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

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NATURE.

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THURSDAY, JANUARY 13, 1916.

AMERICAN STEEL STRUCTURES.

Structural Design. Vol. ii. *Design of Simple Structures.* By Prof. H. R. Thayer. Pp. ix + 495. (London: Constable and Co., Ltd., 1914.) Price 16*s.* net.

THIS is a second volume of a treatise, of which another volume is to follow. It can be heartily commended as a competent attempt to grapple with, and reduce to order, a wide and difficult subject. No English book known to us deals in similar detail with the considerations which should be present in the mind of a designer, or gives equal help in dealing with practical problems. A large number of examples of design are worked out in numerical detail, and this gives the author an opportunity of introducing the discussion of various matters which cannot be reduced to exact rule, but are such as would be pointed out by a chief draughtsman to his subordinate or by a professor to his student at the drawing-board. Thus tips can be given by which difficulties can be obviated or evaded, and modifications indicated where rational formulæ lead to unpractical dimensions. Not only rules of applied mechanics are attended to, but considerations of weight, cost, durability, and convenience of erection are equally stated.

The technical terms may present difficulty to some English readers, and a bilingual glossary would be useful. Ties (sleepers), coids, bents, girts, dapped ties, splice (for joint), and kips (as units of load) are foreign in this country. Probably unavoidably a very large number of empirical formulæ are introduced, and the basis for these or the reason for the selection of the constants suggested is not generally clear. They must be taken on the authority of the author. It is not obvious why the weights of single, double, or treble I beams for the same load should be as 21, 30, and 36, and a built beam as 32 (p. 7), and so in other cases. There are other cases where abbreviation has been carried to a point which will give trouble to readers, but this but little detracts from the considerable merit of the book.

Naturally the chief subjects treated are bridges, plate and braced, for roads and railways, and viaducts for elevated railways. But steel-framed mill and office buildings are treated fairly fully, and railroad stations, mine structures, stand pipes, and steel tanks more briefly. A feature of the work is the tabulation of references to technical journals and memoirs.

An interesting chapter is that on high steel-framed buildings. The author points out that the executive offices of great corporations must be in large cities, and central to facilitate intercourse. Hence arise sections of a city where land is very valuable and high buildings are necessary to secure a fair return on the property. In America there has been a steady drift towards higher buildings, the highest being the Woolworth building with fifty-five stories or 775 ft. high. On the other hand, the disadvantages of the system seem serious enough—exclusion of sunlight from streets, difficulty of fire protection, overcrowding of the water and sewer systems. In the prevalent "cage construction" all loads, including the weight of the walls, are carried at each floor-level by the steel. From the large and increasing sum bringing no return during erection, the work has to be done with remarkable speed.

The author states that it is possible to replace an old building by a new one twenty-five stories high in a year. Work at different heights is prosecuted simultaneously, and as concerns the steelwork, two to four stories may be erected per week. Many of the details of floors and fire protection of steelwork, etc., for high buildings will be new to English readers. The provisions required in the United States for water, drinking water, hot water, elevators, heating (by waste-steam radiators), lighting, telephone, and telegraph are more elaborate than anything exacted in this country.

CANADA.

Stanford's Compendium of Geography and Travel. (New Issue.) *North America.* Vol. i. *Canada and Newfoundland.* Edited by Dr. Henry M. Ami. Second edition, revised. Pp. xxviii + 1069. (London: E. Stanford, Ltd., 1915.) Price 15*s.* net.

IT is inspiriting, in these times of national self-questioning, to turn to a book like this, in which a true Canadian tells with glowing pride of the magnificent and continuous growth of the great Dominion as an integral part of our Empire. The book has been written to replace an earlier edition by Dr. S. E. Dawson, published in 1897; and it shows that the interval has been characterised by a national vitality and progress even more vigorous than those of any previous period. Exploration pushed forward everywhere; old boundaries changed; new territories settled; population enormously increased; fresh industries established; railway and shipping enterprises of world-importance planned and carried through; old political difficulties swept away and others, formerly unthought of, now to the fore; and, through all, as a dominant note, an ever-increasing

sense of Canadian unity and of Imperial responsibility!

In varying degree it is the story also of Australia, of New Zealand, of South Africa; and is the best vindication of our method or lack of method in the world of affairs. As this book will show, our mistakes in the past have been many, but they have been repairable piecemeal. When an unnaturally rigid organisation breaks down, it breaks down utterly.

Dr. Ami has proved himself well qualified for the task of preparing this bird's-eye view of the Dominion. His long service on the Geological Survey of Canada has not only endowed him with stores of direct knowledge, but has also brought him in contact with the best and most recent authorities for other information, as his preface indicates.

His account of the history and characteristics of the maritime provinces and Old Canada, especially of the Province of Quebec, are of peculiar interest to the British reader in presenting a full and sympathetic view of the position of the French-speaking Canadians, whose loyalty to the Empire in the present crisis is doubly assured, and whose influence upon the future of Canada is bound to be of prime consequence.

In the first three chapters Dr. Ami deals with the Dominion as a whole, its exploration, its surrounding seas, its great lakes and their geological evolution, its spacious geography, its flora and fauna, its aboriginals (no longer to be regarded as a moribund people), and its general system of government. Then follow the chapters (iv.–xx.) in which the separate provinces and territories, along with the independency of Newfoundland, are severally dealt with, in each case with an entertaining outline of its individual history and an accurate account of its physical features, geological structure, present economic development, and future possibilities; while all along runs the cheery streak of good Canadian satisfaction and optimism, illuminating everything, even the tables of statistics. The summary of our knowledge of the cold wilderness and archipelago north of the Arctic Circle, contained in chapter xix., and the concluding bibliography, are noteworthy additions to the value of the book as a work of reference.

The critical reader may notice now and again a repetition of the same facts and statements in almost identical terms under different headings; but this is perhaps excusable where so many of the sections are more or less independent and may have to be consulted separately. The book is illustrated with many clear maps, and with well-chosen views of scenery, etc., as text-figures. Most of the latter are reproduced from photographs, and are sometimes good, sometimes smudgy. These unimpressive process-photographs are becoming superabundant, however, and one regrets the passing of the old line-engravings and wood-cuts, which, though less accurate, more directly carried their intention to the eye.

G. W. L.

PRACTICAL BIO-CHEMISTRY.

Practical Organic and Bio-chemistry. By R. H. A. Plimmer. Pp. xii+635. (London: Longmans, Green and Co., 1915.) Price 12*s.* 6*d.* net.

THIS work is a development of the author's "Practical Physiological Chemistry," which had been used by him for teaching purposes for some years. New sections on organic chemistry and the organic substances found in plants have been added, and the work thus rendered much wider in scope, whilst the inclusion of many of the less familiar experimental methods has made it of greater value to the advanced student or investigator. As now presented the book appeals to a very wide audience. The student of medicine, for whom, even in its expanded form, it is still primarily intended, will find in it instruction on every point of practical organic or physiological chemistry which is likely to be of use to him, and may, if he think fit, advance much further in these subjects than is at all usual. At the same time, workers in every branch of biochemistry will find a considerable amount of information, not only concerning the fundamental substances which form the chemical basis of all living organisms, but also, with few exceptions, dealing with that section of the subject in which they are specially interested.

An unusual feature for a work on practical chemistry is the inclusion of a considerable amount of descriptive matter, unaccompanied by any practical details, and often dealing with very complex subjects, such as animal and vegetable colouring matters, the terpenes, etc. Although the information thus supplied is of great interest, and is well and clearly presented, it is in many cases necessarily extremely condensed, and seems somewhat out of place in a professedly practical work. The omission of much of this purely descriptive or theoretical matter might possibly have rendered possible the production of the book at a price less formidable to the student.

Another feature of the work which is also a little unusual is the inclusion of what may be termed "ordinary" organic chemistry, along with more purely biochemical and physiological subjects. There are probably few text-books in which Friedel and Crafts' reaction, the preparation of

a peroxydase solution, and the analysis of diabetic urine receive impartial attention. There is, however, an advantage in this plan, for the worker proceeds from the simpler "organic" preparations, in the course of which he acquires the necessary technique, to the more difficult biochemical methods. Owing, no doubt, to the necessity for compression, some of the directions given for preparations appear to be scarcely explicit enough for a beginner, unless supplemented by verbal instruction—perhaps not a very serious fault.

Turning to the more purely biochemical part of the work, we find that a large number of preparations are described, and a very complete series of illustrative experiments given in connection with the more important branches of biochemical work. Too little stress is, perhaps, laid on the importance of the various factors by which biochemical processes are affected. Thus, the determination of acidity—whether by electrical methods or by the use of indicators—is not described, and, in the section on fermentation, the reference to the sensitiveness of enzymes to salts, acids, and alkalis scarcely does justice to the importance of the subject.

Throughout the book the analytical relations of the substances mentioned and the processes of analysis employed in biochemical work are extremely well and fully described, the author's great experience in this branch of the work enabling him to speak with special authority. Particularly is this the case with the analysis of urine—both normal and pathological—the micro-methods of Folin being included, the analysis of tissues, the examination of the gases of the blood, and the measurement of the activity of enzymes.

As will be seen from the foregoing, the author has brought together an extremely valuable collection of information concerning substances, processes and methods of biochemical interest, and all students and workers owe him a debt of gratitude for the industry and patience which he has displayed in the accomplishment of this task.

A. HARDEN.

TINEID MOTHS OF CENTRAL AMERICA. Biologia Centrali-Americana. Insecta. Lepidoptera-Heterocera. Vol. iv. By the Rt. Hon. Lord Walsingham. Pp. xii + 482, plates x. (London: Dulau and Co., Ltd., 1909–1915.)

AS already stated in NATURE (December 23, 1915, p. 448), the publication in 1915 of the volume under review and of Dr. Godman's "Introductory Volume" marks the completion of the great series of works forming the Biologia Centrali-Americana. Lord Walsingham's contribution deals with the micro-moths of the groups Tineina, Pterophorina, and Orneodina, and includes a supplement to Pyralidina and Hepialina. As he explains in his introduction, the task has been accomplished, not by himself alone, but by the combined efforts of three specialists, the other two being Mr. J. Hartley Durrant, and Mr. August Busck of the United States Department of Agriculture. Lord Walsingham had already commenced to study the material so long ago as 1895, but several causes have delayed the appearance of the volume, notably the decision to extend it far beyond its original scope as a faunistic treatise, "and to give it special value for the future guidance of all students of the Microlepidoptera." It soon became apparent that previously adopted lines of classification were inadequate for dealing with so little known a fauna. Therefore a correlation of the various systems and a revision of the limits of existing family-divisions were undertaken—a study which has produced interesting results.

Earlier writers relied to a large extent on secondary sexual characters, not only for specific, but also for generic, distinctions. These have been discarded, for generic purposes at least, in favour of characters found in both sexes, this being probably the first time that such a principle has been applied to the classification of Tineina as a whole. The reason for this change, which has involved the suppression of very many genera, is that when the structural modifications hitherto used "are carefully examined in relation to the vast number of forms in a great continental fauna, they are found to blend one into another by such infinitesimal gradations as to impede rather than to assist a conscientious worker." For example, the genus Felderia was founded on the strongly bipectinate antennæ of the male, a character found to be modified by such countless and minute gradations as to be quite untrustworthy for purposes of generic differentiation. Again, the family Acrolophidæ, after being exhaustively examined, must be regarded as consisting practically of one large genus, in which, however, the species are separable by secondary sexual differences. Varying degrees of structural divergence are often concomitant with most confusing similarity of general appearance, so much so that, in the case of the genitalia, the differences may almost convey the impression of having been purposely evolved to prevent interbreeding of forms among which confusion might otherwise occur.

On the last page of the introduction is a census of the forms enumerated: 27 families, two described as new; 225 genera, 54 described as new;

1025 species, 586 described as new. These forms are illustrated by ten plates containing 350 coloured figures and by a number of structural text-figures. Notwithstanding this there are grounds for thinking that only the fringe of the Central American microlepidopterous fauna has been touched. Dr. Godman's collectors had to obtain insects of all orders, and could not devote attention to micro-moths to the exclusion of other groups. Thus the most able collectors could scarcely obtain samples of more than a portion of the Microlepidoptera. These insects cannot be packed and preserved so easily as those of many other groups. They require special treatment of a very delicate kind, which it is not easy to give when collecting all orders, as the writer of this review can testify from his own experience in the forests of certain tropical islands.

The extended aim of the work has necessitated a vast amount of bibliographical research. In connection with questions of nomenclature a protest is entered against the practice, now becoming prevalent, of arbitrarily "selecting and maintaining generic names by summary fixation of types without due regard for previous work done by critical authors." Lord Walsingham contends that however necessary in the interests of priority and uniformity arbitrary rules may be for the present and future, they should not be made retrospective. When the limits of genera have been modified by the careful and expert work of earlier writers, such modification must be taken into account; otherwise a death-blow may be struck at the whole system of true priority.

The names of the three specialists responsible for it are a guarantee of the high quality of this treatise, and its appearance as the last systematic volume of the Biologia forms a fitting close to the monumental work of Dr. Godman and the late Mr. Salvin. HUGH SCOTT.

BOTANY, NATURE STUDY, AND GARDENING.

(1) *The Study of Plants: an Introduction to Botany and Plant Ecology.* By Dr. T. W. Woodhead. Pp. 440. (Oxford: At the Clarendon Press, 1915.) Price 5*s.* 6*d.*

(2) *A School Flora for the Use of Elementary Botanical Classes.* By Dr. W. M. Watts. New edition. Pp. viii+208. (London: Longmans, Green and Co., 1915.) Price 3*s.* 6*d.*

(3) *The Surrey Hills.* By F. E. Green. Pp. x+252. (London: Chatto and Windus, 1915.) Price 7*s.* 6*d.* net.

(4) *In Pastures Green.* By P. McArthur. Pp. xi+364. (London and Toronto: J. M. Dent and Sons, Ltd., 1915.) Price 5*s.* net.

(5) *How to Lay Out Suburban Home Grounds.* By H. J. Kellaway. Second edition. Pp. x+134. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1915.) Price 8*s.* 6*d.* net.

(1) THE course of work in elementary botany set forth in this book is such as to fulfil admirably the author's main object: the establishment of the fundamental principles of plant physiology; while the prominence given to plant ecology and the admirable manner in which this aspect of the subject is treated are just what one would expect from a writer who has contributed so materially to the progress of this branch of botany. Form and structure, however, are by no means neglected in Dr. Woodhead's well-planned course, but merely made subservient to physiology and ecology; morphological facts are treated in relation to function and habitat, while the necessary morphological data are introduced where required in the discussion of the various types of vegetation. The book is liberally illustrated, and the figures are mostly new and all extremely good, a large proportion being photographs. It would be very difficult to find a better introduction to the study of plant ecology than is given in the section, extending to about ninety pages, with fifty illustrations of which many are very fine photographs of vegetation, devoted to this subject. We could wish that climatic factors had been somewhat more fully dealt with, and it seems rather inadvisable at present to introduce any terms for vegetation units beyond the non-committal "plant community" in a book intended for young students. It is safe to predict that Dr. Woodhead's book will be widely adopted for class use, and it is to be hoped that it will come into the hands of every teacher of botany.

(2) Watts's "School Flora" is too well known and extensively used by teachers and students of elementary botany to require further commendation for its good points—its cheapness and handiness, and the usefulness of the keys to the families, genera, and species of vascular plants. This new edition is stated in the preface to have been "thoroughly revised," but the chief features of the revision appear to consist in the addition of a key for the identification of trees and shrubs from their leaves, and in the extension of the list of schools near which the rarer plants grow—this fact being noted in connection with the description of each plant concerned. The first feature mentioned is useful, but the second strikes us as worse than useless; it appears somewhat foolish

and dangerous to indicate in a book of this sort the habitats of plants in the increasing rarity and threatened extermination of which teachers and students of elementary botany have undoubtedly assisted. At this date, too, it is ridiculous to retain the old plan of inserting the Coniferæ in the Dicotyledons, calling the vascular cryptogams "Acotyledons," and so forth.

(3) This pleasant book on the Surrey hills is rather of literary than scientific interest, but nevertheless it ought to be in the hands of all who visit this attractive region with the primary object of studying its flora and fauna. Such readers will find much of the book of real service as a guide to the topography, even though it is only casually interpolated in the author's entertaining chat concerning past and present dwellers in what is, unfortunately, rapidly becoming suburb rather than countryside.

(4) This book also, though dealing with quite another aspect of country life, is scarcely of scientific interest; in fact, as the author tells us, the reader who consults these pages for scientific information does so at his peril, though he will certainly find much of interest concerning various aspects of farming. The book is cast in the form of a diary, dealing with all kinds of farm work at different seasons of the year. Though written in a racy and humorous style, the book contains a vast amount of information which will prove of interest and value to a wide circle of readers, but more particularly so to those who, like the author himself, are looking forward to the inevitable land-hunger which will be one of the results of the present war, and will surely force a solution of the land problem. "Back to the land" is the author's text, and his experiences, as here related, will undoubtedly be helpful to others who are thinking of going back to the land.

(5) The purpose of this book is indicated in the title; and so practical and thorough is the author's treatment of his subject that it cannot fail to be of value to all who are interested in the planning of suburban gardens and home surroundings in general. Even those who cannot begin at the beginning, but must make the best of what the builder has done, will find here many useful hints regarding the laying out and planting of lawns and gardens, the kinds of trees, shrubs, and herbaceous plants to choose, etc. Some striking photographs are given to illustrate the manner in which well-built and pleasantly situated houses of moderate size may be rendered more attractive, and even ugly and ill-placed houses beautified, by following out the schemes set forth in detail by the author. F. C.

OUR BOOKSHELF.

Elementary Practical Metallurgy for Technical Students and Others. By J. H. Stansbie. Pp. viii+151 (London: J. and A. Churchill, 1915.) Price 3*s.* 6*d.* net.

