THURSDAY, MAY 3, 1917.

THE PROBLEM OF HEREDITY.

A Critique of the Theory of Evolution. By Prof. T. H. Morgan. Pp. x+197. (Princeton: University Press; London: Oxford University Press, 1916.) Price 6*s.* net.

THE title of this little volume of four lectures delivered at Princeton University is likely to cause some disappointment. The book is almost entirely an exposition of certain facts as to inheritance ascertained by experiments with the fruit-fly, *Drosophila ampelophila,* and "a review of a long series of researches as to the nature of the hereditary material." The author claims that "the mechanism of heredity has been discovered" and that "the problem of heredity has been solved." He holds that "the mechanism of the chromosomes offers a satisfactory solution of the traditional problem of heredity."

Whilst all credit is due to Prof. Morgan for his long and careful investigations—which have been published elsewhere and are here summarised with excellent diagrams—it cannot be admitted that the demonstration of the numerical relations of the chromosomes distributing to the germ-cells the hereditary factors carried by the parents is of the importance which he supposes. The "traditional problem of heredity" cannot be correctly described as limited to the inquiry as to what are the carriers of the factors of heredity and their relations to one another as carriers. The questions as to *how* the factors arise and *how* they influence the development of the embryo cannot, as Prof. Morgan somewhat arbitrarily states (in so many words), be excluded from a solution of the real, traditional, and actual problem of heredity. The fact seems to be that the knowledge of what is called "Mendelian inheritance" and the relation to it of the chromosome mechanism does not take us much further into the "problem of heredity" than we had already got when, after Darwin had stated the facts known to him and the views they suggested in his "Animals and Plants under Domestication," Edouard Van Beneden and other histologists first unravelled the chromosomes and gave us the classical records of their visible activity in fertilisation.

We have not got much further since those days, but there is no doubt that some facts of interest have been added to the stock of knowledge by those who have confirmed Mendel's experiments. When we look to the present summary for some statement of what important progress in our conception and understanding of inheritance is to be reported, we are reluctantly driven to the conclusion that what Prof. Morgan calls "a satisfactory solution of the traditional problem of heredity" is only a restatement of the problem in terms of invisible "factors" associated with the chromosomes. The existence of such "factors" is not a new inference, but has been a feature of theories of inheritance both before and since Darwin's treatment of the subject. Mendel contributed to knowledge the solid fact that in certain easily observed cases (if not universally) a pair of opposed or contrasted factors—present one in one parent and one in the other—do not really "blend" in cross-breeding, but in successive in-bred generations of the hybrid offspring (of intermediate or mixed character) become separated out in two pure races, each identical, so far as the factor selected for study is concerned, with one of the original cross-bred parents. That observation and its extensive confirmation are important steps in the study of the nature, origin, and possibilities of the "factors." So also is the demonstration of their close association with the chromosomes, which was suggested as soon as the activity of those structures in the process of fertilisation was first observed.

This is, however, only a beginning: it remains to be seen how far the application of these results to the actual facts of inheritance as stated by Darwin in the successive chapters of his "Variation of Animals and Plants under Domestication" helps us to explain or understand those facts. So far the application has not been made—so as to obtain any result beyond a restatement of the facts in other terms and language—nor does there appear to be any immediate prospect of progress in that direction.

An important suggestion is made by Prof. Morgan, namely, that the "factors" themselves may vary or fluctuate. He says: "I do not know of any *a priori* reason why a factor may not fluctuate, unless it is, as I like to think, a chemical molecule." He, however, proceeds to give evidence opposed to such fluctuation.

It seems that the line of investigation pursued by Prof. Morgan and other recent experimenters who have developed Mendel's original observations into an imposing volume of detail has disappointed expectation. It will, we believe, be of service, but it has, to the regret of all, not led into the fruitful region anticipated by those who entered upon it with so much enthusiasm and energy. In order to gain a deeper understanding of the many remarkable facts of organic heredity a new departure is necessary, new inductions suggesting new and untried lines of observation and experiment.

So far as the title of these lectures, "A Critique of the Theory of Evolution," is concerned, there is very little said in them which justifies it. Prof. Morgan objects to the use of the word "evolution" as employed by Herbert Spencer, on the ground that it is "rather an empty generalisation to say that any kind of change is a process of evolution. . . . What has," he asks, "the evolution of the stars, of the horse, and of human inventions in common?" This seems to be somewhat unnecessary, since no one has said that "*any* and *every* kind of change is a process of evolution," and the instances of evolution which he cites have, as such, well-recognised features in common. Attempts to correct flagrant misuse

of words are often of great value; but a writer may bring his own qualities of judgment and understanding into discredit by erroneously supposing that a misuse requires correction where no such misuse exists.

