knots of nebulosity are bluer than the bluest of the neighbouring stars. The spectral character of the outlying regions differs from that of the central nucleus. In the case of the planetary nebula N.G.C. 3242 no important differences of this sort are revealed.—K. G. **Falk**: The action of alkali in the production of lipolytically active protein. The author discusses inactivation of the enzymes by acid, by alkali, by alcohols, by acetone, by salts, and by heat; nature of the chemical changes involved in the inactivations; and activation of proteins by alkali.—A. R. **Haas**: The excretion of acids by roots. The author finds that no acid other than carbonic was excreted from the roots of corn seedlings. Similar results were obtained with wheat seedlings.—W. W. **Campbell** and J. H. **Moore**: Spectrographic observations of relative motions in the planetary nebulæ. Further observations indicating the probability of the hypothesis that the so-called ring nebulæ are in reality not ring forms, but ellipsoidal shells. Tentative conclusions are also drawn as to the probable masses of the nebulæ.—S. C. **Brooks**: New determinations of permeability. The determinations have been made by a new independent method and by improved older methods. The results agree in showing that living protoplasms are normally permeable to the salts studied, but salts of pure solutions may alter permeability, some causing an increase of permeability, while others cause a decrease, followed by an increase. In a properly balanced solution the permeability remains normal. Cell-walls may be semi-permeable to an extent which renders them important in such experiments.—A. A. **Coble**: Point sets and Cremona groups. Part iii. The group $G_{6,2}$ is used in the problem of determining the lines of a cubic surface. The determination differs from that of Klein.—C. **Barus**: The interferences of spectra, both reversed and inverted.—A. M. **Banta**: Sex intergrades in a species of Crustacea. The author has collected a large amount of data on several species of Cladocera, which is interesting because of the remarkable array of sex forms, the stock in general consisting of perhaps 40 per cent. normal males and about 8 per cent. normal females, the remainder being intergrades with almost every combination of sex characters.—G. H. **Hardy** and J. E. **Littlewood**: Some problems of Diophantine approximation: a remarkable trigonometrical series. A series is given which is never convergent or summable for any value of θ, and is accordingly not a Fourier's series; and further, a function which does not possess a finite differential coefficient for any value of θ.—G. N. **Lewis**: Steric hindrance and the existence of odd molecules (free radicals). It is contended that the hypothesis underlying the somewhat elusive phrase, "steric hindrance," should not be introduced until phenomena are known which cannot be so well explained in other ways. It is shown how the so-called free radical of organic chemistry may be explained independently of the hypothesis of steric hindrance.—A. A. **Bennett**: Newton's method in general analysis. An extension to general analysis of the special algebraic work of H. B. Fine.—W. D **Harkins**, R. E. **Hall**, and W. A. **Roberts**: The cobaltammines. The authors have determined accurately the freezing-point lowerings caused by eight different cobaltammine salts, and have derived from the results the number of ions into which each salt dissociates. These are found to be in accordance with Werner's theory.—National Research Council: Report of the first meeting of the council; reports of meetings of the Executive Committee; organisation of the Research Council (as at present constituted).

NEW SOUTH WALES.

Linnean Society, August 30.—Mr. A. G. Hamilton, president, in the chair.—R. J. **Tillyard**: Further observations on the emergence of dragonfly larvæ from the egg, with special reference to the problem of respiration. The observations were made upon eggs of *Anax papuensis* (Anisoptera) and *Austrolestes leda* (Zygoptera). By curtailment of the oxygen supply during embryological development, larvæ of Anax were made to hatch from the eggs in a weakened condition, so that the pronymphal stage lasted three and a half hours instead of a few seconds. Results:—(1) The first gas to enter the tracheæ appears during the pronymphal stage, and enters simultaneously into dorsal and ventral trunks and their connecting tracheæ. (2) Experiments with a 10 per cent. solution of caustic potash, and with a 4 per cent. solution of azol, indicate that this gas is CO_2, and that it is replaced by a mixture of oxygen and nitrogen differing little from air. (3) Sections of a pronymph, made to discover the nature of the "cephalic heart," suggest that this is not a special organ, but merely a temporary development in the œsophagus. (4) The abnormal conditions imposed upon one egg, with an embryo which had not completed reversion, caused this embryo to continue its development head downwards, and, finally, to hatch tail foremost. (5) Newly hatched larvæ of Austrolestes practise rectal respiration regularly for the first half-hour of larval life, thenceonward intermittently. Practically all dragonfly larvæ must practise rectal respiration directly after hatching to replace the CO_2 in the tracheal system.—Dr. E. W. **Ferguson**: Revision of the Amycterides (Coleoptera), part v. This part deals with the genera Molochtus (four species, one new) and Cubicorrhynchus (twenty-eight species, seven new).—A. H. S. **Lucas**: Notes from the Botanic Gardens, Sydney. Parthenogenesis in aquatic phanerogams. *Elatine triandra*, Schrank (Elatinaceæ), and *Glossostigma spathulatum*, Arnott (Scrophulariaceæ),

in a submerged state freely produced capsules only, but were induced to produce normal flowers by growing them in soil exposed to sunlight in the open air.—E. F. **Hallmann**: Revision of the genera with Microscleres, included, or provisionally included, in the family Axinellidæ (Porifera), part i. The first part treats of the peculiar and aberrant genus Trachycladus, hitherto represented only by the briefly described *T. laevispirulifer*, Carter, and two species imperfectly described by von Lendenfeld, under the generic names Spirophora and Spirophorella. Seven additional representatives are described, three of which are designated as varieties of *T. digitatus*, Lendenfeld. The genus appears to constitute a connecting link between the Axinellidæ and the Spirastrellidæ, thus pointing to the possibility that these supposedly quite unrelated families may be derived from a common stem.