LABORATORY courses for metallurgical students have often in practice consisted merely of instruction in assaying. The needs of evening students attending technical classes are not, however, met by such courses, and a complete change from the old methods is observable in most schools. Mr. Stansbie has found at the Birmingham Municipal Technical School that students desire only so much practical instruction as will give them an insight into the properties of the metals in which they are interested. Several special courses were gradually developed to meet the requirements of the various metal trades, and this book is put together from the laboratory notes of these courses. It offers sufficient scope for practical work in general metallurgy extending over the evenings of two years and leading up to the higher stages.

There is little in this admirable little book to which exception can be taken. It is a good piece of work, and will be very useful to teachers and students of evening technical classes, for whom it is primarily intended. Experiments are described on fuel, refractory materials, slags, fluxes, the formation and reduction of oxides and sulphides, and on the common metals. The last chapter describes the assay of gold and silver. The section on mechanical testing is particularly well done. If the student has previously passed through a course in elementary chemistry, he will find no difficulty in understanding the experimental work which he is asked to do.

An Introduction to Ethics for Training Colleges. By G. A. Johnston. Pp. x+254. (London: Macmillan and Co., Ltd., 1915.) Price 3*s.* net.

MORALITY of some sort, from the most ideal to the mere "reach-me-down" variety, has been indirectly taught in schools ever since schools became an institution. But, like the morality which is taught by all experience, to the primitive as well as to the civilised member of society, such instruction is founded in group-morality, which varies with climate, epoch, and other phases of environment. The various systems of theological morality are not to be excluded from the genus of group. When an attempt is made towards absolutism, whether by the *a priori* or the comparative method, we have ethical "science," the "moral philosophy" of European mental tradition. Ethics is actually a subject in French schools, a fact probably due to the logical bias of the French intellect. There is also a tendency now towards a moral *entente* between the different interests and racial features of the world.

Mr. G. A. Johnston's very complete little volume, designed for those who will teach in elementary schools, aims very sensibly at a psychological answer to the instructional problem as it is presented to-day. Every moral influence

of our civilisation is evaluated into simple terms by means of proved psychological conclusions.

But the whole social organism is one, and the influence of the school is only one factor; whether with rich or with poor, the home and the "street" have a majority influence.

The subject is all-important for the future of a race, but the intrinsic character of the race always supervenes unless and until acquired characters become transmissible.

A. E. CRAWLEY.

LETTERS TO THE EDITOR.

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

The Organisation of Science.

SIR WILLIAM CROOKES hit the nail on the head when he said that the nation's attitude towards science is "largely due to the popular idea that science is a kind of hobby" (NATURE, December 2, 1915); and "F.R.S." directed the point of it when he said:—"What else can the general public do while men of science, in dealing with one another, generally act upon the principle that scientific investigation is a hobby for which facilities are required, not payment?" (NATURE, December 23, 1915). There is in this a distinct dereliction of duty, both by the public and by men of science. Science is not an amusement, but the most important of industries; and it is a premier obligation, of the public, of Government, and of men of science themselves, to advance it by every means in their power. Now what is the truth? Of all the occupations which individual men can possibly follow, the serious investigation of nature is the most profitable to the world at large—and the least profitable to the person who undertakes it. The result, controlled by ordinary economic laws, is that very few persons indeed ever do really engage in it, and if they do they suffer in consequence.

There is, of course, much scientific dabbling being done—precisely as a hobby; but as I take it, what may be called high science has for its end, not the mere recording of isolated observations, of plausible speculations, and of interesting curiosities, but the solution of difficult problems. Petty science is one thing; high science is another. Petty science is often extremely useful, and even occasionally leads to discoveries of the first importance; but the general advancement of our knowledge of nature depends upon the indefatigable, the laborious, and often the unavailing, search for solutions. It is precisely this last and greatest kind of effort which the hobby idea renders almost impossible—except perhaps for a few comparatively wealthy persons.

Consider, for example, the case of the dysentery problem. One form of this disease was found more than thirty years ago to be caused by certain amœbæ. Since then innumerable petty papers have been written on this subject, giving the results of a few weeks' or months' work, scattered observations, brilliant speculations, and beautiful coloured pictures. But even to-day we do not know how these organisms enter our bodies, and many questions which are fundamental as regards both treatment and prevention remain unanswered. The result is that thousands if not hundreds of thousands of persons die annually from a most painful disease; that our armies suffer in the field; and that the taxpayer is forced to expend large sums of money, a tithe of which would probably have solved the problem if it had been expended on proper research. But certain bodies which disburse small doles for so-called scientific research will hold up their hands in horror, and will say, "We have given such-and-such sums; we have paid so-and-so's salary; we have provided laboratories and microscopes here and there." So they have; but the result has been almost nil, because no individual man capable of solving the difficult problem has set his intellect to the task. Supposing that such a man exists, why should he set himself to the task? Should he give up his medical practice, or his professorship, or his leisure, to undertake a difficult inquiry which might prove fruitless in the end, just because a Government grant will provide him with apparatus and possibly a laboratory assistant? Personally, I think that such a man would not be likely to possess the capacity to solve any problem.

We may acknowledge with thanks that the nation does appear to be wakening to the necessity for assisting science; but it has not yet awakened to the fundamental issue—namely, that it must pay for work actually done—for results actually achieved—and not only for the expenses of research students and of professors who wish to indulge their "hobbies." This is the proper and most economical way to encourage science. For example, suppose that some person has solved, after years of toil, the dysentery problem, what would he receive for it? He would almost certainly lose his medical practice (as Edward Jenner did), much of his work would be pirated, he would be hampered at every turn by jealousies, and the only reward which he would be likely to receive might be a knighthood (which is the gift of the King and not of the country).

Men of science are themselves mostly to blame for this state of things. They show no solid front and have no courage in enforcing their demands. Besides this, there are many of them who actually make a cult of pretending that scientific work should be gratuitous. They are themselves too noble to accept payment; but I observe that few of these gentlemen have ever done important scientific work, but that, on the other hand, they are always first in the field when lucrative appointments are going. Indeed, quite a profession has grown up—that of persuading other men to do gratuitous scientific work for Government departments and for the public; and our grateful Governments respond at once by giving these people honours and lucrative posts, which they too often withhold from the men who have actually done the investigations.

Our learned societies are not less to blame Although they profess to encourage science in every way, they do nothing, or almost nothing, for the workers. What efforts have they made to remedy the innumerable abuses now existing in connection with science—the wretched salaries without pensions, the uncertain tenure of office, the misappropriation of appointments, the piracies, the farming out of scientific men by certain institutions for their own profit, and a dozen others? Indeed many of these societies do themselves lead the way in perpetuating such abuses. One of their grossest faults is to obtain gratuitous scientific work from their members for the advantage of Government departments and private institutions—thus, to speak plainly, acting as touts for the departments referred to, and at the same time depriving their expert members of the emoluments which they should receive for

their work or advice. What wonder, then, that the public, which sees through this kind of thing, should tend to despise, not only scientific men, but science itself?

It is idle to disguise the fact that recent events have filled most educated persons with a sense of extreme resentment against the administration of this country —a resentment which I have heard expressed by numbers of persons—civilians and soldiers. It is felt by many (and I am one of them) that we live under the rule of the invertebrates. The people who administer the country are not the best, the most vigorous, and the most sagacious of men. They are too often the time-servers and the mediocrities. The maladministration of scientific affairs is only one of the many forms of maladministration; but, on the whole, I think it is perhaps the most important form, because it gives to the mind of the whole nation a lower, a meaner, and a thoroughly sentimental and unpractical turn. For more than half a century before the war England has ceased to be an intellectual nation; the public at large has remained indifferent to science, art, literature, invention, and all the great intellectual pursuits, and has given itself up to game-playing, party politics, faddism, and a debased drama. We are now paying the penalty, and, if I do not mistake, will have to pay a heavier one before the end. If we have produced great men their names are unknown to the multitude, while the wire-pullers, the sentimentalists, and the hypocrites sit on high. That is my own summing up of the British nation of to-day—and I know that many agree with me. I am also of opinion that when our soldiers return from this war there will be something very like a revolution against the class of men who at present misgovern us in almost everything.

Sir William Crookes suggests a Ministry of Science and representation of science on the Privy Council. But in the light of our present experience are these likely to help us in any way? The Board of Education was appointed partly for this purpose, and what does it do for the worker? It has formulated a contributory pension scheme, but I believe nothing else. The able editorials in NATURE of November 24 and December 2, 1915, well define the position of science in this country to-day; but no reform is likely to be effected so long as men of science themselves do not insist upon it. What is required is a small association of strong men banded together for the express purpose of forcing the pace without fear or favour, and in spite of twaddlers who now paralyse all efforts at improvement. I would suggest at once the following programme :—

(1) Direct payment by the State for non-remunerative scientific work which has been of benefit to the public at large.

(2) Invariable payment by Government departments and public bodies for all scientific expert advice or assistance whatever.

(3) No issue of Government grants for expenses of researches without a fixed payment of, say, 50 per cent. to the workers themselves for their expenditure of time on the work.

(4) Control by the State over the sweating system now employed by universities and numerous public bodies in connection with scientific workers of all kinds.

Sir William Crookes thinks that our national attitude towards science "can only be rectified slowly, step by step." But war is a rapid arbiter, and the sword does not wait for the armour to be girded on. If I mistake not, we have not much time left for repentance.

RONALD ROSS.

January 3.

Germany's Supplies of Nitric Acid.

AN article in the *Times* of January 6 deals with the resources in Germany for producing nitric acid. Formerly, the major part of the world's supply of nitrates came from the *caliche* beds on the west of the Andes, but of recent years, as is well known, nitric acid and nitrates have been manufactured by the electric process of Birkeland and Eyde in various parts of Norway. Franck and Caro, some years ago, introduced a process whereby ammonia can be produced from calcium carbide, after conversion into calcium cyanamide. The Ostwald-Kaiser process of partially oxidising ammonia by passing it along with air over platinum or other contact substances, afforded a practical means of producing cheap nitric acid. Then the discovery of Haber and Le Rossignol, that nitrogen and hydrogen could be combined in presence of contact agents under high pressure, and at moderate temperatures, made it possible to synthesise ammonia more cheaply than it could be obtained by recovery from gasworks liquors.

It is understood that the German Government subsidised the Badische factory to the extent of 100 million marks at the beginning of the war, so that no shortage in their supplies should occur. They claim to be producing sulphate of ammonium, according to Mr. D. Milne Watson, at the rate of 300,000 tons a year, and it is not impossible, provided they can get sufficient sulphuric acid. Mr. A. E. Barton, who has just returned from a visit to Norway and Sweden, learned that the increase in the Badische Company's output of ammonium sulphate was 200,000 tons; they had formerly manufactured 150,000 tons a year. Plant of 10,000 h.p. is being erected, too, in Westphalia, to produce ammonia by the carbide process; the result is expected to be the production of 200,000 tons of concentrated nitric acid a year. Other two works, one in Bavaria, and the other near Cologne, produce between them 45,000 tons of cyanamide.

Had our Government taken the steps which were urged upon them in August, 1914, to prevent Chile saltpetre from entering Germany, in all probability there would have been a shortage of nitric acid in Germany. That shortage is now not likely to occur.

W. R.

National Technical Training.

WITH reference to the recent leading articles dealing with the position of science and industry in this country, attention may usefully be directed to the system under which the work of the smaller technical schools is conducted.

At present it is generally admitted that our workpeople are not very scientific, and their trades unions do not appear to realise how much might be done if the various industries had colleges of their own. The only chance a workman has therefore of learning the technical portion of his business is by attending evening classes at the smaller technical colleges, and it is with these schools I would like to deal, since the subject is now of considerable importance.

At most of these places so many subjects are taught that they resemble museums of applied education more than anything else, and the principals in charge of them, and the inspectors who frequently inspect them, have generally no knowledge of *technical* work, or *business* experience. Why there are so many inspectors nobody knows, or what becomes of their reports. Further, the old system of examination has been given up, and "student hours" are made such a fetish, that I have seen classes opened and closed as many as seven times during a session; closed when one

out of six students failed to appear, reopened again later.

The London County Council has recently tried to centralise its system of teaching, and heads of departments find themselves dispensed with after perhaps eight years' hard work. This is a serious state of matters, as it shakes one's confidence in technical teaching as a profession. In many schools there is no pension.

From the nature of their appointments the teachers are not allowed to do outside work, yet specialists are sometimes engaged to lecture because they have outside experience. If more security was offered to teachers, and if they could keep in touch with the outside world, workpeople would go to their classes. Under the present system large sums have to be spent advertising these schools which should not require it. There has been a great deal too much of the village schoolmaster attitude, and it is surely a mistake to allow technical work to fall into the hands of such people.

W. H. F. MURDOCH.

Westerlea, Millhill.

WAR ECONOMY AND AGRICULTURAL EDUCATION.

THE necessity for economy is having the interesting result of showing the relative values attached by county councils to the things over which they have control. When economy becomes necessary one first of all cuts off the things that do not matter, so as to keep hold of those that count.

The present attitude of the county councils towards agricultural education affords a case in point. Considerable sums of money, known as the "whisky money," have been placed by the Treasury in the hands of the county councils for purposes of technical education. Over the spending of the money the taxpayer retained no adequate control, so that the county council can, if it likes, simply apply this money to the reduction of the local rates. Most county councils, of course, have not taken this narrow view, but have conscientiously fostered technical education, with the result that a number of good agricultural colleges and departments of universities are now in existence doing very useful work. But a few have thought of little more than relieving the rates, and, while this course is undoubtedly popular with a certain section of the community, it cannot be described as wise.

A recent instance is furnished by the action of the East Sussex County Council in closing the Uckfield Agricultural College. By a curious anomaly Sussex is divided for educational purposes into two areas, each under wholly distinct administration. East Sussex has tried to run elementary education and higher education on its own account, and has not co-operated with any of its neighbours in the matter. It had an agricultural college at Uckfield which admittedly did useful work: the number of students was well maintained, and grants were earned from the Board of Agriculture. As a war economy the college has been closed. There is, we understand, no suggestion of inefficiency on the part of the staff: had that existed of course the matter would have been different. Nor was there any widespread demand on the part of East Sussex farmers that their sons should be saved from the possibility of receiving agricultural education. The whole thing appears to have been done by the education committee without reference to anyone, and without any other reason than economy.

Now this action is very serious, more indeed than appears at first sight. An agricultural college is not simply a building—which is at least permanent; it comprises also fields, crops, livestock, etc., which are not permanent, and, once sold into other hands, can scarcely be got together again. To restart the college would be a difficult business. The committee, in short, for the sake of a small saving now, is piling up difficulties in the way of any future attempts at agricultural education that may be made by more enlightened successors. If the college had been paid for exclusively by the East Sussex ratepayers we might leave the matter in their hands. But it has not: the whole State has paid a good deal. The very important question is raised whether an education committee of a county council ought to have the power to close an institution subsidised by the State, and whether the State ought not to have the power of veto.

We believe that East Sussex is the only place where an agricultural college has been closed by the county council, but in another instance—again a case where a county council is split into sections for purposes of education—the expert agricultural organiser has been dismissed on the score, not of inefficiency, which would have been a satisfactory reason had it existed, but of economy. This section of the county will save the organiser's salary—which was not very great—but every agricultural college has mentally noted the fact, and it is scarcely likely that they would recommend competent students to enter the service of that particular body in future. Again the State ought to have the power of veto, for here also it has provided part at least of the funds.

It appears to be only in cases where a county is split up into sections that these unfortunate incidents occur. In larger areas larger ideas prevail, and the further question arises whether it is right that education, which is essentially a matter for the future—and in which, therefore, the large idea is indispensable—should be in the hands of a small committee representing a small area, and we fear animated by rather small ideas? It would seem that better results could be obtained by working over larger areas, for there alone is the hope of finding enough men with ideas and ideals to serve on the committees, and to protect the lecturers and organisers who are honestly trying to do their best for the agricultural community.

Gt. Britain – Economic conditions

THE HISTORY OF BABYLON.[1]

PROF. L. W. KING'S "History of Babylon" appears at the moment when, owing to the folly, ambition, and half-religious, half-patriotic fanaticism of a small, intelligent, but absolutely immoral clique that has arrogated to itself the government of the Turkish Empire, England finds herself at war with her old allies of the Crimea and friends of 1878, and British soldiers are contending with the hosts of the Padishah on the ancient plains of Babylonia. It is a day which many Englishmen and many Turks had never thought to see; but if the most energetic men in Turkey happen to be thoroughly evil, and choose wilfully to make friends rather with the militarism of Prussia than with the liberalism of England, it is one that cannot be helped. *Kismet!* it was so written, say those Turks who would still be our friends: the issue is in the hands of Allah. As Babylon fell, so will Turkey. But the battle of Ctesiphon, fought not so far away from Babylon's ruins, shows us that it is no easy task that Turkey, sold to Prussia, has forced us to undertake.

Prof. King tells us the ancient history of the country in which our men and their Indian comrades are now struggling with the hardy peasant-soldiers of Anatolia, the descendants of those Hittites who long ago sacked Babylon and brought the dynasty of Hammurabi to its end. He takes us from the foundation of the Semitic kingdom of Babylon down to the conquest by Alexander, through a period of some two thousand years. The earlier history of Babylonia under its Sumerian inhabitants has already been told by him in his "History of Sumer and Akkad," the first of a trilogy of which the "History of Babylon" is the second, and a forthcoming "History of Assyria" will be the third volume. The book is of the same format and has the same fine appearance as its predecessor, and is printed and produced in the same good style, which reflects great credit on the publishers.

Prof. King starts by describing the great city itself, as it is now shown to us excavated by the labours of the German archæologists, led by Prof. Koldewey, who for some years past have been digging up its remains. We see the great *zig-gurat* or Temple of Bel-Marduk (the Tower of Babel itself, that so struck the imagination of the Hebrews in their captivity that they enshrined it in their oldest legends), the broad street of Aibur-shabu, the splendours of the Gate of Ishtar with its reliefs of many-coloured ceramic enamel; all the ruined glories of Babylon the great, that Nebuchadnezzar the king made so mighty and splendid; the courts of Jamshyd, that now the lion and the lizard keep.