We are also unable to admit the validity of Prof. Morgan's assimilation of the "artificiality" of the conditions under which humanly selected breeds are produced and studied to the "artificiality" of a spectroscope or a galvanometer (p. 84). The justification for reserve and caution in generalising in the former case is not that these breeds are "artificial," but that the essential and significant conditions of the phenomena they present are not clearly ascertained, whilst in regard to the instruments known as spectroscope and galvanometer those conditions are accurately established.

The point of greatest interest at the present moment in a critique of the theory of organic evolution by a capable and accomplished investigator of the facts of inheritance—such as Prof. Morgan—is his answer to the question: "Does natural selection influence the course of evolution?" (p. 187). Prof. Morgan gives a very carefully worded answer in the affirmative. He says: "If through a mutation a character appears that has a *beneficial* influence on the individual, the chance that the individual will survive is increased, not only for itself, but for all of its descendants that come to inherit this character. It is this increase in the number of individuals possessing a particular character that might have an influence on the course of evolution." He goes on to say: "The causes of the mutations that give rise to new characters we do not know, although we have no reason for supposing that they are due to other than natural processes. Evolution has taken place by the incorporation into the race of those mutations that are beneficial to the life and reproduction of the organism. Natural selection as here defined means both the increase in the number of individuals that results after a beneficial mutation has occurred (owing to the ability of living matter to propagate), and also that this preponderance of certain kinds of individuals in a population makes some further results more probable than others. More than this natural selection cannot mean, if characters are fixed and are not changed by selection."

We do not know of anyone who maintains that factors are changed by selection. Darwin certainly did not make such a misuse of the word "selection." But there is a great field of inquiry still to be undertaken which is indicated by the words "if factors are fixed." We are a long way from possessing knowledge that would justify the conclusion that they *are* fixed—as Prof. Morgan is careful to point out (p. 166). Darwin held that they are subject to influences which cause them to vary, and it is by research in this area that we may hope for future advance in the understanding of the complex web of the phenomena of heredity.

E. RAY LANKESTER.

GENERALISED CO-ORDINATES.

An Introduction to the Use of Generalised Co-ordinates in Mechanics and Physics. By Prof. W. E. Byerly. Pp. vii+118. (Chicago and London: Ginn and Co., 1916.) Price 5*s.* 6*d.*

THIS work is sure to be welcomed, because Prof. Byerly has undoubtedly the gift of appealing successfully to the average student. More than that: in its small compass it includes a wide scope because, starting with the notion of generalised co-ordinates in its abstract analytical form, it proceeds to the discussion of such things as the Hamiltonian equations, the principle of least action, the ignoration of co-ordinates, and the proper use of the modified kinetic-energy function. For a teacher the book is cheap, if only for the example (*d*) on p. 21, and the subsequent discussion of the same example on pp. 98–103. We have not seen a more illuminating example within the range of an ordinary student; it shows admirably the difference between abstract dynamics, where all necessary data are provided, and practical physics, where the data are experimental, and need by no means correspond with the actual elements of the problem. In this case it is a question of guessing at the simplest explanation of an unseen "control" of a mechanism on which we can make experiments within a certain range.

Among the many merits of this book we may signalise the following: the examples are almost all instructive and free from artificiality; we have some where the same result is obtained by different advanced methods—for instance, pure Lagrange, pure Hamilton, and Hamilton *plus* Routh (with a modified function), and these are compared with previous solutions by elementary methods. As a matter of notation, we may direct attention to the symbol $M_{q,r}$ for the energy-function modified with respect to the position-co-ordinates q, r. The meaning of partial derivatives is so variable in this connection that we should like such symbols as $T(q^2)$, $T(p^2)$, $T(pq)$ introduced throughout for the velocity-forms, momentum-forms, and "mixed" forms of T whenever there is any risk of confusion. The fact that, *in a certain sense,* the Lagrangian function L means $T-V$ (strictly $T(q^2)-V$), and the Hamiltonian function means $T+V$ (strictly $T(p^2)+V$), is extremely baffling to a beginner. In particular, the "canonical" equations of Hamilton imply a special representation of the energy-function.

Prof. Byerly's book is so good that it deserves a much more searching criticism than the present reviewer can pretend to give; but a few remarks may be ventured here. The example (p. 18) about the dog running down a plank is all right as it stands, but it tacitly implies that the dog is reduced to a mere machine applying a constant frictional force to the plank parallel to the inclined plane. Students who try to solve "animal" problems by Lagrange's method may make some fearful howlers. Another point (p. 72) is the question how far we can treat ω_1, ω_2, ω_3 occurring

in T as if they were ω_x, ω_y, ω_z referred to fixed axes; here Prof. Byerly is not so clear as Routh, and although he makes no mistake (the chapter is on impulsive forces), he may mislead his reader unwittingly. As a mere matter of typography we may note that $\phi^2 \cos\theta$ is much clearer than $\cos\theta\phi^2$ (and so in many other cases). In the answer (p. 9) on the simple pendulum (ex. 2) it would be well to reduce R to a configuration expression ($R=(3\cos\theta-2\cos\alpha)mg$); on p. 18 read "$mg$ the weight of the dog"; and there may be other trivial blemishes of the same sort.