CAPE TOWN.

Royal Society of South Africa, September 27.—Dr. L. Péringuey, president, in the chair.—H. H. W. **Pearson** and Mary R. H. **Thomson**: Some stages in the life-history of Gnetum. An account is given of an investigation of the ovule and embryo-sac of *Gnetum africanum* (West Africa) and *G. Gnemon* (Ceylon); the material studied included also *G. Buchholzianum* (West Africa) and *G. scandens* (Poona, Darjeeling, Penang, Singapore), and two species of doubtful identity, one from Singapore and one from Java.—H. **Bohle**: The theory of automatic regulators. Automatic regulators may be classified as sluggish and fast regulators. The theory of each form of regulator is explained in this paper.—T. F. **Dreyer**: Variation in the Mylabridæ illustrating a new theory of evolution based on Mendelism.

BOOKS RECEIVED.

The Portland Cement Industry. By W. A. Brown. Pp. x+158+plates xxxvi. (London: Crosby Lockwood and Son.) 7*s*. 6*d*. net.

Ministry of Finance, Egypt. Survey Department. The Geography and Geology of West-Central Sinai. By Dr. J. Ball. Pp. 219+plates xxiv. (Cairo: Government Press.) P.T.30.

Practical Experiments in Heat and Light. By W. St. B. Griffith and P. T. Petrie. Pp. viii+123+viii+112. (London: Rivingtons.) 3*s*. 6*d*. net.

Text-Book of Elementary Chemistry. By Dr. F. M. Perkin and E. M. Jaggers. Pp. vi+384. (London: Constable and Co., Ltd.) 3*s*. net.

Facts and Fallacies regarding the Bible. By W. Woods Smyth. New edition. Pp. vii+210+plates. (London: Elliot Stock.) 3*s*. 6*d*. net.

Janus and Vesta: A Study of the World Crisis and After. By B. Branford. Pp. xviii+316. (London: Chatto and Windus.) 6*s*. net.

An Outline of Theosophy. By C. W. Leadbeater. Third impression. Pp. 99. (London: The Theosophical Publishing Society.)

The Weather Map: An Introduction to Modern Meteorology. By Sir Napier Shaw. Pp. 94. (London: H.M.S.O.; the Meteorological Office.) 4*d*.

The Mirage: A Fantastic Study of Evolution in Australia. By Bunyip. Pp. 64. (London: W. H. and L. Collingridge.) 6*d*. net.

Aircraft of To-day. By C. C. Turner. Pp. 315. (London: Seeley, Service, and Co., Ltd.) 5*s*. net.

The Origin of the Earth. By T. C. Chamberlin. Pp. xi+271. (Chicago: The University of Chicago Press; London: At the Cambridge University Press.) 6*s*. net.

Macmillan's Graphic Geographies. The British Isles. By B. C. Wallis. Pp. 32. (London: Macmillan and Co., Ltd.)

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 23.

ROYAL SOCIETY, at 4.—Annual Report of Council.—At 4.30.—The Corrosion and Electrical Properties of Steels: Sir Robert Hadfield and Dr. E. Newbery.—(1) Monoclinic Double Selenates of the Nickel Group; (2) X-ray Analysis and Topic Axes of the Alkali Sulphates and their Bearing on the Law of Valency Volumes: Dr. A. E. H. Tutton.—The Scattering of Plane Electric Waves by Spheres: Dr. T. J. I'a Bromwich.—Numerical Results of the Theory of the Diffraction of a Plane Electromagnetic Wave by a Perfectly Conducting Sphere: J. Proudman, A. T. Doodson, and G. Kennedy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Parallel Operation of Electric Power Stations: J. S. Peck.

FRIDAY, NOVEMBER 24.

PHYSICAL SOCIETY, at 5.—Measurement of the Thomson Effect in Wires: H. R. Nettleton.—Thermoelectric Properties of Fused Metals: C. R. Darling and A. W. Grace.

MONDAY, NOVEMBER 27.

ROYAL SOCIETY OF ARTS, at 5.—Howard Lecture—Coal and its Economic Utilisation: Prof. J. S. S. Brame.

TUESDAY, NOVEMBER 28.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—The Common Objections to the Reality of the Migrations of Early Culture, with Special Reference to the Dogma of the Similarity of the Working of the Human Mind: Prof. G. Elliot Smith.

WEDNESDAY, NOVEMBER 29.

ROYAL SOCIETY OF ARTS, at 4.30.—The Internal Combustion Engine: Dr. Dugald Clerk.

THURSDAY, NOVEMBER 30.

LINNEAN SOCIETY, at 5.—(1) The Floral Anatomy of some Compositæ; (2) Demonstration on the Force for Dispersal of Fruits: J. Small.—A Note on the Seed of *Iris pseudacorus*, Linn.: T. A. Dymes.

SATURDAY, DECEMBER 2.

GEOLOGISTS' ASSOCIATION, at 3.—The Palæoliths of Farnham: H. Bury.

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