We are then taken through certain chronological problems that have lately arisen to be discussed, and must be settled before we can settle down to the course of the history itself. These problems are largely concerned with the determination of the date of Hammurabi, the great Semitic king and law-giver, and of his dynasty. In the light of new evidence lately brought to light, Prof. King revises the date he before considered probable, and shows us that we can now date Hammurabi with practical certainty to about 2100 B.C., a century and a half earlier than was before considered possible.

We then are told all that is known (and it is a great deal) of the great king himself and of the age in which he lived, down to the extinction of his dynasty by the Hittites from Asia Minor. The long period of the Kassite kings, Indo-European conquerors from northern Persia, now follows, Babylon first comes into contact with Egypt, and the secular struggle with her daughter and enemy Assyria begins, until finally Babylon shrinks into a mere unwilling dependency of Nineveh that is finally destroyed by the ruthless Sennacherib, a worthy model for the destroyers of Louvain and their Young-Turk friends. The *beau geste* of the more civilised Esarhaddon follows, and Babylon is restored, to take her revenge on her oppressor, Nineveh, when the latter fell amid the rejoicings and execrations of the nations, as we hope some day Berlin will also fall. For, as Prof. J. L. Myres has already shown in his brilliant little book, "The Dawn of History," published two years before the war, it is no fortuitous resemblance that modern Germany bears to ancient Assyria.

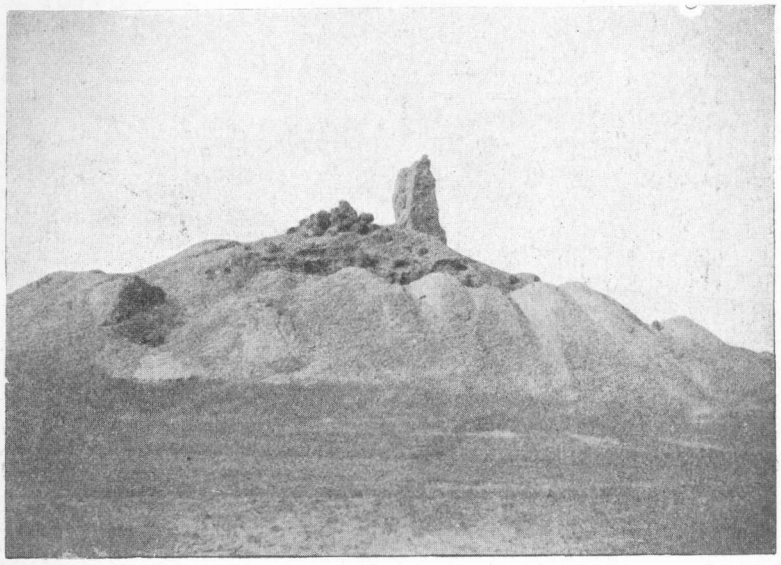

FIG. 1.—The Temple-Tower of E-zida at Borsippa. From "A History of Babylon."

[1] "A History of Babylon from the Foundation of the Monarchy to the Persian Conquest." By Prof. L. W. King. Pp. xxiii+340. (London: Chatto and Windus, 1915.) Price 18s. net.

Review
Babylonia - History

Yet Babylon showed herself little better in prosperity than Assyria had been. Nebuchadnezzar made Babylon splendid, but he also carried the Jews away captive like any Sennacherib. Babylon also fell, and a saner conqueror, Cyrus, removed from her finally all temptation to exercise power and dominion, while at the same time treating her with humanity. The religion of Zoroaster had brought a better *ethos* into the Middle East than had ever been known before.

With the end of the Persian dominion and the coming of Twohamed Alexander, Prof. King's history closes. He adds in conclusion a most interesting chapter entitled "Greece, Palestine, and Babylon: an Estimate of Cultural Influence." Readers of Dr. Farnell's most interesting book, "Greece and Babylon," will be glad to read Prof. King's contribution to the discussion of this subject. The priest of Saïs who talked to Herodotus knew much more than he told Herodotus. But one hopes that Prof. King will pursue this subject further, some time, than he does in this book.

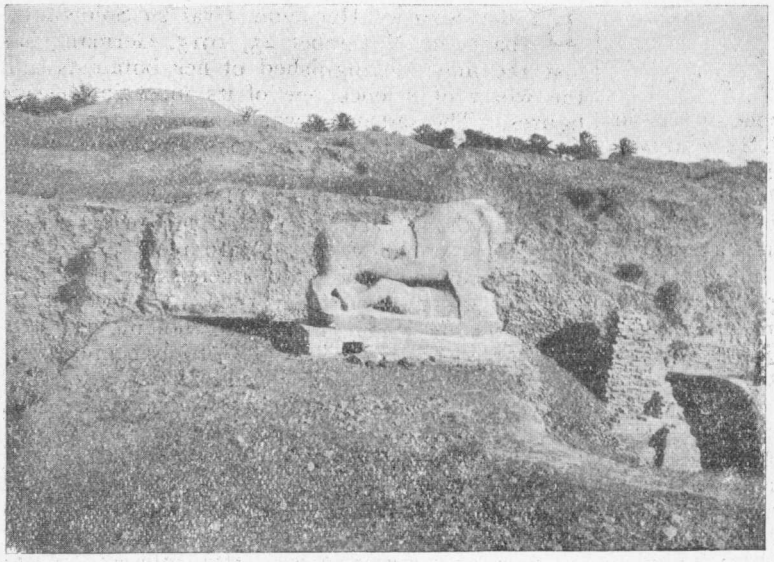

FIG. 2.—The Lion of Babylon on the Kasr Mound. From "A History of Babylon."

In this chapter Prof. King soon goes on to a matter that has agitated archæological circles very considerably during the last decade: the German "Astralmythen" theory and its marvellous ramifications and developments. In measured language he points out, following the Dutch scholar, Dr. Kugler, the weakness and uselessness of this latest shower of chips from a German workshop. It is curious to see how magnificent German work can often be, and how extraordinarily absurd it often is. It is like the national mind: sublime and ridiculous at once; and when ridiculous, absolutely sublime in its absurdity. No Englishman can ever talk such nonsense as a German can and will, if he tends that way. It was no Englishman who invented the Sun-myth and the Dawn-maidens, but a German of Germans, Max Müller. It is the British sense of humour that saves us from this sort of thing. Gladstone accepted Max Müller, but Gladstone was a *dilettante* and had no sense of humour, besides. True Britons, sceptics by blood and users of that irony which is one of our most national characteristics, always derided Max Müller and his Dawn-maidens, and now they must rise again to laugh out of court the new revival of them which Germany has imagined in the "Astralmythen" theory. For this is nothing but Maxmüllerism all over again, though it rises this time from a Babylonian, not an Indian source. For the Astral-mythologists, not only acknowledged myth, but even ordinary tradition, becomes Babylonian and astral in its origin, whether it is a case of the five kings hiding themselves from Joshua in the cave of Makkedah or the voyage of Odysseus to Scheria. Everything is an astral *motif*: the phraseology of Wagner is brought in, of course. If five kings hide in a cave: it is the "Descent into the Underworld" *motif*. If anybody goes into a cave or hides anywhere: it is the same *motif*. Ishtar and Tammuz are there. Doubtless then Prince Charlie in the '45 was Tammuz, and Flora Macdonald was Ishtar. We are scarcely jesting: Dr. Jeremias, one of the high-priests of this theory, is almost capable of saying so. Taking a realm of history doubtless more familiar to Dr. Jeremias, Enzio, too, King Heinz, who was imprisoned at Bologna, is obviously Tammuz, and the noble lady of Bologna who comforted him in his captivity is no less obviously Ishtar. And his long fair hair (*"i capelli biondi alla cintura"*) that betrayed him by falling out of the basket in which "Ishtar" was trying to get this medieval German "Tammuz" smuggled out of Bologna; that would be just a sunbeam, no doubt. Dr. Kugler has shown the absurdity of the theory by demonstrating that the life of Louis XI. of France, for instance, can be made out to be full of solar and astral *motifs*.

Then there is the "Bel and the Dragon" *motif*. If we apply it to the myths of Canossa and Jena, two myths highly interesting to Germans, we should have little difficulty in showing that Pope Gregory and Napoleon were simply forms of Bel, and that the Dragon was in the first case the Hohenstaufen, in the second the Hohenzollern. And that were *Majestätsbeleidigung* and enough to hang us all, every mother's son: for there is no more fearful wild-fowl than your Hohenzollern living!

Prof. King quietly and temperately points out the absurdities of the astral enthusiasts, with, we think, a quiet smile of amusement at their extravagance, especially when he has the malicious

pleasure of pointing out that their chief hierophant, the late Prof. Winckler, got most of his astronomy, on which he based his theory, all wrong. His criticism is all the more effective for the studious moderation of his language.

So the book ends, with the final abolition of an absurdity comparable only to that other absurdity, Winckler's *Musri* theory, which was first exploded in the columns of NATURE some years ago (September 25, 1902). The said theory, so far as we can see, is not even mentioned by Prof. King in his book, so dead is it and buried.

So critical common-sense triumphs over nonsense, and true scientific knowledge increases. And Prof. King's book is a landmark of such progress in Babylonian studies, besides giving the general reader an admirable presentment of a most interesting period of ancient history. Its illustrations are good and well chosen: we show two of the photographs of the ruins at Borsippa and Babylon. H. H.

DR. BENJAMIN WILLIAMSON, F.R.S.

THERE has just died at his residence in Dublin Dr. Benjamin Williamson, F.R.S., who was for sixty-three years a fellow of Trinity College. Dr. Williamson was born at Mallow, in the county of Cork, in 1827, and entered Trinity College from Kilkenny College in 1843. In 1852 he was elected to a fellowship of Trinity College, but owing to the stagnation of promotion among the fellows, due to the abolition of the obligations of celibacy and of taking Holy Orders, he did not become a tutor until many years afterwards. The intervening years were not, however, wasted, and Williamson quickly earned a considerable local reputation as a lecturer who was able to estimate the capacity of his hearers and did not endeavour to teach them what they were unable to learn. In 1872 he published his first work, a "Treatise on the Differential Calculus," which was followed in 1874 by his "Integral Calculus," both of which have run into many editions and have been used all over the English-speaking world. In 1879 he was elected a fellow of the Royal Society, and in 1884 he became professor of natural philosophy in Trinity College. In the latter year he published, along with Dr. Tarleton, a treatise on dynamics, and in 1893 appeared his last publication, "The Mathematical Theory of Stress and Strain." The articles "Infinitesimal Calculus," "Maclaurin," and "Variations, Calculus of," in the ninth edition of the "Encyclopædia Britannica" are also due to him.

Williamson's personality was one of the most delightful, and his rooms in college in the 'eighties were the place of hospitality which many an Englishman, sent for his sins to govern Ireland, remembered with pleasure. The human side of Williamson was always turned towards his fellows, and his mind was always ready to receive suggestions on which his generosity could act. When, in 1897, he became a member of the governing body of the college, his ripe judgment and his wide acquaintance began at once to be appreciated by his colleagues. The magnificent new laboratories for physics and botany are a portion only of the fruit of his efforts. In matters of learning he was free from prejudice, and proposals for the founding of new chairs or the improving of old found in him always a ready support. Until a couple of years ago he filled with great dignity the honourable office of vice-provost of the college, and it was only with the greatest reluctance that he was compelled by weakness of the body to abandon cares from which his mind did not recoil. The fate of those who by living too long outlive all their friends was not his, for his genial presence and the freshness of his mind made friends for him everywhere. His death is mourned by all who knew him. S. B. K.

COUNT SOLMS-LAUBACH, For.Mem.R.S.

BY the death of Hermann, Graf zu Solms-Laubach, on November 25, 1915, Germany has lost the most distinguished of her botanists and the world of science one of its most impressive figures. The sad news was communicated to this country through the Swedish palæontologist, Prof. Nathorst, of Stockholm.

Count Solms was born on December 23, 1842, and had thus nearly completed his seventy-third year. He came of one of the most ancient of German families, who were sovereign in their own domains down to the year 1806. He himself devoted his life wholly to science, holding the professorship of botany, first at Göttingen and afterwards at Strasburg. He resigned the latter post a few years ago, but continued to live in the town, surrounded by his university friends.

His work extended to every department of botany. Beginning with an important series of researches on parasitic phanerogams, he subsequently monographed several natural orders, including the screw-pines. His interest in the morphology of flowering plants continued in later years; in 1900 he described the remarkable Crucifer, *Capsella Hegeri*, with indehiscent fruits, regarding it as a mutant of the common *C. Bursa pastoris*. He was always interested in variation, and carried out important investigations on the history of cultivated plants, such as the fig, the papaw, wheat, tulips, and strawberries.

In embryology, he showed that in certain monocotyledons the growing point of the embryo is terminal, as in dicotyledons.

In addition to the flowering plants, his systematic researches extended to every class of cryptogams. One of his most remarkable works in this field is his monograph of the Acetabulariaceæ, a family of calcareous Algæ with an ancient fossil history. This was published in 1895 in the Transactions of the Linnean Society, and was his only paper written in English. His book on the "Principles of Plant Geography" (1905) treats in an original manner of the leading conceptions in this great subject.

Perhaps the most important of all his work was that on fossil botany. Solms was an intimate friend of Williamson's, and appreciated his writings and his collection as no one else did at the time. He wrote the obituary notice of Williamson, published in NATURE for September 5, 1905, a worthy tribute to his old friend's work.

Solms's "Einleitung in die Paläophytologie," published in 1887 and translated for the Oxford Press in 1892, was of the utmost importance in bringing home to botanists the value and significance of the geological record as affecting plants.

Among his special papers may be mentioned his brilliant work on the Isle of Wight fossil, *Bennettites Gibsonianus* (1890; translated 1891) the type of the Mesozoic Cycadophytes, on the Cycadofilices Protopitys, Medullosa, etc.; on the Devonian and Lower Carboniferous plants of Germany, and on Psaronius. In a quite recent paper on the last-mentioned group he elucidated, for the first time, the true nature of the root-zone. The remarkable recent progress of Palæobotany is in a great degree due to his researches.

Count Solms became a foreign member of the Linnean Society in 1887, of the Royal Society in 1902, and of the Geological Society in 1906. He received the gold medal of the Linnean Society in 1911, and was made a Sc.D. of the University of Cambridge at the Darwin Celebration in 1909.

He had a thorough knowledge of this country, and was a good friend of the English; many who knew him personally were deeply attached to him. He was always intensely averse to the idea of a rupture between his country and ours. We have no record of his feelings after war broke out, but must remember that he was a patriotic German, who had served in the war of 1870.

He was a striking and original personality, of rare intellectual power, and a born leader of men.

D. H. S.

NOTES.

IN the course of a debate on co-operative fiscal and economic policy, in the House of Commons on Monday, reference was made to the fact that some industries were almost entirely in German hands before the war broke out. Mr. Runciman, President of the Board of Trade, made the following remarks upon this subject towards the end of the debate:—We have been placed under grave disabilities owing to the fact that optical glass was made almost entirely in Austria and Germany and so little of it was made in this country. It was one of the first articles in which the Board of Trade took an interest in the autumn of 1914. We gathered together all the information we could on the subject of optical glass. We gave every possible assistance to those in this country who were prepared to undertake its manufacture, and already they are producing optical glass which never before had been equalled here. We trust that the monopoly which was held by Germany before the war will never go back to her. In chemicals we have produced to a remarkable degree a large number of articles which before the war were almost entirely in German hands. Take the case of dyes. Not only the company which by leave of this House was assisted out of our national funds, but also other concerns have produced an enormous amount of dyes during the war. Electrical apparatus in some particulars was almost entirely in German hands. Every one of these articles, glass, chemicals, dyes, electrical apparatus, and I could name about a dozen others, were industries of vast importance not only to us as a great commercial country, but as a fighting country. Without these glass articles, without some of the porcelain articles which are essential for electrical construction, without the best type of magneto, without some of the best of our chemicals, and without a great range of dyes, which used to be manufactured in Germany, we were placed at a great disadvantage. Never again should that happen. This is more than a mere matter of competing with Germany. It ought to be part of our national organisation. Government departments can do a great deal, and I believe they ought to do more, but without the personal ability, without the training, skill, and industry of the individual, nothing can be done by Government departments. I therefore put down as one of the first necessities of this country, if she is to hold her own during times of war and when war is over, that we must improve our research methods, the education of our people, and the training of our young men. We should not attempt to economise on the money we now spend on technical colleges and modern appliances. There are other directions in which we can cut down expenditure with less national damage.

PROF. W. H. PERKIN, F.R.S., professor of chemistry at the University of Oxford, has accepted the post of head of the research department of British Dyes, Limited. He has also accepted the chairmanship of the Advisory Council of that company, in the place made vacant by the death of the late Prof. Raphael Meldola, F.R.S. The board of British Dyes, Limited, expresses special gratification that it has been able to secure the services of Prof. Perkin, who occupies a position of unique distinction as an organic chemist, and has done much valuable research work in regard to problems arising in connection with the manufacture of dyes. He is a son of the late Sir William Perkin, who was the founder of the coal-tar colour industry.

THE council of the Geological Society of London has this year made the following awards of medals and funds:—Wollaston medal, Dr. A. P. Karpinsky (Petrograd); Murchison medal, Dr. R. Kidston, F.R.S. (Stirling); Lyell medal, Dr. C. W. Andrews, F.R.S. (Natural History Museum, London); Wollaston fund, Mr. W. B. Wright (Geological Survey of Ireland); Murchison fund, Mr. G. W. Tyrrell (Glasgow University); Lyell fund, Messrs. M. A. C. Hinton and A. S. Kennard.