It may be added that there are proofs of Thomson's and Bertrand's theorems in the proper dualistic form, examples taken from hydrodynamics and electrodynamics, and two appendices—one on dynamical formulæ, the other on the calculus of variations. We hope that Prof. Byerly's book will have the full success which it deserves. G. B. M.

TROPICAL AGRICULTURE.

Tropical Agriculture. By Dr. E. V. Wilcox. Pp. xviii+373. (New York and London: D. Appleton and Co., 1916.) Price 10*s.* 6*d.* net.

THE selection of a title is sometimes not an easy matter. "Tropical Agriculture" has been given as the name of the book before us, written by Dr. E. V. Wilcox, of the States Relations Service of the U.S. Department of Agriculture. The book deals very briefly with nearly every product of the tropics, whether agricultural or otherwise. In this case the title is, therefore, misleading. But in the preface the author speaks of "tropical products," and one wonders why he did not give his book that name. It would have been fully descriptive and appropriate.

The author tells us that his book was "written from the standpoint of the general reader, business man, and agricultural student." But in the next breath the agricultural student is dismissed and the book is then said to deal with tropical agriculture in the commercial sense. Moreover, Dr. Wilcox regards the literature of his subject as abounding in exaggeration—rather hard on the authors of the numerous publications enumerated by him in the appendix. Still, it is satisfactory to be assured that our author, knowing the shortcomings of his predecessors, will not likely err in overdrawing his pictures of the wonders and resources of the tropics.

The opening chapters on tropical climate, soils, agricultural methods, etc., might with great advantage be carefully revised and reconsidered. The assumption, for example, that the inhabitants of tropical countries were ignorant of agriculture until the "white race" invaded their country is very nearly an entire misconception. It is certainly not true of India, China, and Japan. The systems and methods these peoples are now following came down to them through countless ages. It is quite uncalled for and, moreover, irrelevant to say that "the native races are obviously inferior to the white race, and that their supposed rights to property in tropical countries must yield to the superior demands of the white race." It would be more correct to affirm that the closer we study native conceptions and practices—the evolutions of centuries towards environment—the more readily and completely shall we attain to the higher flights of tropical industry.

So much for the speculations of our author. Turning over the pages of his book cursorily, the reader is disappointed to note a lack of proportion, an utter disregard of uniformity in treatment, and an entire absence of method—qualities essential in a book of reference. The plates serve a pictorial rather than a practical purpose. Facing p. 144, for example, a hand is seen to thrust the rhizome of an aroid into view. Below the illustration has been printed "Dasheen Tuber, Trinidad Variety." There is no number to the plate (nor, in fact, to any plate), so that the reader has to turn to the index to find the text—some eleven pages farther on. But in the text no reference is made to the plate, so that, after perusing the book through, the reader may remain ignorant that the "dasheen" has been illustrated.

The book has twenty-one chapters, as well as an appendix and an index. Turning to chap. xii., which deals with fibres, it is found that two pages have been devoted to cotton, three-fourths of a page to jute, four pages to sisal, and so on—no attempt at proportional spacing to importance of subject. But in the twenty-one lines given to jute the writer manages to inculcate three egregious errors. He speaks of the flowers being "rather conspicuous," which they most certainly are not, gives the Indian area of the crop at half what it is, and speaks of a yield at very nearly four times the record production of the crop. On p. 70 it is observed that tea has been cultivated in India since 1875, whereas it was extensively grown in that country thirty to forty years before that date. A photograph of Japanese hedges of the tea plant is given, apparently as being illustrative of the great tea cultivation from which the supplies of commerce are drawn. Nothing could be less accurate. The geography of our author is often startling, as, for example (p. 141): "Large quantities of pistachio-nuts are shipped from Afghanistan to India."

The book, as it stands, cannot become a textbook for either the merchant or the student. It needs drastic revision.

OUR BOOKSHELF.

Science and Education: Lectures delivered at the Royal Institution of Great Britain. Edited, with an Introduction, by Sir E. Ray Lankester. Pp. 200. (London: W. Heinemann, 1917.) Price 1*s.* net.