THE late Prof. Meldola left property of the value of 34,956*l*., the net personalty being 33,767*l*. He bequeathed his entomological collection and cabinets to the Hope Museum, Oxford. After certain legacies have been paid, the residue of the property is left to the testator's wife for life, and then for his children,

and on failure of issue, 500*l.* each is to be paid to the Royal Society, the Chemical Society, the Entomological Society, and the Institute of Chemistry of Great Britain and Ireland.

THE Government of India has created a special appointment in research for Prof. J. C. Bose, in recognition of his important contributions in biophysics. Dr. Bose is now engaged in completing his new work on "Experimental Phyto-dynamics," which will contain a detailed course of new methods and instrumental appliances for the advanced research on plant-irritability, the specimens of plants chosen being those available in Europe and America. The Government of India has also placed at his disposal experimental stations in the hills, where climatic conditions are similar to those in the West. The faculty of Presidency College, Calcutta, has appointed Dr. Bose professor emeritus, *honoris causâ*, for the benefits conferred by him on the college by his services for the last thirty-one years.

MISS MARGARET HARWOOD, formerly at Harvard Observatory, and, by annual award, a fellow of the Nantucket Maria Mitchell Association, 1912–16, has been appointed for an indefinite term a fellow of this association and director of its observatory. Miss Harwood is at present studying at the University of California. Her new year at the Nantucket Observatory will begin on June 15 next. Many women teach astronomy successfully, but few openings exist for women to do research work, and a majority of the fellowship committee recommended Miss Harwood's permanent appointment, to ensure to a woman in every way prepared this unusual privilege, free from academic control. The Maria Mitchell memorial fellowship at Harvard Observatory has been awarded for 1916–17 to Miss Susan Raymond. The value of the fellowship is 100*l.*

THE Journal of the Institution of Electrical Engineers for December 15, 1915, contains a report of an interesting presentation of original Faraday papers made to the institution by Mr. D. J. Blaikley, whose wife is a niece of Faraday's. Her sister, Miss Jane Barnard, lived for several years with Faraday and his wife as a daughter of the house. She died in 1911, and left these books and papers to Mr. Blaikley to dispose of under certain conditions. They include Faraday's journal of the Continental voyage which he undertook, at the age of twenty-two, as an assistant to Sir Humphry Davy—the voyage which, Prof. Silvanus Thompson said, in proposing the vote of thanks to Mr. Blaikley, "transformed Faraday from being little more than a bookbinder's apprentice and laboratory assistant of a great chemist, into a man who could speak and think and work scientifically."

THE Rome correspondent of the *Times* announces the death, at eighty-three years of age, of Dr. Guido Baccelli, professor of clinical medicine in the University of Rome. Dr. Baccelli took a very active part in Italian politics: he was four times Minister of Public Instruction, and once Minister of Agriculture, Industry, and Commerce.

AMONG the victims of the *Persia* outrage was Miss Elizabeth Stephens Impey, M.B., Ch.B., who was on her way to take up her post as medical officer at the Dufferin Hospital, Lahore. Miss Impey, who was an all-round athlete, was the first woman to be president of the Guild of Undergraduates of Birmingham University.

THE death is reported of Mr. T. L. Willson, of Ottawa, Canada, who was awarded the McCharles prize by Toronto University in 1909 for his various discoveries. His manufacture of calcium carbide had a most important industrial influence. His inventions were principally concerned with acetylene gas and carbide, and included the Willson acetylene-gas buoys and the Willson gas beacons. He was formerly president of the International Signal Company of Ottawa. At the time of his death Mr. Willson was working out an enterprise in Newfoundland for the production of an artificial fertiliser.

DR. R. A. WITTHAUS, a prominent American toxicologist, died recently at his home in New York at the age of sixty-nine. He had successively occupied chairs of chemistry at the University of Vermont, the University of Buffalo, and the medical college of Cornell University. He was best known as a "poison expert" in a number of sensational criminal trials. He was also the author of several manuals of chemistry, and had contributed largely to the literature of medical jurisprudence. Dr. Witthaus was a graduate in arts of Columbia University, and in medicine of New York University.

THE *Engineer* for January 7 records the death of Mr. Peter Whyte, which took place in Edinburgh on December 31. Mr. Whyte occupied the post of superintendent and engineer of Leith harbour and docks for thirty years, and retired two years ago. He was a member of the Institution of Civil Engineers, and was an authority in dock engineering and port management; he acted as advisory expert to the Government Commission charged with the taking over of the docks at Singapore. Papers on professional subjects were contributed by Mr. Whyte to the Royal Society of Arts, the Royal Society of Edinburgh, the Association of Municipal and County Engineers, and kindred bodies.

THE death has occurred, at the age of eighty, of Dr. D. G. Elliot, who shared with the late Prof. A. S. Bickmore the honour of being one of the two scientific founders of the American Museum of Natural History. His career as a zoological traveller and collector began when he was scarcely out of his boyhood, and continued until quite recent years. As late as 1909 he made a tour which included such diverse points as the second cataract of the Nile, Mandalay, Batavia, Hankow, and Mauna Loa. His expedition into the recesses of the Olympic Mountains in 1898 is said to have been the first penetration of that range by any naturalist. Dr. Elliot's outstanding work was his recently published "Review of the Primates." He was the author of many other books on zoological subjects and of hundreds of papers in scientific journals.

THE death is reported, in his eightieth year, of Dr. A. W. Wright, of Yale, who occupied the chair of molecular physics and chemistry in that University

from 1871 to 1887, and of experimental physics from 1887 to 1906. From 1883 to 1906 he was in charge of the Sloane physical laboratory at Yale, which was built under his supervision from his own plans. Earlier in his career he had been professor of physics and chemistry at Williams College, and a consulting specialist in the U.S. signal service. He was sent by the American Government to Colorado in 1878 to observe a total eclipse of the sun, and at that time made the first measurement of the polarisation of the solar corona. He was the first to observe the electric shadow in air, discovered and analysed gases in stony meteorites, and applied kathode discharge *in vacuo* to form metallic films for mirrors. Prof. Wright is said to have been the first American to obtain definite results with X-rays, and his papers upon the subject attracted wide attention.

BY the death of Prof. F. W. Putnam, honorary director of the Peabody Museum of American Archæology and Ethnology, Harvard, news of which reached us only a few days ago, anthropology throughout the world has suffered a grievous loss. His interest in the subject began in 1857; in 1873 he was appointed first curator of the Peabody Museum, and in 1886 professor of American archæology and ethnology in Harvard University. His activity was shown in museum organisation rather than in field work, and under his control the great collections in his charge were systematically arranged and catalogued. In spite of his absorption in museum work, he found time to publish a large number of scientific papers, the anniversary volume presented to him in 1909 containing no fewer than four hundred titles. But it was by the encouragement of research and by his kindly sympathy with younger workers that his best work was done, and he will rank with Brinton and Powell as one of the founders of the American school of scientific ethnology.

THE death of Sir Frederic W. Hewitt on January 6 deprives us of one of our most prominent anæsthetists. Born in 1857, he graduated at Cambridge, receiving his medical training at St. George's Hospital. Hewitt specialised early in his career, and, becoming attached to a dental hospital, experimented with the combined use of oxygen and nitrous oxide. Bert had demonstrated its value, employing it under plus-pressure; more recently it had been used on the Continent at normal pressure, but Hewitt it was who by his ingenious apparatus introduced a practical method into this country. In the wider field of general anæsthetics he had done much most valuable work. In "Anæsthetics and their Administration," he focused his individual views. The book reveals the meticulous care of Hewitt's clinical observations. Indeed, few men worked harder or strove more whole-heartedly to advance our knowledge of anæsthetics. In his hospital appointments at the London Hospital, and afterwards at St. George's Hospital, as anæsthetist and lecturer, his teaching was highly and rightly appreciated. He was appointed anæsthetist to the late King, and received the M.V.O. for his personal services to that monarch. Later he held the same post to King George, and received a knighthood. Hewitt contributed some valuable articles to the transactions of medical societies and journals, notably one on the effect of posture on anæsthesia. He, always a most strenuous fighter, endeavoured to obtain legislation to protect patients from the dangers of unskilled persons using anæsthetics. On this subject he gave useful evidence before a Departmental Committee. Science and practice have lost much through his early death.

THE *Indian Journal of Medical Research* for October, 1915 (vol. iii., No. 2) contains a number of valuable papers. Lieut.-Col. Sutherland details notes on 2643 medico-legal cases, in which 6566 articles, suspected to be bloodstained, were examined. The method of examination was by the precipitin test, by which it is possible to determine the *kind* of blood, and by chemical, microscopical, and spectroscopical examinations. Major Grieg has noted the production of gall-stones in rabbits following intravenous inoculations of cholera-like vibrios. These observations may throw some light on the formation of gall-stones in the human subject, a lesion which is frequently observed in Calcutta.

A VERY interesting summary of the more striking of the Batrachia of the world, now living in the Gardens of the Zoological Society of New York, appears in *Zoologica*, vol. ii., No. 1, by Mr. Richard Deckert. The author gives the more important features of the life-history of each of the species described, supplementing his remarks with some most excellent photographs. His review is greatly enhanced in value by means of a coloured plate giving figures of some extraordinary harlequin frogs from tropical America. Two of these are of a brilliant scarlet, and one species has blue legs, forming a most striking contrast. A third species is of an emerald green, boldly marked with black. These frogs, which belong to the genus Dendrobates, are remarkable for the virulence of the poison secreted by the skin-glands, and some interesting notes on this subject find a place here.

AN ingenious attempt to demonstrate "a Tetrapteryx Stage in the Ancestry of Birds" has just been made by Mr. C. W. Beebee in *Zoologica*, vol. ii., No. 2. The author insists that the precocious and conspicuous development of the femoral tract in the pterylosis of nestling birds points conclusively to a stage in the development of the pro-aves when this tract was formed of large quill-like feathers, which, with similar feathers along the post-axial border of the fore-limb, afforded a parachute-like mechanism, comparable to the flying-membranes of flying-squirrels, and preceded true flight. The hypothetical restoration of this four-winged stage, which forms the frontispiece to his essay, is curiously like that which appeared in *Knowledge* in 1906, save that this lacked the "femoral wings." Mr. Beebee seeks to justify his hypothesis by an appeal to photographs of the remains of the Archæopteryx in the Berlin Museum. These, however, certainly seem to have been misinterpreted, for the feathers to which he evidently refers are those which invested the tibia. No one who has studied the original remains of this fossil would for a moment agree that these afford evidence for this "femoral tract."

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THE pea-aphid (*Macrosiphum pisi*) is a well-known garden pest in this country and in Europe. In 1878 it appeared in the United States, where it has now become sufficiently important to form the subject of a paper by J. J. Davis (U.S. Dept. Agric., Bulletin 276). The species ranges westwards beyond the Mississippi valley, and is found in a few localities near the Pacific coast. Among several points of interest in this bulletin may be mentioned the fact that "oviparous females may be produced by either wingless or winged [virgin] females, and the same female may produce both viviparous and sexual forms alternately." It is not surprising that American syphid-flies and ladybirds prey upon the aphids, as their relations do in these countries, but the predaceous habits of a cecidomyid larva (*Aphidoletes meridionalis*), which feeds "upon the juices of the plant-louse till the latter is dead," are remarkable for a member of this gall-forming family.

IT is well known that during the last five years numerous specimens of the handsome European ground-beetle, *Calosoma sycophanta*, have been imported into the New England States that they may feed upon caterpillars of the gipsy moth (*Porthetria dispar*), itself a species introduced from Europe into North America. An account of the establishment of the Calosoma across the Atlantic, recently given by A. F. Burgess and C. W. Collins (U.S. Dept. Agric., Bulletin 251), contains some interesting details. A map shows how by natural extension and by fresh importations the beetle has spread its range north, south, and westwards from Boston; "it has already demonstrated that it is a very important factor in the control of the gipsy moth by natural enemies." Unfortunately, the beetle is not without "natural enemies" of its own in its new home, the most dangerous being that notorious American mammal, the skunk, the excrement of which in some localities consists chiefly of fragments of Calosoma.

THE widespread death and dying back of seedlings of sal (*Shorea robusta*) is a very common occurrence in the Indian sal forests. Mr. R. S. Hole, in the *Indian Forester*, vol. xli., No. 10, gives an account of his investigations into the matter, and finds that bad soil aeration and drought are the chief factors responsible for the failure of sal reproduction. Deficiency of oxygen owing to water-logging of the soil, and also some toxic substances possibly emanating from dead sal leaves, have been found to be definitely injurious, since in similar soil well drained and kept clear of leaves very good germination resulted. Practical recommendations for forest use are put forward as the result of experiments made in the Dehra Dun forests.

IN the Bulletin of the Department of Agriculture, Trinidad and Tobago, part v., vol. xiv., 1915, Mr. J. B. Roner, mycologist to the Board of Agriculture, contributes a paper on the Anthracnose of the mango, the disease caused by the fungus *Gloeosporium mangiferae*, which also attacks avocado pears, citrus trees, and many other plants. A description of the fungus as it affects the flowers, leaves, and fruit of the mango is given, and a plate of figures illustrates the appearance of attacked leaves and fruits. The beneficial results of spraying the trees during the blossoming period is fully described. A clean, and also a heavy, crop of fruit resulted in all cases. Another noticeable and valuable feature of the sprayed fruit is that it keeps much longer than unsprayed fruit. This was proved from consignments of mangoes sent to Kew and to the United States, and also from mangoes which which were kept in cold storage in Trinidad. The fruit reached England in splendid condition, and a number of fruits were not fully ripe at Kew twenty-two days after they had been picked in Trinidad.

THE inheritance of bearding and felting in wheat forms the subject of a paper by Mr. and Mrs. Howard in Memoirs of the Department of Agriculture of India, vol. vii., No. 8, and is a continuation of their earlier paper published in vol. v., 1912. Owing to the fact that heretofore wheat with short awns as well as those without beards have been described as beardless, controversy has arisen over the results of earlier workers. In the present work on Indian wheats, bearded crossed by beardless—as usually described—showed two different phenomena. In one series, F-1, plants were half bearded, and in the other only very short tips were present on the glumes, these differences being correlated with the beardless parent; in the first place the parent having tips to the glumes and in the second being quite beardless. The results are set out in detail and illustrated by a very clear series of plates. The inheritance of the felted character of the chaff continues the earlier work, but it is shown that two kinds of hairs may be present, long silky and much shorter hairs, which are inherited separately.

IN a pamphlet entitled "The Urgency of a Definite Forward Movement in the Study of the Active Principles of South African Plants" (Capetown: Townshend, Taylor and Snashall) Dr. C. F. Juritz again directs attention to the urgent necessity for a systematic study of South African plants from botanical, chemical, and physiological points of view. He deals with several examples of toxic or medicinally active drugs, and shows what progress has been made and in what directions further investigation is necessary. The appendix, which constitutes about one-half of the pamphlet, is both interesting and valuable. In addition to a bibliography of the subject, it contains a list of plants that so far have been examined, together with the constituents that have been isolated from each, and also a list of cases of poisoning or suspected poisoning by indigenous plants investigated in the Cape Government Laboratories. These two lists clearly support Dr. Juritz's plea, and leave no room for doubt that researches made with sufficient material, possibly following the method so successfully employed by Dr. Power and his collaborators, would yield scientific results of the greatest value.

SOME experiments on the physiology of indigo-yielding glucosides are described by Mr. F. R. Parnell in the Memoirs of the Department for Agriculture in India (Botanical Series, vol. vii., No. 5). An indigo-forming glucoside is present in the root and seed of both *Wrightia tinctoria*, Br., and *W. tomentosa*, R.

and S.; it is absent, however, from the leaves of the latter. The glucoside and its enzyme in *W. tinctoria* are distinct from those of *Indigofera arrecta* and *I. sumatrana*, although the Wrightia enzyme has some action on the glucoside of Indigofera, and *vice versâ*. The question of the conditions leading to the formation of indican in plants is discussed at some length. Indican is produced in the dark by etiolated shoots of *I. arrecta*, and there is no variation in indican content between night and day in *I. arrecta* and *I. sumatrana*. Moreover, no marked effect is produced by keeping plants of *I. sumatrana* in the dark for thirty-six hours. In the light of present knowledge no definite function can be assigned to the indigo-yielding glucosides in general or to the glucoside of any special species.

THE last quarterly Bulletin of the Seismological Society of America (vol. v., 1915, pp. 121–9) contains the presidential address delivered by Mr. A. McAdie on August 4. The writer notes that the last catalogue of earthquakes issued by the International Seismological Association was that for the year 1907, published five years later, and he suggests that the catalogues for subsequent years might be issued under American auspices, possibly with the aid of the Seismological Society. The material for such catalogues is now in German hands, and it is worthy of notice that Mr. Otto Klotz, of Ottawa, has been compelled to suspend his annual lists of epicentres owing to the lack of reports from Europe since the outbreak of the war. Moreover, urgent as are the claims of the war upon us, the Seismological Committee of the British Association has not ceased its useful task of collecting and analysing the records from British and Colonial observatories, and no other country in the world is connected with earthquake stations so numerous and so widely scattered over the globe.

THE Weather Bureau of the U.S. Department of Agriculture has reprinted a "Note on the Effects of Raingauge Exposures," by Mr. W. G. Reed, from the *Monthly Weather Review* for July, 1915. For two years the University of California has been engaged in an extensive study of the rainfall conditions over the watershed of Strawberry Creek, which has an area of about one square mile. During 1913–14 rainfall measurements were made from five standard 8-in. gauges, visited at the end of each storm, and in the autumn of 1914 the number of gauges was increased to thirteen. The gauges are at different heights above sea-level, ranging from 520 to 1655 ft., and the heights above ground range from 8 to 22 in. It is stated that from a strictly meteorological point of view the most important result so far seems to be the difficulty, if not the impossibility, of determining the precipitation on a watershed *by means of ordinary gauges* where the area is broken into valleys and ridges. It was hoped to make experiments with shielded gauges, but this was not carried out. It is noted that the catch of the gauge is largely controlled by local conditions, and perhaps the desire or attempt to shield the gauge from wind has too much attention. Precise details are given as to the exposure of the several gauges and the results, and ratios of the individual gauges to the average are given. The discussion has been carried out with great care and affords an exceedingly interesting inquiry.

THE "James Forrest" lecture before the Institution of Civil Engineers this year took the form of a detailed critical paper on electric railways, by Mr. H. M. Hobart, and in the absence of the author, in America, was read by Mr. John A. F. Aspinall. Mr. Hobart described in detail the working of the Butte, Anaconda, and Pacific 2400-volt direct-current railway, and other American lines, and gave exhaustive figures to show the gain in economy since the steam locomotives have been replaced by electric locomotives. Comparing the single-phase and high-pressure D.C. systems, he argued that even with sparse traffic the latter was the most economical. His general conclusions were that we are on the eve of the extensive employment of electric locomotives on railways at present run by steam, that the D.C. system is the most appropriate, and that D.C. locomotives for use from high-pressure contact conductors are now a thoroughly demonstrated success.

THE *British Journal of Photography* for December 24, 1915, contains the first part of Mr. F. J. Cheshire's lecture before the Royal Photographic Society on the modern range-finder. With the help of a diagram involving two similar triangles the geometry of range-finding is very clearly explained, and it is shown that the error in the measured range due to a constant small error in the determination of the displacement of one image with respect to the other is proportional to the square of the range. Mr. Cheshire starts with a simple range-finder consisting of two photographic cameras firmly attached to the ends of a rod a yard long, so that their lenses are in the same plane. He shows how by first pointing the instrument at a star and marking the positions of the images on the ground glass plates in the focal planes, then getting the image of a near object on the star mark in the left-hand camera, and measuring the distance of the image from the star mark in the right camera, the distance of the object from the cameras can be found. From this simple instrument it is shown how the range-finders of Clark (1858), Adie (1860), Mallock (1885), Christie (1886), Barr and Stroud (1888), and Marindin (1901) may be considered to have developed.

FOR many years past the custom of delivering lectures before the Chemical Society at its ordinary scientific meetings has practically lapsed, although an important series of memorial lectures has been maintained. Possibly as a result of the diminished flow of miscellaneous researches caused by the prolongation of the war, the custom has now been revived. The first lecture of the series, on "The Principles of Crop Production," was delivered by Dr. E. J. Russell, of Rothamsted, on November 18, 1915, and is reproduced in full in the Society's Journal for December, 1915. The lecture is illustrated with a striking series of diagrams, as well as by actual photographs showing the effect on the growth of the plant of various quantities of manures. Further lectures will be given by Prof. Bragg and by Mr. F. Gowland Hopkins.

A NEW form of viscometer is described by Mr. W. R. Bousfield, K.C., in the recent December issue of the

Chemical Society's Journal. The whole of the circulating system is enclosed, so that it can be immersed completely in a thermostat, the movement of the liquid being controlled by means of a series of taps connected to a suction-pump. The capillary is arranged in a vertical position, but contrary to the usual practice the flow is in an upward direction, so that the risk of partial obstruction of the capillary by particles of dust is greatly diminished. The adjustment of the volume of the flowing liquid is practically automatic and very exact. A special tube with a tap is provided, whereby the liquid to be tested can be drawn from the centre of a stock-bottle after ample time has been allowed for all traces of sediment to settle; this is a marked improvement on pouring the liquid into the viscometer directly or from an ordinary pipette. The new viscometer has been tested during several years of actual practice, and promises to take a permanent place alongside the pyknometer and the stills for conductivity-water, which have already been described by the author.

THE University of Chicago Press has in preparation for early publication in the "University of Chicago Science Series":—"The Origin of the Earth," by Prof. T. C. Chamberlin, and "The Isolation and Measurement of the Electron," by Prof. R. A. Millikan. The volumes will be issued in this country by the Cambridge University Press.

OUR ASTRONOMICAL COLUMN.

COMET 1915*e* (TAYLOR).—This comet has been under observation a number of times at the Hill Observatory since the beginning of the year. It has slowly increased in brightness. The ephemeris given below (No. 498, Eph. Zir., *Astronomische Nachrichten*) is based on the second orbit calculated by Messrs. Braae and Fischer-Petersen, and is for 12h. M.T. Greenwich:—

Jan.	R.A.	δ	Jan.	R.A.	δ
	h. m. s.	° ′ ″		h. m. s.	° ′ ″
12	5 2 47	+13 8·0	18	5 2 28	+16 13·9
14	2 30	14 9·1	20	2 44	17 17·2
16	2 24	15 11·1	21	3 13	18 20·9

The R.A.'s increase after January 16. The comet continues to approach the sun. An observation on January 7 showed that the ephemeris then required corrections of +2·7 min. in R.A. and −43″ in declination. It may be remarked that it is moving through a region devoid of bright stars—N. and W. of Bellatrix.

We have received the following upon this comet from the Union Observatory, Johannesburg, December 9, 1915:—

On December 2, 1915, Mr. Clement J. Taylor, of Herschel View, near Capetown, reported to the Union Observatory, Johannesburg, he had found a comet in Orion on November 24, and that it was near 31 Orion, and moving northwards. It was observed on the same evening and subsequently. The 1915·0 astrographic positions obtained at the Union Observatory are:—

Greenwich Time.

1915	h. m. s.	° ′ ″
Dec. 2·347 ...	5 24 45·9 ...	0 39 6
4·325 ...	5 23 50·3 ...	0 21 48
5·347 ...	5 23 19·9 ...	0 12 12

COMET 1915*a* (MELLISH).—Some measurements of the additional nuclei of Mellish's comet (1915*a*) have been made by Mr. Knox Shaw (Helwân Observatory Bulletin, No. 16). The nuclei were situated on a bright ray in the tail, the one more distant from the head being the brighter, and in the later stages appeared to be subdividing. During May these extra nuclei receded from the head with daily motions of about 1000 km.

THE SPECTRUM OF THE BINARY SYSTEM 41 ERIDANI.—In Bulletin No. 274, Lick Observatory, Dr. G. F. Paddock investigates the question of spectroscopic orbit formulæ, especially considering the derivation of elements of nearly circular orbits, and the reduction in cases where spectra of both components are available. In the first case, he improves the determination of position and epoch of periastron, and in the second enables the reduction of the double measures to be carried on as one operation instead of using them to obtain two symmetrical solutions. The new formulæ have been put in use in a study of the spectroscopic binary 41 Eridani (mag. 3·9, Sp. B9A). Briefest reference only can be made to some of the many important questions dealt with. A definite value is adopted for the wave-length of the magnesium line—4481·400 A., or 4481·230 I.A., and the variations of wave-length of this line alone are employed in deducing the orbit. All the thirty-nine spectrograms employed show it as a double line due to the two component spectra. The system proves to be one of normal values, although accurate photometric measures are yet required to fix the inclination of the orbit-plane. Measured wave-lengths are given for fifty lines (K to Hβ) and origins discussed. The lines are stated to be not so sharp as in Sirius, and distinctly fainter. A noteworthy feature is the number of proto-Mn lines represented. Intensities are merely verbally described. Two notes on the table of wave-lengths call for special remark. First, Mr. F. E. Baxandall, in 1914, published several new enhanced lines of Mn, including one at λ 4282·65. This origin will account for the line at λ 4282·7. Secondly, the line λ 4416·9, although masked in spark spectra, was shown by Prof. A. Fowler to be an enhanced line of iron, and provided a recognised origin for the stellar line. These points only emphasise the conclusion that 41 Eridani has an essentially enhanced line spectrum.

THE CONSTANTS OF THE TERRESTRIAL SPHEROID.—The Paris Conference (1911) adopted Hayford's values for the equatorial radius and aplatissement. Since then Helmert has derived a new value for the radius, and S. Wellisch suggests that Hayford's and Helmert's results should be combined. Instead of taking the adopted Hayford values he proposes that the mean be taken of three sets of values based on different assumed depths of the isostatic compensation layer 162·2 km., 120·9 km., and 113·7 km.). Taking Helmert's values with weight=unity, and the modified Hayford values with weight=4, he obtains for the equatorial radius=6,378,372 metres, excess over polar radius=21,476 metres, whence the reciprocal of the aplatissement=297. The length of the "metre" derived from these values is 1·00022632 metres (*Astronomische Nachrichten*, 4822).

SCIENCE AT EDUCATIONAL CONFERENCES.

"WHAT difference has the war made? I believe it has opened the eyes of the nation to the perils which arise from the neglect of intellectual things, the satisfaction with book knowledge, the inattention to facts, the concentration on physical prowess, and on a passive kind of material prosperity—the widespread ignorance of natural facts even among our leaders, and consequent contempt for investigation and expert knowledge. What has become apparent is the ignorance of our governing classes. The ignorance of all classes. The facts that education has not

led to widely diffused knowledge, was not designed to lead there, that it failed to stimulate any healthy intellectual interest in the majority, have now glared at us too prominently to be overlooked."

The above is an extract from the inaugural address which Sir Oliver Lodge delivered at the opening of the fourth annual Conference of Educational Associations. The audience was large—it was drawn from thirty educational societies—and the address was the precursor of strenuous activity displayed during the week by the great majority of the societies. It is not without significance that the representative committee which organised the conference should have sought a leader from the ranks of scientific workers, in an hour so fateful to the education of the nation. For this year there has been no question as to the desirability of holding educational conferences; the lessons of the war having intensified among teachers of all grades their sense of the national responsibilities of their work. Whether the same recognition of the inevitable consequences of training (or lack of training) in school has been reached by the public, is doubtful. There is only too good ground for Sir Oliver Lodge's warning to parents:—"Conservatism is natural in education. We have been through a certain mill, and we think it proper that our children should go through the same process. If a great school were subjected to sweeping reforms, a whole generation of fathers and grandfathers would feel themselves defrauded of the right of basking again in the queer, half-forgotten traditions of their boyhood." Our readers may recollect that the headmaster of one of our greatest public schools has declared that any extension of science in the school was impeded by the indifference, or even opposition, of the parents.

The address passed from castigation of anti-scientific obscurantism to constructive suggestions for training the average fourth form boy, involving a cultivation of inventive faculty by a variety of enterprises sometimes requiring mechanism, facilities for genuine experimentation and subjective discoveries, for self-developed interests and actual experience of the workings of nature. The utmost importance should attach to elementary physiology, and hygienic details ought to be inculcated as part of the tradition of the race. These and other points were treated in the address in a manner absolutely in accord with the practice of our more progressive schools for many years past. But although to some present their restatement may have seemed superfluous, in reality Sir Oliver Lodge was doing a most useful service by backing the methods of our science teachers with the support of his acknowledged authority in the realm of science. How necessary such support is may be gauged by the fact that within three days the Board of Education actually circulated a suggestion to secondary-school authorities that economies should be effected by dropping laboratory work in schools and substituting lecture-demonstrations!

Prof. A. N. Whitehead treated the Mathematical Association to a brilliantly phrased address, and his concluding sentences may serve as a comment on the endeavour of the Board of Education to reduce the efficiency of science teaching:—"The race which does not value trained intelligence is doomed. To-day we maintain ourselves. To-morrow science will have moved forward yet one more step, and there will then be no appeal from the judgment which will be pronounced on the uneducated." Prof. Whitehead fell foul of external examinations, and put a broad view of the task of mathematical teachers, defining mathematics as the science of life. The impression conveyed to at least one of his hearers was that this concept of mathematics should inspire both teacher and taught, the proper attitude being induced in the learner by giving him problems which deal with things which really matter in the big world.

The pervading sense of national responsibility was perhaps most intense at the meeting of the Public Schools Science Masters, who met, as did also the Mathematical Association, at the London Day Training College. The president, Sir William Osler, gave "The Fateful Years, Fifteen to Seventeen," as the title of his address, the main feature of which was a plea that the schools should give intending medical students such a training in physics, chemistry, and biology that they may enter at once upon their purely medical studies as soon as they enter the university. The address, which had much literary charm as well as common-sense merit, was well received, the general feeling of the members being clearly in accord with their president. It was pointed out, however, that the real obstacle to the plan suggested was the faulty regulations of the University in which Sir William Osler is Regius professor. The schools tend to send their best boys to Cambridge and London, because Oxford will not allow the medical course to begin at once. From the discussion it appears that the would-be medical student enters in October, is compelled to wait until December before he is allowed to pass "Divinners," and has then to wait until the next medical course opens in the following October. The irony of the situation is heightened by the fact that the university has just sent an appeal to the headmasters on the lines of Sir W. Osler's request to the science masters. The situation would be humorous at another time; but at the present moment it is of the most obvious importance that every encouragement should be given to aspirants to a medical degree, and that every hindrance to rapid and thorough qualification should be removed. The discussion will, it may be expected, cause the rescission of the offending regulation.

Like most of the work of the meeting, the next paper dealt with a topic of immediate national concern, viz., the improvement of agriculture. With a force derived from unrivalled knowledge, Mr. Christopher Turnor dealt with the desirability of giving a bias towards agriculture in the science teaching, pointing out the need for arousing interest in the minds of those landowners of the future who are at present in the public schools. He effectively contrasted the interest and energy shown by the leaders of Denmark with the state of affairs in England. England is the only country in which the agricultural population has *absolutely* declined. The present writer was reminded of a remark made to him four years ago by a Swedish professor:—"You have a wonderful country. England will be a garden, *when you have developed your agriculture*." A whole morning was given to a discussion on war work in schools, which was so practical and informative that its publication appears to be contrary to the interests of the various institutions concerned. Instructors from Woolwich and the War Office each testified to the value of the help which science masters are giving, especially by giving future officers instruction which will be immediately useful in active service. The members of the association, and especially Mr. C. L. Bryant, who, as honorary secretary, is the intermediary between the War Office and the science masters, may be congratulated on the work they are doing in this connection.

There was a discussion on school museums, as to which it is hoped to say more in a future article. The same remark applies to various discussions at different societies, also to the exhibitions; the present article being restricted to those problems of science instruction which directly influence national affairs. It is satisfactory to record that a sub-committee, consisting of Messrs. Hill, Tripp, and Oldham, has been

appointed to report upon possible ways and means of furthering the claims of school science, and of raising it from its present position, in view of the fact that the status of science in the public schools has so important a relation to the recognition of science by the nation's leaders.

The Association of Teachers in Technical Institutions arranged a discussion on "Technical Education: the War and After," which formed part of the great conference at the University of London. The attendance was relatively small; a fact quite creditable to the Association, as the absentees were all engaged on technical work of value and urgency in connection with the war. Nevertheless the quality of the papers and speeches evoked justified the organisers of the meeting—they will be read both in England and abroad in the general report of the Conference. Mr. Barker North (Bradford Technical College) reviewed the situation, laying emphasis on the necessity for maintaining the efficiency of technical institutions if we wish to succeed in the coming industrial war. He advocated more central organisation, not only in instruction and research, but also in commerce and industry. Referring to the Board of Education, he reiterated Mr. Abbott's warning that any diminution in expenditure which interferes with the efficiency of technical education will handicap the nation in the coming industrial struggle.

Mr. James Baker vividly sketched the contrast between England, with miserably limited technical departments and slum-infected cities, and Bohemia, with splendid scientific institutions, rapidly advancing industries, and consequent abolition of poverty. Incidentally he referred to the high state of general culture and enlightenment in Bohemia, where the people wish to be on England's side in the war.

Dr. C. Dorée considered the possibilities of industrial research work in technical institutions. The remarkable applications of science in the war have opened the eyes of manufacturers, and many firms for the first time have employed a chemist. What is more, they have admitted that scientific methods pay better, and that Government specifications are passed more easily with a chemist than without one. Those firms are not likely to do without such trained assistance in the future. Seeing that instruction must form a large part of the work of technical institutions, it is recommended that a director of research should find out problems, obtain material, and apportion the work among the institutes according to their capacity. Such centrally directed work is now being carried out in making drugs, and is quite successful.

The Science Teachers' Association also held a successful meeting, the description of which must be deferred. Efforts to broaden the membership and widen the work of this society are being considered. The Council of the Association will do well to throw its energies at once into the work of expansion.

The striking vigour and success of the whole Conference of Associations demonstrate that teachers are alive to the national position. Their united efforts are needed to make clear to the public, and to persons in high authority, that upon education, and especially on scientific education, depends our progress towards a wiser England. G. F. DANIELL.

PRIZE AWARDS OF THE PARIS ACADEMY OF SCIENCES, 1915.

Mathematics.—The Francœur prize is awarded to Joseph Marty for his work on the theory of integral equations. The Bordin prize is postponed to 1916.

Mechanics.—No award was made of the Montyon prize; the Poncelet prize is accorded to Charles Rabut, for his work as a whole; Umberto Puppini receives the Boileau prize, for his work in hydraulics.

Astronomy.—The Lalande prize to Lucien d'Azambuja, for his important contribution to the daily measurement of the upper layer of the solar atmosphere and to the recognition of the action exercised by the magnetic field on band spectra; the Valz prize to Armand Lambert, for his work as an observer and in applied mathematics; the G. de Pontécoulant prize to Louis Fabry, for his researches on the asteroids; no award of the Pierre Guzman prize is made.

Geography.—The Tchihatchef prize to J. Couyat-Barthoux, for his geological and geographical work on the Sinai and Suez Canal regions; the Gay prize to Henri Lecomte, for his studies on the distribution of plants in Indo-China.

Navigation.—The Extraordinary prize of 6000 francs is divided between Maurice Marchand (3000 francs), for his memoir on the protection of the submarine against mines, Jean Lorfèvre (1500 francs), for his essay on the use of Diesel motors, and Louis Jauch and Auguste Masméjean (1500 francs jointly), for their work on marine engines; the Plumey prize is not awarded.

Physics.—The Hebert prize to Michael Idvorsky Pupin, for the whole of his work in applied electricity; the Hughes prize to R. Marcelin, for his theoretical and experimental memoir entitled "Contribution to the Study of Physico-Chemical Kinetics"; the H. de Parville prize to Jean Blein, for his contributions to the thermodynamics of gases and detectors in wireless telegraphy; the Gaston Planté prize to Marcel Moulin, for his researches on the positive rays of radium, ionisation, radiation of black bodies, and other interesting questions of modern physics; the Pierson-Perrin prize to Maurice de Broglie, for his studies on ionised gases, the Brownian movement, and the diffraction of the X-rays.

Chemistry.—The Jecker prize to Gabriel Bertrand, for his work in organic and biological chemistry; the Cahours prize to Paul Viguier, for his researches on tetrolic aldehyde and some of its derivatives; the Montyon prize (unhealthy trades) to André Kling (2500 francs), for his work in the Paris Municipal Laboratory; honourable mentions (1500 francs), to Daniel Florentin and René Schmutz (1000 francs); the Houzeau prize to Paul Pascal, for the whole of his work in inorganic and organic chemistry.

Mineralogy and Geology.—The Delesse prize to Albert de Romeu, for his petrographic researches, and an encouragement (1000 francs) to A. Laville, for his researches on fossil vertebrates; the Joseph Labbé prize to René Tronquoy, for his studies on tin ore deposits; the Victor Raulin prize to Louis Doncieux, for his palæontological researches; no award of the Cuvier prize is made, and the funds will be used for charitable purposes.

Botany.—The Desmazières prize to Giovanni Battista de Toni and Achille Forti, for their contributions to the Mediterranean algological flora; the Montagne prize to Fernand Camus; the de Coincy prize to Pierre Choux, for the whole of his botanical work; the Thore prize to Isidore Doin; the de Rufz de Lavison prize to Paul Becquerel, for his researches on the life of seeds.

Anatomy and Zoology.—The Savigny prize to Pierre Fauvel, for his researches on annelids obtained in the voyages of the *Hirondelle* and the *Princess Alice*; the da Gama Machado prize is not awarded.

Medicine and Surgery.—Montyon prizes: A prize of 2500 francs to François Maignon, for his researches on the toxicity of albumenoid materials; an honourable mention of 1500 francs to Emile Terroine, for his work on pancreatic secretion; citations to Eugène Olivier and Dr. Ginestoux; the Barbier prize to Charles Dassonville and Cléry Rivière, for their memoir on epizootic abortion in mares; very honourable mentions to Charles Besnoit and V. Robin, for their works on cutaneous sarcosporidiosis of the ox,

and to Henri Bocquillon, for his botanical and therapeutical studies of tropical plants; 2500 francs from the interest on the Breant prize to M. Brumpt, for his work on parasitology; the Godard prize to Noël Hallé, for his researches on chronic renal tuberculosis; a mention to Henri Vignes, for his notes and researches on menstruation; the Baron Larrey prize is not awarded; the Bellion prize to Henri Gougerot, for his memoir on the treatment of syphilis in practice; a very honourable mention to Emile and Camille Guillot, for their work entitled "The Healthy House"; the Mège and Argut prizes are not awarded; the Chaussier prize is not awarded, but an encouragement (500 francs) is given to Raoul Benon, for his book on post-traumatic psychic and nervous troubles; the Dusgate prize is not awarded, but Arcangelo Creazzo receives a mention for his work on real and apparent death.

Physiology.—The Montyon prize to André Thomas, for his work on the brain; the Philipeaux prize to Henri Stassano, for the whole of his work in physiology; the Lallemand prize between Jules Glover (1000 francs), for his work on the physiology of the voice applied to art and industry, and Pierre Achalme (800 francs), for his book on electrotonics and biology; no memoirs have been received dealing with the subject proposed for the Pourat prize, and the prize is postponed to 1917; the Fanny Emden prize to Jean Chatanay.

Statistics.—The Montyon prize (1000 francs) to Fernand de Montessus de Ballore, for his seismological work.

History of Sciences.—The Binoux prize between Albert Anthiaume, for his work on the history of nautical science, F. Marguet, and George Sarton.

General Prizes.—Berthelot medals to Gabriel Bertrand, M. Viguier, and Paul Pascal; the Becquerel prize between M. Arnaud (2000 francs), Jean Merlin (750 francs), and M. Rabioulle (750 francs); the Gegner prize (3800 francs) to G. Cesaro, for his work in descriptive crystallography; the Lannelongue fund, the interest is divided between Mme. Cusco and Mme. Rück; the Gustave Roux prize to Lucien Berland, the prize reserved from 1914 to Georges Lery; the Trémont prize to Charles Frémont; the Wilde prize to Commandant Batailler, for his work in experimental mechanics relating to ballistics; the Lonchampt prize to Fernand Jadin and Albert Astruc, for their work on the presence and estimation of arsenic and manganese in the vegetable kingdom; the Saintour prize to A. Blondel, for his work on the theory of tides; the Henri de Parville prize between Jean Escard (1000 francs), for his books dealing with scientific and technical questions, Gustave Loisel (1000 francs), and Albert Buisson (500 francs); no memoir dealing with the subject proposed for the Vaillant prize was received, and the prize is postponed to 1919; the Grand prize of the Physical Sciences to Henry Hubert, for his study of the geology of French Western Africa; the Le Conte prize to Sir Almroth Wright, for his researches in antityphoid vaccination; the Petit d'Ormoy and Laplace and Rivot prizes are not awarded.

Wireless Telegraphy Communication.

SOME notes on the present state of wireless telegraphy were communicated by Dr. M. I. Pupin in the course of a lecture which he delivered before the National Academy of Science in New York, on "Aerial Transmission Problems." None of the points raised by Dr. Pupin were entirely new, as they have been frequently discussed in both continents without being appreciably helped towards solution. But the manner in which they were presented and illustrated assisted towards a better understanding of the formidable character of the obstacles in the way of extending the distance of wireless communication. These obstacles are due mainly to the interference produced by electrical waves, which are passing through the terrestrial atmosphere continuously, and it is not until we attempt to magnify the minute signals coming from a distant transmitting station that we are really aware of their presence. An engineer who took part in the recent long-distance wireless telephony trials and listened for the famous telephone message from Arlington, reports that at times "it was drowned completely in a roar of musketry," due, of course, to the action of the electrical waves produced by the incessant electrical discharges in the atmosphere. All attempts up to the present which the "practical" wireless engineer has made in the direction of overcoming these disturbances have consisted in increasing the power applied at the transmitting station so as to make the incoming signals at the receiving station stronger than the signals made by the "static." Ordinary electrical tuning is not sufficient for the purpose, because every system which is highly selective through ordinary tuning is also highly sonorous; every tap of the static will cause it to vibrate, and it will vibrate in the same way as when it is under the action of the signalling waves. The method advocated by Dr. Pupin involves the use of a sectional wave conductor between the antenna and the receiving apparatus, which will not transmit electrical waves of a frequency higher than a given range of frequencies. By this means, he states, "the station becomes an ear, which is quite sensitive for frequencies which are in the vicinity of the signalling frequency, which is deaf to frequencies which are considerably beyond this range, as most static disturbances are." "Similarly," he adds, "a sectional wave conductor can be constructed which is quite responsive to frequencies in the vicinity of the signalling frequency, but absorb almost completely everything below this range."

Dr. Pupin corrects the popular misconception that wireless telegraphy formed its first roots in German soil, whereas in reality it is a particular case of the oscillatory motion of electricity discovered by Joseph Henry, and the laws of which were formulated by Kelvin. It is true that Hertz employed these oscillations more skilfully than anybody else did prior to his time, and thereby succeeded in improving experimentally the complete validity of the physical foundation of the electromagnetic theory which was conceived and formulated by Clerk Maxwell, and paved the way for Mr. Marconi. Dr. Pupin claims that "Marconi discovered wireless telegraphy," but he altogether ignores the achievements of Branly, of Lodge, of Popoff, and others. It cannot be said of Mr. Marconi that he discovered the principles or invented the primary appliances upon which the transmission of electromagnetic waves are based. He accomplished his result by combining, in the utilisation of known principles, features which had been disclosed by others, which he improved and co-ordinated, with additional features of his own invention.

Mr. E. H. Colpitts, the research engineer of the Western Electric Company of America, under whose direction the apparatus was developed and the experiments conducted which resulted a few weeks ago in the wireless transmission of speech between Arlington, U.S.A., and Honolulu, on one hand, and Arlington and Paris on the other, discusses in the *Scientific American* the significance of the recent achievement in long-distance wireless telephony. The technical details of the system have already been described, so far as they are available, and chief interest in Mr. Colpitts's article lies in his views regarding the future of wireless telephony. He does not consider that it will displace line telephony, and even if it is physically possible and can be usefully employed, it must fail to be commercially practicable. Atmospheric disturbances were found to be a great drawback, while another difficulty

revealed in the Arlington trials was the susceptibility of the receiving stations to induction from near-by power circuits or electrical apparatus. With the present limited use of wireless, this latter trouble can be avoided by carefully choosing the sites of receiving stations, but it would become a serious factor if the use of wireless telephony became general. Mr. Colpitts predicts the use of wireless telephony for long-distance communications. Thus a transoceanic telephone cable is not an engineering or commercial possibility; and to enable, say, America to talk to Europe or Asia, wireless telephony will be the means chosen. In extending the possibilities of wireless communication between ships at sea there is a field for telephony, while from ship to shore wireless telephony is the only possibility.

THE TRANSMISSION OF BILHARZIA DISEASE BY SNAILS.

THE cause of Bilharzia disease of man was discovered by Bilharz in 1851, and it is only now, more than half a century later, that the mode of transmission has been discovered. The disease is due to the presence of flukes in the mesenteric and vesical veins, or, rather, it is in the main the eggs which these worms lay that cause the inflammation which has such dire consequences. The cause being known, helminthologists of repute then naturally sought to determine how infection arose. It was known that the eggs hatched in water into ciliated embryos, and from what was also known of the life-history of other flukes, it was natural to conclude that in this case also the embryos next entered into the tissues of some fresh-water mollusc. This could be shown in two ways, either (1) by experimentally infecting molluscs with the larval forms (ciliated embryos), or (2) by dissecting molluscs from an endemic area and finding the larval forms in them. All attempts in these directions proved in vain. But it is astounding to learn in this report that whereas some fifty species of fresh-water molluscs occur in Egypt, only nine species are recorded as having been examined by the various observers who took up the problem. Nine species out of fifty! One cannot help adding that these observers really deserved their bad luck not to have by accident stumbled on the right mollusc.

Before, however, we proceed to describe how Dr. R. T. Leiper, who conducted this expedition, found the intermediate host (mollusc) we should point out at what stage our knowledge had previously arrived.

In Japan there exists in man and dogs a "Bilharzia" disease due to a different species of fluke, but to one belonging to the same genus. Japanese workers had shown that dogs could be infected by standing them in the water of flooded fields of infected areas, but not in water containing simply ciliated embryos, and they noted that the invading form differed so much from the ciliated embryos that an intermediate host seemed probable. Further, in 1913 it was announced that a reproductive stage of this fluke had been found in Lymnæus sp. Mice were also infected from the water in which snails had lived, these having been previously infected with larval stages. These results were fully confirmed and extended by Leiper and Atkinson in Japan. The problem of the Egyptian bilharziasis was now ripe for solution, and we see in the present report how rapidly Leiper and his colleagues effected it. On p. 23 it is stated the mission found bilharzia worms in three species out of eight of the commonest fresh-water molluscs within half an hour's train journey from Cairo!

1 Report on the Results of the Bilharzia Mission in Egypt, 1915. By Temporary Lieutenant-Colonel R. T. Leiper. Journal of the Royal Army Medical Corps, July and August, 1915. (London: John Bale, Sons, and Danielsson.)

Other workers aware of the Japanese results were also attacking the problem. In July, 1915, Causton and Warren published the results of their experiments. Though they hesitated in forming a definite conclusion, it now appears certain that the cercariæ they found in *Physopsis africana* were those of bilharzia.

To return to the present report. At El Marg, a village where the only water supply is a branch of the fresh-water canal from Cairo to Ismailia and Port Said, forty-nine out of fifty-four boys of about twelve years of age were found to be infected. Fifteen species of molluscs were found in the canal when the water in the latter was turned off, which occurs for a fortnight every three weeks. The commonest species were *Planorbis boissyi, bullinus*, and *cleopatra* spp. The two former species "attracted" ciliated embryos of bilharzia eggs when these were presented to them in water.

P. boissyi was so commonly infected with bilharzia cercariæ (larval forms) that large quantities of cercariæ could easily be collected. Rats were successfully infected with these cercariæ, and the adult worms were found in the portal veins. An examination of the eggs proved them to be the human species. Experiments on monkeys now showed that the oral as well as the cutaneous modes of infection occurred, but the oral probably means mucosal and not gastric. The incubation period was one-two months in these animals, as it is in man. The main fact has now been discovered. There will remain the working out of details. Further work will be necessary on the life-history of the snails, and it will perhaps be wise to wait until we know this thoroughly before precise measures of prophylaxis are advocated, but we may point out some of the factors bearing on the problem.

The disease is commoner in the Delta and in the Fayum than in those parts of Egypt supplied with "basin" irrigation. For instance, as Madden has pointed out, Ghizeh furnishes to Cairo hospitals only about ten cases per 100,000 population, while Sharkieh furnishes twenty, Qaloubieh eighteen, and Menoufieh about thirteen. These latter provinces have perpetual irrigation, while Ghizeh has basin irrigation. The probable explanation is that perpetual irrigation favours the development of snails.

There are 30,000 children born annually in Cairo; 10,000 of these, it is said, become infected. How? Cairo has two water supplies, a filtered, and an unfiltered derived from the Nile. Now water that has been taken from the Nile and used for agriculture as a rule does not re-enter the Nile, but is removed by drains which eventually reach the sea, but south of Cairo a number of these drains re-enter the Nile, so that this is a possible source of infection of Cairo by its *unfiltered* water. Cercariæ, however, can only be kept alive experimentally for thirty-six hours in water, and it is calculated that if the water has entered more than thirty miles upstream the cercariæ should be dead before they reach Cairo. As regards the infection in Cairo, one would like to have the actual proof of the finding of cercariæ in the unfiltered water from the pipes. The opinion is expressed that storage for 1½–2 days of this unfiltered water would protect Cairo. In villages, the principle involved is a simple one, viz., turning off or diverting the water from a particular canal, with the result of killing the molluscs, but the problem is complicated by a consideration of the agricultural aspect of such a procedure.

It is at present premature to indicate exactly how this can be best done; a very careful study of the life-history of snails will, as we have said, be necessary, but we have no doubt that Egypt can at last be freed from the scourge of bilharzia, evidence of the ravages of which has been found even in the mummies.

J. W. W. S.

MODERN SYSTEMS OF INDEPENDENT LIGHTING AND HEATING.[1]

II.—*Acetylene Lighting.*

ACETYLENE is now quite a familiar method of lighting country houses, and many early difficulties against which the system had to contend have been removed. Originally the gas could not be obtained in a state of purity. The impurities were apt to give rise to a slight "haze" or mist in the room, the odour of the gas was disagreeably evident, and in the early forms of generating plant sufficient care was not always taken to avoid mixtures of gas and air capable of giving rise to explosions.

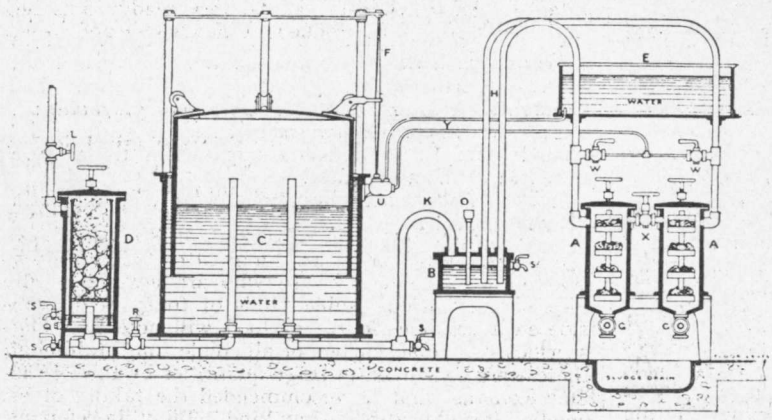

FIG. 1.—Sectional view of "Imperial" acetylene generator.

The careful purification of the gas, and the improved designs of the generators of to-day, have removed these defects. It is, however, now as ever, important for the householder who instals acetylene to purchase a good standard type of plant and to secure the very best workmanship throughout the installation. Acetylene, like petrol-air gas, is used to a great extent in remote situations, where expert assistance is not readily available. A cheap and inferior installation may therefore be a constant source of trouble and annoyance. Many reputable firms will undertake to execute any repairs within a given period after installation, thus making themselves responsible for the plant being in good order.

The acetylene plant is usually stored in a small outhouse, and the gas is led into the house through pipes in the same way as coal-gas; the piping, however, is usually very much smaller. It is impossible to describe acetylene generators in great detail within the space of this article, but it may be said they are divided broadly into "carbide to water" and "water to carbide," and into automatic and non-automatic types. Generally speaking, the addition of water to carbide is considered preferable, the water being so easily controlled. Automatic plants are now preferred for sustained lighting on a large scale.

The essential parts of an acetylene generator are as follows:—

(1) The generator proper, which contains the carbide. This is divided into compartments in such a way that the charge in one compartment is used up before the water enters the next. In modern installations duplicate generators are frequently used. By merely turning a tap either can be put into action, and in an emergency it is possible to continue supplying gas from one generator while the other is being attended to and recharged.

(2) The washer, which consists essentially of a piece of apparatus through which the gas passes on its way to the gas-holder, and is partly purified in doing so.

(3) The water-supply tank, which may be automatically controlled by the aid of a piston, actuated by a projection in the gas-holder, which in its descent admits more water as the gas becomes exhausted.

(4) The gas-holder, in which the gas is collected when it has passed through the "washer."

(5) The drier and purifier, by which the gas is finally purified on its way into the house for actual use.

In Figs. 1 and 2 these various parts are seen in a typical "Imperial" plant.

It is interesting to notice that while the nozzles of burners used for petrol-air gas require to be larger than those used with ordinary coal-gas, acetylene burners, on the other hand, must have a very small aperture. This is one reason why good methods of purification are necessary, as in the early days impurities sometimes led to the small apertures in the burner becoming choked with soot. Modern acetylene burners should last a long time. The smaller types merely employ a pin-hole, the large types (*e.g.* the "Roni") have a slot. A common arrangement is to have two twin burners, the flames of which impinge on one another. The ordinary range of consumption of acetylene burners is from ⅛ to 1 cub. ft. of gas per hour, the usual pressure being about 4 in. of water. The efficiency is generally stated, but is usually taken as about 25–30 candles per cub. ft. of gas. One may expect to get, roughly, 5 cub. ft. of gas from 1 lb. of carbide.

Bunsen burners and incandescent mantles have been used with acetylene, but the general impression is

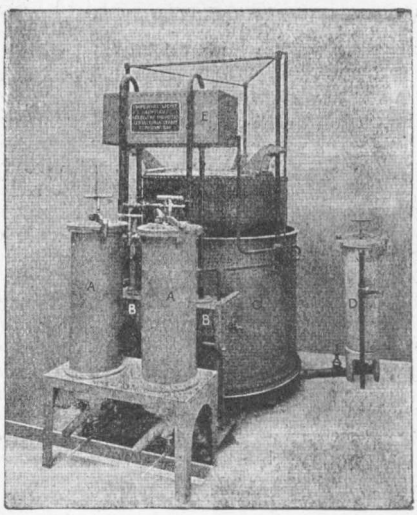

FIG. 2.—"Imperial" acetylene generator (general view).

A, Generator.
B, Washer.
C, Holder.
D, Purifier.

When the plant is in action water flows from the tank E into the generator A through the valve U. The acetylene thus produced passes through the washer B into the bell at C, causing it to rise. When the holder is about half full the control tap is automatically turned off and no more gas is generated. As the gas is used up the bell falls and turns the tap on again so that gas is generated once more. This automatic action continues until the carbide is exhausted. Meanwhile the gas generated passes out through the purifier D into the pipes. By closing one of the taps W either of the two twin generators can be put out of action. The sludge is run out through the cock G, and the drain pipes S S S serve to run off any accumulated water.

[1] Continued from p. 524.

that the gain in efficiency is offset by the comparatively short life of the mantles.

Acetylene installations have been widely used for country houses, for country railway stations, etc.; in fact, in similar circumstances to petrol-air gas. The comparative advantages of the two systems have been the subject of much discussion. The fact that there are opportunities for both seems to be borne out by the practice of several firms who are prepared to instal either system.

The following might be taken as a very rough indication of the cost of installations :—

Size of installation	Cost of plant £	Total cost of installation £
30 lights ...	30–40 ...	75–120
50 ,, ...	50–60 ...	130–160
100 ,, ...	75–90 ...	180–250

Here, again, allowance must be made for the very variable item of fixtures, on which a large sum may be expended if artistic effects are in demand. Prices will also be found to have risen somewhat during the war.

FIG. 3.—Portable acetylene lamp of very simple construction; requires 1 lb. of carbide and is stated to give 50 candle-power for eight hours.

A special province for acetylene lighting is in connection with portable lamps, some of which are of very ingenious and attractive design. Lamps of this kind are in demand for temporary workshops and construction work undertaken during the night time, a type of apparatus much used for the latter purpose being the acetylene flare and generator, which is equipped with a parabolic reflector designed to concentrate the light over a small area. (Shortly before the war a large number of these flares were introduced into the Pantheon, Paris, on the occasion of the bicentenary of Jean Jacques Rousseau. It was only just before the performance that the organisers suddenly realised that there is neither gas nor electricity in the building.)

In Fig. 3 is shown a very handy form of portable lamp recently introduced by the Thorn and Hoddle Acetylene Co. Its characteristic is extreme simplicity. All that is necessary is to throw a charge of carbide into the inner vessel, pour some water into the outer can, and light up. There is no cock attached to the lamp, and this enables the gas consumption to be automatically balanced by the inlet of water through a special valve. The lamp is very strong, and can be carried in the hand, stood up beside the work, or hung from the roof or wall. It is said to be now very widely used for military purposes.

Acetylene, like petrol-air gas, can be used for heating and cooking with small stoves consuming from 1 to 6 cub. ft. per hour, but is not recommended for use on a large scale. It would, however, be useful for laboratory work. Another application of acetylene which sometimes comes in handy in this connection is its use, in connection with oxygen, for welding purposes. For this purpose tubes of dissolved acetylene are sometimes used. The gas is dissolved under pressure in acetone, and is evolved when the pressure is relaxed. Such cylinders can be very readily detached and sent off to be refilled, a newly-charged vessel being substituted.

THE BRITISH MYCOLOGICAL SOCIETY.

THE Transactions of the British Mycological Society for 1914 (vol. v., part 1; May, 1915; Worcester: E. Baylis and Son) contain a number of interesting articles. Prof. A. H. R. Buller's presidential address on the fungus lore of the Greeks and Romans shows the various ways in which fungi attracted the attention of the ancients. Those who are adverse to the idea of our various edible kinds of fungi being considered a valuable source of food will note that Dioscorides was so suspicious of all edible fungi (although these were consumed in large quantities by the Greeks and Romans) that he recommended the taking of an emetic after the eating of any kind. Pliny, in referring to the rust of cereals, which he calls "the greatest pest of the crops," says that it may be averted "by fixing branches of laurel in the fields." Such kinds of belief die hard; the present writer can recall that when, a few years back, the American gooseberry-mildew first invaded Kent, a prominent fruit-farmer announced his intention of planting a hedge of Eucalyptus to ward off this new pest.

Miss Gulielma Lister, well known as the monographer of the Mycetozoa, publishes an account of the Japanese species collected during the past eight years by Mr. Kamagusu Minakata. The species new to science are illustrated with the beautiful and faithful drawings characteristic of Miss Lister's work. Mr. Minakata, moved primarily by a sense of their national importance, has protested against the demolition of the ancient Shintoist temples. The sacred groves of ancient trees round these temples have proved an excellent "hunting-ground" for Mycetozoa. So vehement on one occasion was his opposition that it led to his being put into prison for eighteen days; this was not wholly wasted time, however, since he was able to collect a species of Stemonitis "on an old post in the gaol."

Mr. J. Ramsbottom contributes a very useful summary of recent work on the cytology of fungus reproduction, and in a separate note points out that the "*guttulae*" in spores of the Discomycetes—a feature commonly introduced into the diagnosis of species—disappear in sections mounted in glycerine. Biographical accounts of the late Dr. M. C. Cooke and of the Rev. W. L. W. Eyre are also given by the same author.

Mr. C. K. Sutherland describes some new genera of marine Pyrenomycetes.

One of the activities of the society is the holding annually of "fungus forays" in the spring and autumn; those held in 1914 led, as in previous years, to the discovery of fungi new to Britain. It is satisfactory to find that care is taken to obtain a critical determination of all the species collected. The collection of *Fusicladium dendriticum*—the cause of the destructive disease known as apple "scab"—on *Pyrus torminalis* suggests that some of the fungous "pests" of the fruit-grower may—like some of the insect pests—emerge from woods which often neighbour fruit-farms.

INTENSIVE WORK IN SCHOOL SCIENCE.[1]

IN a presidential address, and to this audience, a preliminary reminiscent note may be pardoned. As a boy I had the common experience of fifty years ago—teachers whose sole object was to spoon-feed classes, not with the classics, but with syntax and prosody, forcing our empty wits, as Milton says, to compose "Theams Verses and Orations," wrung from poor striplings like blood from the nose, with the result that we loathed Xenophon and his ten thousand, Homer was an abomination, while Livy and Cicero were names and tasks. Ten years with really able Trinity College, Dublin, and Oxford teachers left me with no more real knowledge of Greek and Latin than of Chinese, and without the free use of the languages as keys to great literature. Imagine the delight of a boy of an inquisitive nature to meet a man[2] who cared nothing about words, but who knew about things—who knew the stars in their courses, and could tell us their names, whose delight was in the woods in springtime, who told us about the frog-spawn and the caddice worms, and who read to us in the evenings Gilbert White and Kingsley's "Glaucus," who showed us with the microscope the marvels in a drop of dirty pond water, and who on Saturday excursions up the river could talk of the Trilobites and the Orthoceratites, and explain the formation of the earth's crust. No more dry husks for me after such a diet, and early in my college life I kicked over the traces and exchanged the classics with "divers" as represented by Pearson, Browne, and Hooker, for Hunter, Lyell, and Huxley. From the study of nature to the study of man was an easy step.

My experience was that of thousands, yet, as I remember, we were athirst for good literature. What a delight it would have been to have had Chapman's "Odyssey" read to us, or Plato's "Phædo," on a Sunday evening, or the "Vena Historia." What a tragedy to climb Parnassus in a fog! How I have cursed the memory of Protagoras since finding that he introduced grammar into the curriculum, and forged the fetters which chained generations of schoolboys in the cold formalism of words. How different now that Montaigne and Milton and Locke and Petty have come to their own, and are recognised as men of sense in the matter of the training of youth.

Neither Montaigne nor Milton nor Locke had the wide national outlook on education displayed by Petty, who alone almost of his generation realised that the problems of natural philosophy, as it was then called, must be attacked in a systematic and co-operative study by a group of men "as careful to advance the arts as the Jesuits are to propagate their religion."

To come now to the subject-matter of my address—the earlier and more intensive study of science at school to save time at the university.

At fifteen years of age a boy should have had sufficient general education—the three R's, a fair knowledge of the history and literature of his country, and in the public schools enough classics to begin a technical training and to pass the ordinary entrance examination. Now comes the fateful period in which the bent of the boy's mind is determined. A difficulty exists in only a small proportion, a large majority have already selected careers, and the work of the sixteenth and seventeenth years should be determined by this choice, whether professional, commercial, academic, or the Services. The classical, modern, and scientific departments of the schools now meet these demands.

The profession of which I can speak is in a serious quandary. With the rapid development of science the subjects of study have become so multiplied that the curriculum is overburdened, and the five years is found to be insufficient. Men come up to the university later, remain longer, and the twenty-fifth or twenty-seventh year is reached before the qualification to practise is obtained. A measure of relief to this heavy burden—and it is one not likely to lighten during the next decade—is in your hands. Devote the sixteenth and seventeenth years to the preliminary sciences—physics, chemistry, and biology—and send us at eighteen men fit to proceed at once with physiological chemistry, physiology, and anatomy.

To do this three things are needed: teachers, laboratories, and a systematic organisation of the courses.

I put the personal first, as the man is more important than his workshop. Your association indicates the position which the science master has reached in our public schools, not without long years of struggle. The glamour of the classics lingers, but the shock which the nation has had in this great war will make us realise in the future that to keep in the van we must be in the van intellectually in all that relates to man's control of nature. Science "Heads" at Winchester, Eton, and Harrow would give the death-blow to the old-time Anglican tradition so well expressed in a Christmas sermon by the late Dean Gaisford, that classical learning "not only elevates above the vulgar herd, but leads not infrequently to positions of considerable emolument."

Brains, not bricks, should be the school motto in the matter of laboratories. A young Faraday in a shed is worth a dozen scientific showmen in costly buildings with lavish outfits. The accommodation, I am told, is at present ample in the larger schools. I have, indeed, seen laboratories which the most up-to-date college would envy. In the smaller schools it has not always been easy to get either the men, the space, or the equipment for teaching all the branches, and if an attempt is made to give earlier and more intensive science teaching there will have to be improvement all round.

The real crux is not with men or with buildings, but so to organise the teaching of the school as to have a continuous science course through two years. What is done now occasionally by the individual, I should like to see done by all the science men coming up to the universities or to the medical schools. The plan I urge would make a radical change in the constitution of some schools. Not that science is not taught and well taught, but it should be given its proper place, as the dominant partner in the educational family, not a Cinderella left in the kitchen. From an intellectual point of view the advantages are obvious. The mental exercise of the physical and mathematical sciences, combined with the technical training in the use of apparatus, gives a type of education singularly stimulating to boys. How many of our great inventors have lamented colourless careers at school! Things, not words, appeal to most boys. What an evolution of mind and hand is wrought by a year in a well-conducted physical laboratory. The fascination of making and fitting the apparatus, the wonders of electricity, and the marvellous laws of heat and light—into this new and delightful world a boy of sixteen may pass safely for a thorough training. Only it must not be a mere dabbling, to which the physical laboratory too often lends itself, but a serious day by day, week by week, gradual progress. The senior boys could keep their knowledge of the subject fresh by acting as demonstrators in the junior classes.

[1] From an address delivered to the Association of Public School Science Masters by the president, Sir William Osler, Bart., F.R.S., Regius Professor of Medicine, Oxford.

[2] Rev. W. A. Johnson, Warden and Founder of Trinity College School, Canada.

Many lads show an extraordinary aptitude for physics; there is always a boy Pascal in a big school, and no subject is so suited to arouse a fervid devotion to science. It would do the nation great good to have each generation, at the sixteenth or seventeenth year, pass automatically through a laboratory of physics.

I have spoken of the doubts expressed whether chemistry in the public schools can be taught at a college level. Of course it cannot if as a subsidiary subject, to which only a few hours a week are devoted, but in a course extending over two years, as a major subject, with laboratory work four or five mornings a week, surely a youth in his sixteenth and seventeenth years should be able to put in the foundation-stones, and in individual cases it is done already. As a mental discipline chemistry almost rivals physics; indeed, the new physical chemistry is a blend which appeals with magic potency to all science students.

But no subject attracts the young mind so strongly as biology, in its varied aspects. Elementary teaching is now admirably arranged, and in a two-year curriculum it should be an easy matter to cover much more ground than in the preliminaries demanded for medicine. Field classes in botany, gardens, museum work, should all be utilised. I would like to see at every school that excellent plan adopted by the late Sir Jonathan Hutchinson at his village museum, Haslemere—nature lectures on Sunday afternoons, with exhibition of the flowering plants of the season, with any other specimens of interest. The biology class gives an opportunity of a clear statement of the facts of sex, always so hard to discuss with boys.

There are objections, of course, to extensive and intensive teaching of science in schools. It is the business of the college, not of the school, to prepare boys for technical studies; but if it is the business of the school to teach science at all, why not teach it thoroughly? The general influence of the school may be trusted to counteract the evil possible in a too early concentration upon special subjects. Nature is never special, and a knowledge of her laws may form a sound Grecian foundation upon which to build the superstructure of a life as useful to the State, and as satisfying to the innner needs of a man, as if the groundwork were classics and literature. The two, indeed, cannot be separated. What naturalist is uninfluenced by Aristotle, what physician worthy of the name, whether he knows it or not, is without the spirit of Hippocrates? It has been well said that instruction is the least part of education. Upon the life, not the lips, of the master is the character of the boy moulded; and doubtless the great master of masters had this in mind when he said: "It may be, in short, that the possession of all the sciences, if unaccompanied by knowledge of the best, will more often than not injure the possessor." (Plato, "Alcibiades," ii.)

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—Dr. H. M. Woodcock, assistant to the late Prof. E. A. Minchin, has been appointed acting head of the department of protozoology at the Lister Institute.

Applications for the Gilchrist studentship for women must be received by the Academic Registrar not later than February 29. The studentship is of the value of 100*l*., and is tenable for one year by a graduate in honours of the University of not more than three years' standing who is prepared to take a course of study in an approved institution for some profession.

A course of six lectures on the "Electrical Production of Nitrates for Fertilisers and Explosives" will be delivered this term, at University College, by Mr. E. Kilburn Scott. The first lecture, which is open to the public without fee or ticket, will be given on Wednesday, January 26, at 5.30 p.m. At the same college Dr. Marie Stopes will give a course of free public lectures on "Coal" on Tuesdays, at 5 p.m., beginning on January 18. These lectures are intended for advanced students in botany and geology, and for persons interested in mining.

FOUR lectures on "Dietetics" will be delivered on January 18–21, by Dr. H. Campbell, at Gresham College, Basinghall Street, London, E.C. The lectures are free to the public, and will begin each evening at six o'clock.

IT is announced in the issue of *Science* for December 17 last that a gift of 30,000*l*. to Harvard University with which to found a professorship in archæology is contained in the will of the late Mrs. E. M. Hudson, widow of a former president of the American Bell Telephone Company.

IT was stated in the issue of the *Times* of January 8 that the Maharani of Baroda has given 10,000*l*. for the permanent endowment of scholarships for deserving Hindu girls. Twenty-nine scholarships are provided for, and the remainder of the income will be devoted to a studentship for Hindu women who desire to study out of India.

THE annual meeting of the Geographical Association was held at University College on January 6. In the course of his presidential address, Mr. H. J. Mackinder laid great stress on the value and importance of maps in relation to the present crisis. He pointed out that a misrepresentation of ideas on a map was now a serious matter, not only to geographers, but also to the masses of the people; that, after the war, methods and subjects in education would have to be re-valued; that while scientific analysis in human geography could give assistance, every human distribution could not be explained by purely scientific reasoning; that the German idea of a road to the East *viâ* Bagdad was a magnificent one (and it could be represented on a map), but the idea required valuing as well as perceiving, and in that case the ocean route from Hamburg to India might prove to be equally important, even if less attractive at the moment; that one result of the war had been to make people think in maps and in continents in order to gain a proper perspective and right judgment of the course of events, hence the construction of maps and the cultivation of the map habit of thought should not form the end, but only the beginning of geographical studies. In a lecture on the geographical study of rivers, Dr. Marion Newbigin suggested that as geographers and geologists study the world from widely different points of view the geographer should lay stress on what most concerns his own subject, and should not accept materials chosen by the geologist. With regard to a river, the geologist describes it as a tool for modelling the land; hence the upper course is of the greatest interest to him, and he pays particular attention to abnormal features, such as the Niagara Falls and the Grand Canyon. To the geographer, however, the river provides lines of communication, suitable homes for man, and an outlet to the ocean; hence the middle and lower courses are mainly important to him.

THE statistics of public education in England and Wales for the year 1913–14 have been issued as a Blue-book [Cd. 8097]. In previous years the volume has been published in two parts, one of which dealt with financial statistics only, and this is not to appear this year. Nor is it intended to publish the usual

statistics for the year 1914–15. The present volume shows that for 1913–14 there were in England and Wales 1027 secondary schools on the Board of Education grant list, in which 10,824 full-time teachers and 3418 part-time teachers were employed. Of the former, 5447 were men and 5377 women. The schools educated 99,171 full-time boy pupils and 88,036 full-time girl pupils; while in addition 5802 part-time pupils were in attendance. Of the total number of schools on the grant list, 397 were for boys, 349 for girls, and at 281 both boys and girls attended. Of the full-time boy pupils 19,583 were under twelve years of age, 70,096 were twelve and under sixteen years of age, 8651 were sixteen and under eighteen years of age, and 841 were eighteen years of age and over. Of the total number of teachers 6829 were graduates and 3995 non-graduates. In addition to these secondary schools on the grant list, information is provided concerning 121 other schools which though efficient receive no aid from the Board. In these schools 13,618 boys and 8928 girls were taught. In a second Blue-book [Cd. 8098] the statistics of the Welsh schools included above are published separately. In Wales (with Monmouthshire) there were 117 schools on the grant list—30 for boys only, 29 for girls only, and 58 for boys and girls. The number of pupils in full-time attendance were: boys, 8,412; girls, 8757. In addition there were 814 part-time pupils on the roll. The staffs of the schools included 554 men and 460 women, exclusive of 278 part-time teachers. There were four efficient Welsh schools not on the grant list educating 112 boys and 296 girls.

THE first volume [Cd. 8137] of the reports for the year 1913–14 from those universities and university colleges in Great Britain which are in receipt of grants from the Board of Education is before us. The reports are of special interest for two reasons; it is not intended to publish similar volumes for the year 1914–15, and the statistical information provided here relates to the last academic year before the outbreak of the war. In the introductory report, with which the volume opens, attention is directed to the loss of students and income which the universities have suffered as a result of the war, and to the additional assistance to meet such loss provided by the Treasury. A number of notable gifts and bequests made to university institutions during the year are recorded. These include, among others, a capital grant of 30,000*l.* received from the London County Council by the University of London for the extension and equipment of University College; 15,000*l.* from the Drapers' Company to defray the whole cost of the buildings and equipment of the chemical laboratories at East London College; 18,000*l.* from Sir George Kenrick for the endowment of a chair of physics at Birmingham University; 40,000*l.* from Messrs. G. A. and H. H. Wills for the University of Bristol; and 5000*l.* from Sir Joseph Jonas for a testing laboratory for the applied science department of Sheffield University. Interesting information can be gathered from the numerous tables. In England the total income from fees rose during the year by more than 6000*l.*, that from endowments by more than 5000*l.*, and the local authority grants supplied nearly 5000*l.* more than in the previous year. In England, again, the total expenditure of these institutions rose by about 15,000*l.* during the year. The total number of full-time students increased from 7666 in 1912–13 to 7756 in the year under review, an increase of 90. There was an increase of 37 students taking degree courses, and an increase of 36 in the number of students taking post-graduate courses.

SOCIETIES AND ACADEMIES.

WASHINGTON, D.C.

National Academy of Sciences (Proceedings, No. 12, vol. i.).—L. T. **Sharp**: Salts, soil colloids, and soils. New light is thrown upon the subject of salts in relation with soil-colloids. The way is opened for extensive experiments in the physical chemistry of soils, and the principles involved will be of particular significance for the subject of the applications of "alkali" and of fertiliser salts.—Alice C. **Fletcher**: The child and the tribe. The rites connected with the initiation of the child into the tribal life are described with emphasis upon their significance in Indian education and philosophy.—H. S. **Washington**: The correlation of potassium and magnesium, sodium and iron, in igneous rocks. The author's earlier suggestion that soda not uncommonly tends to vary with the iron oxides while potash shows similar relations to magnesia is greatly strengthened by a compilation of analyses of igneous rocks, numbering nearly 10,000.—G. D. **Birkhoff**: Theorem concerning the singular points of ordinary linear differential equations. It is shown that transformations of the independent variable have no significance over and above linear transformations of the dependent variables for the purposes of classification with respect to the notion of equivalence.—D. I. **Macht**, N. B. **Herman**, and C. S. **Levy**: A quantitative study of cutaneous analgesia produced by various opium alkaloids. By the use of exact experimental methods the order of analgesic power in the individual alkaloids from strongest to weakest is found to be:—Morphine (10 mg.), papaverine (40 mg.), codeine (20 mg.), narcotine (30 mg.), narceine (10 mg.), thebaine (10 mg.). The combinations of alkaloids are also studied.—W. D. **Harkins** and E. C. **Humphery**: The surface-tension at the interface between two liquids. The substitution of experiments on the liquid-liquid interface for the ordinary method in which a liquid-air interface is used, makes it possible to compare the drop-weight results with those obtained in a capillary tube of large bore. Various advantages appear from the use of this method.—W. H. **Wright**: Outline of a proposed system of classification of the nebulæ by means of their spectra. The spectra are arranged according to the degree of concentration of 4686A, and some of the neighbouring lines. The successive nebulæ stand in very close relation to one another, yet at one end of the scale is a purely gaseous nebula, and at the other a banded star.—W. H. **Wright**: Some probable identities in wave-length in nebular and stellar spectra. The evidence renders probable the presence in the nebulæ of carbon and nitrogen, and fortifies the assumption of a close relationship between the nebulæ and the early type stars.—F. G. **Benedict** and H. **Murschhauser**: Energy transformations during horizontal walking. The metabolism found for the subject walking at moderate speed without food has an average value of 1/2 gram-calorie. Slow, medium, and fast walking, and running are investigated for comparison.—F. G. **Benedict** and F. B. **Talbot**: The physiology of the new-born infant. The results of experiments on 105 new-born infants give opportunity for suggestions as to supplemental feeding and methods of conserving energy.—T. M. **Carpenter**: A comparison of methods for determining the respiratory exchange of man. The apparatus compared were the following: bed respiration calorimeter; two forms of the Benedict universal respiration apparatus; Zuntz-Geppert apparatus; Tissot apparatus: and so on.—R. **Dodge** and F. G. **Benedict**: Neuro-muscular effects of moderate doses of alcohol. Contrary to the theory of Kraepelin, the authors find no facilitation of the motor processes, but the depression of their simplest forms in the finger- and eye-movements seem to be one of the most characteristic

effects of alcohol.—Ruth J. **Stocking**: Variation and inheritance in abnormalities occurring after conjugation in *Paramecium caudatum*. In respect to the abnormalities, while some lines are constant in hereditary character, in others hereditable variations do occur within the line, so that, by selection, it is possible to break the single stock into a number of stocks differing hereditarily.—L. R. **Cary**: The influence of the marginal sense organs on functional activity in *Cassiopea zamachana*. There is no direct relationship between the extent of muscular activity and the rate of regeneration. In the absence of the influence of the sense-organs regeneration can take place normally but always at a decidedly lower rate.—A. R. **Middleton**: Heritable variations and the results of selection in the fission rate of *Stylonychia pustulata*. It is possible to give precise data as to the occurrence of heritable variations and their accumulation through selection; and this can scarcely fail to have influence on the conception of the genotype as a fixed thing.—H. **Cushing**: Hereditary anchylosis of the proximal phalangeal joints (symphalangism). The character behaves as a simple Mendelian dominant with equal chance among the offspring of affected individuals that it will be or will not be inherited.—S. O. **Mast**: The relative stimulating efficiency of spectral colours for the lower organisms. The stimulation in all of the organisms studied depends upon the wave-length of the light, and the stimulating efficiency is very much higher in certain regions of the spectrum than in others, but the regions differ in certain organisms closely related in structure.—W. M. **Davis**: The Mission Range, Montana. This range seems unique in its systematic tripartite arrangement of normally and glacially sculptured forms.—E. H. **Moore**: Definition of limit in general integral analysis. The definition is noteworthy in that it involves no metric features of the range $\mathfrak{P}$ underlying the range of definition of the function $F(\sigma)$.

NEW SOUTH WALES.

Linnean Society, November 24, 1915.—Mr. A. G. Hamilton, president, in the chair.—R. J. **Tillyard**: Studies on Australian Neuroptera. No. I.—The wing-venation of the Myrmelionidæ. The tracheation of the pupal wing was obtained by dissecting off the wing-sheaths of the newly-formed pupa, and making photomicrographs from them in water. The forewing offers a very interesting condition, inasmuch as it is found that the supposed main stem of the cubitus (Cu_1) is really the lower branch of the media (M_2), except for a small basal portion. For this compound vein, the name *cubito-median* (Cu_1+M_2) is proposed. The passage of M_2 over to Cu_1 in the imago is marked by a *persistently oblique* cross-vein, similar to that marking the bridge in Odonata. In the hindwing, the media is unbranched, and the venation follows the tracheation exactly. The peculiar formation called the "Banksian line" is also studied and explained, and is contrasted with the "gradate series" of Chrysopidæ. Finally, the phylogenetic interpretation of the results is shown to point to the descent of the Myrmelionidæ from ancestors similar to the present Australian Nymphidæ—a conclusion that can also be arrived at by a study of other organs, larval forms, and habits.—Miss A. A. **Brewster**: Observations on the pollination of *Darwinia fascicularis*. Among the generic characters of Darwinia, Mr. Bentham gives "Style exserted, usually long, and more or less bearded towards the end" ("Fl. Aust.," iii., 6). By the late Mr. E. Haviland, the bearded portion was thus described:—"Immediately below the stigma is a ring of stiff hair-like glands, which secrete an adhesive fluid copiously" (Proc. Linn. Soc., N.S. Wales, 1884, p. 70); and pollination was ascribed to insect-agency. It is now shown, (1) that the hairs serve the purpose of entangling and storing the viscid pollen, which is shed from the anthers when the perianth opens to allow of the exit of the young, elongating style; (2) that the flowers are pollinated by nectar-seeking birds; and (3) that the process is facilitated by the condition that, in almost every cluster of flowers (6–12), there is a distinct zone of mature, or almost mature, pistils, representing about one-half of the cluster, while those of the other half are in bud or in some intermediate stage of development; so that flowers of the same cluster may offer elongated styles with stigmas ready for pollination, as well as shorter styles with pollen-masses ready for transfer.—R. **Greig-Smith**: Contributions to our knowledge of soil-fertility. No. XIV.—The stimulative action of traces of chloroform retained by the soil. When a soil is treated with chloroform and then exposed to the air, traces of the volatile disinfectant are retained by the soil. These stimulate the growth of bacteria in soil-extracts. The action of volatile disinfectants upon the soil is, therefore, in part due to the direct stimulation of the soil-bacteria by traces retained by the soil.—E. W. **Ferguson**: Revision of the Amycterides. Part IV.—Sclerorinus (section ii.). Section ii. comprises four groups. Group i. (sixteen species) is well represented in South Australia, extending also to north-west Victoria, Central Australia, and the Murchison district of Western Australia. Group ii. (seven species) includes species which occur along the highlands of Queensland and New South Wales, and two which extend to Victoria, Tasmania, and South Australia. Group iii. (five species) is distributed over the southern tablelands of New South Wales. Group iv. (fifteen species) is strongly represented in South Australia, with a few species extending to Victoria, New South Wales, and Queensland. Five species are described as new; and two, previously described, are regarded as anomalous, and left ungrouped.—F. H. **Taylor**: Australian Tabanidæ. No. I. Eight species of Silvius (subfamily Pangoninæ) are described as new, increasing the total number of described species to fourteen. Only two of these are known to occur south of the tropic of Capricorn.

BOOKS RECEIVED.

Le Scuole Ionica Pythagorica ed Eleata (1 Prearistotelici 1). By A. Mieli. Pp. xvi+503 (Firenze: Libreria Della Voce.) 12 lire.

Bacon's Contour Atlas. Northern Wales Edition. Pp. 41. East Anglia Edition. Pp. 41. South-West England Edition. Pp. 41. (London: G. W. Bacon and Co., Ltd.) Each 6*d*. net.

The Cosmogony Actual: a Statement of Certain Stresses in Stellar Physics. By A. R. Ward. Pp. 68. (Sydney: W. Brooks and Co., Ltd.)

The Prophecy concerning the Rōsh Kelälăh. By A. R. Ward. Second edition. Pp. 58 (Sydney: W. Brooks and Co., Ltd.) 1*s*. 6*d*.

National Efficiency. A Series of Lectures delivered by Prof. R. F. Irvine, M. Atkinson, Prof. W. H. Moore, and Prof. W. A. Osborne, at the Victorian Railways Institute in August–September, 1915. Pp. 56. (Victorian Railways Printing Branch.)

Land and Marine Diesel Engines. By Prof. I. G. Supino. Translated by Eng.-Lieut.-Com. A. G. Bremner and J. Richardson. Pp. xv+309. (London: C. Griffin and Co., Ltd.) 12*s*. 6*d*. net.

An Elementary Grammar of Colloquial French on Phonetic Basis. By Prof. G. Bonnard. Pp. xii+180. (Cambridge: W. Heffer and Sons, Ltd.) 3*s*. 6*d*. net.

The Magic of Jewels and Charms. By Dr. G. F. Kunz. Pp. xv+422. (Philadelphia and London: J. B. Lippincott Co.) 21*s*. net.

How to Make Low-Pressure Transformers. By

Prof. F. E. Austin. Second edition. Pp. 17. (Hanover, N.H.: F. E. Austin.) 40 cents.

Medicinsk-Historiske Smaaskrifter, 12: Enkjorningen. By A. Garboe. Pp. 119. (Kobenhavn: V. Trydes Forlag.)

Eight Lectures on Theoretical Physics, delivered at Columbia University in 1909, by Prof. W. Planck. Translated by Prof. A. P. Wills. Pp. ix+130. (New York: Columbia University Press.)

Four Lectures on Mathematics delivered at Columbia University in 1911. By Prof. J. Hadamard. Pp. v+52. (New York: Columbia University Press.)

The Rat: Reference Tables and Data for the Albino Rat and the Norway Rat. Compiled and edited by H. H. Donaldson. Pp. iii+278. (Philadelphia: Wistar Institute of Anatomy.) 3 dollars.

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

Manual of the New Zealand Mollusca, by H. Suter. Atlas of Plates. 72 plates, with descriptions. (Wellington, N.Z.: J. Mackay.)

A Budget of Paradoxes. By A. de Morgan. Second edition. Edited by D. E. Smith. 2 vols. Vol. i., pp. viii+402. Vol ii., pp. 387. (Chicago and London: The Open Court Publishing Company.) 30*s.* net.

The Embryology of the Honey Bee. By Dr. J. A. Nelson. Pp. 282+plates. (Princeton: Princeton University Press; London: Oxford University Press.) 8*s.* 6*d.* net.

Occasional Papers of the Boston Society of Natural History. vii.: Fauna of New England. 13: List of the Mollusca. By C. W. Johnson. Pp. 231. (Boston, Mass.)

Reports for the Year 1913–14 from those Universities and University Colleges in Great Britain which are in Receipt of Grant from the Board of Education. 2 vols. Vol. i., pp. xxxiii+554. Vol. ii., pp. 518. (London: H.M.S.O.; Wyman and Sons, Ltd.) 2*s.* 4*d.* and 2*s.* 1*d.* respectively.

DIARY OF SOCIETIES.

THURSDAY, JANUARY 13.

ROYAL SOCIETY OF ARTS, at 4.30.—The Romance of Indian Surveys: Sir T. H. Holdich.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Predetermination of the Performance of Dynamo-electric Machinery: Prof. Miles Walker.

MATHEMATICAL SOCIETY, at 5.30.—The Transition from Vapour to Liquid, when the Range of the Molecular Attractions is Sensible: Sir J. Larmor.—(1) A Note on the Uniform Convergence of the Fourier Series $\Sigma a_n \sin n\theta$; (2) A Condition for the Validity of Taylor's Expansion: T. W. Chaundy.—The Average Order of the Arithmetical Functions $P(x)$ and $\Delta(x)$: G. H. Hardy.—Green's Dyadics in the Theory of Elasticity: C. E. Weatherburn.—A Problem in "Analysis Situs": G. N. Watson.

FRIDAY, JANUARY 14.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Occultations of Stars by the Moon, observed at the University Observatory, Warsaw, 1914-15: S. Tscherny.—(1) 8th Note on the number of faint stars with large proper motions; (2) The distribution in space of the stars in Zone +25° of the Oxford Astrographic Catalogue: R. J. Pocock.—Real Paths of 250 Fireballs and Shooting Stars observed in the British Isles during the four years 1912 to 1915 inclusive: W. F. Denning.—Note on lines of Silicon in the Spectra of B Stars: A. Fowler.—The R—D discordance of the Greenwich transit-circle, Royal Observatory, Greenwich.

MALACOLOGICAL SOCIETY, at 7.—The Operculum of the Genus Bursa (Ranella) Rev. A. H. Cooke.—The Shells of the South African Species of Lepiidæ: E. A. Smith.—(1) A Volume of Plates Prepared by Rackett for the Second Edition of Pulteney's "Dorsetshire Shells" in Hutchin's "History of Dorset"; (2) Lovell Reeve's "Elements of Conchology," with some Dates of Publication: A. Reynell.

TUESDAY, JANUARY 18.

ROYAL INSTITUTION, at 3.—The Physiology of Anger and Fear: Prof. C. S. Sherrington.

ROYAL STATISTICAL SOCIETY, at 5.15.

INSTITUTION OF PETROLEUM TECHNOLOGISTS, at 8.—Oil Storage: H. Barringer.

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