THESE lectures were given at the Royal Institution in 1854, and the lecturers were Whewell, the famous Master of Trinity College, Cambridge, Faraday, Latham, the philologist, Daubeny, then professor of chemistry and botany at Oxford, Tyndall, James Paget, the eminent surgeon and

pathologist, and W. B. Hodgson, who became professor of political economy in Edinburgh University. They should be read by everyone interested in education, and this convenient little volume at the cost of one shilling will enable them to do so.

Sixty-three years have elapsed since these stimulating and powerful discourses were delivered, and some of the illustrative references to the scientific views as well as to the popular superstitions current at that time require explanation or modification. This is provided by a series of useful notes inserted by the editor after each lecture.

The lectures are not occupied with denunciations of the "elegant imbecility of classical learning," but with an exposition from various points of view of the advantages to education of the observation of natural phenomena and the scientific study of language. In 1854 there were not more than two or three schools in England where natural science was taught, and in the universities such subjects were almost ignored except where they formed an integral, though subordinate, part of the medical curriculum. We have moved on since that time. All the large schools and some of the small are provided with laboratories and teachers more or less competent. The time given to experiment and observation is, however, quite insufficient, and until headmasters with purely literary qualifications and sympathies are got rid of progress will still be slow.

Some Questions of Phonetic Theory. By Dr. Wilfrid Perrett. Pp. vi+110. (University of London Press, 1916.) Price 2*s.* 6*d.*

THIS book forms a notable contribution to the literature on the science of speech. The first chapter exposes some current misconceptions as to the position of rest of the organs of speech. In the remaining three chapters (entitled "Willis on Vowel Sounds," "The Wheatstone Test," and "The Compass of the Mouth") Dr. Perrett deals with the intricate subject of vowel-pitches. He gives examples of the hopelessly divergent results which have been arrived at by different authorities on acoustics, and endeavours, in our opinion with success, to bring some order into the chaos. Naturally the work of those who have contributed to bring about the chaos comes in for strong criticism. Upon Helmholtz Dr. Perrett is particularly severe; he shows that "wherever it bears upon phonetics Helmholtz's book has no right to be considered authoritative," and states that even in other branches of the theory of sound Helmholtz attained a reputation to which the quality of his work did not entitle him. The Helmholtzian harmonic overtone theory of vowel-quality is shown to be untenable by simple experiments described on pp. 79, 81, and 107—experiments which may be performed without difficulty by any phonetically trained person.

The methods by which Dr. Perrett arrives at his interesting table of vowel-pitches (p. 98) appear to us to be sound.

We commend the work to the notice not only of those interested in the science of speech, but also of students of sound generally. D. J.

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.*]

Science Teaching and National Character.

I WAS asked to address a Workers' Educational Association meeting; was prevented by illness; and wrote a long letter to the chairman. Phrases from this letter, referring to the teaching of science, very much abbreviated, appeared in the newspapers. Now NATURE (April 19) flagellates me for what I am supposed to have said. And, indeed, if I had meant anything so grotesque as you naturally inferred from the disconnected phrases you saw, I should have deserved all your strictures.

What I *did* say, briefly, was that we had seriously neglected science, not so much in schools as in higher work and in practical life; that we were realising this; but that there was a danger of our trying to mend matters in the wrong way, by cramming too much science into the schools, where, certainly up to the age of sixteen, the boy would profit most from an education in the "humanities," even if he intended to devote himself to science later. By the "humanities" I meant the studies which deal with the thoughts and actions of man. I added that there was another danger, quite distinct in character, attaching to our new-found reverence for physical science, and this was that we might be tempted to imagine that we could apply its concepts and methods to the totally different problems presented by human life. I do not remember whether on this occasion I used an illustration which I have used at other times: that of the older political economy, which, in trying to become an exact science setting forth unalterable laws, had lost touch with the realities of social life. But I *did* give an illustration from Germany, where, I urged, the attempt to apply the Darwinian theory (misinterpreted) to the life of that strange justice-loving animal, man, had produced the hideous political philosophy of Treitschke and modern Germany, and had largely contributed to bring about the war. I did not say, or mean, or think anything so absurd as that science caused the war, or that Germany's soul had been poisoned because she took science more seriously than we. But it is possible that some of my phrases, hurriedly written from a sick bed, may have conveyed that impression. If so, I am glad that you have directed attention to them. RAMSAY MUIR.

Manchester, April 23.

WE are glad to know that the published extracts from Prof. Ramsay Muir's letter do not represent his views as to the influence of science upon national character. Prof. Muir need not fear, however, that too much attention will be given to science teaching in schools, or that British men of science are likely to leave the working of the human spirit out of consideration because this has been done by German historians and philosophers. All that the most advanced reformers of school curricula ask is that the natural sciences (with geography) shall be given approximately the same amount of school time as three other main groups, namely, languages and literature, English and history, mathematics and other subjects, and that up to the age of about sixteen years all these subjects should be fairly represented as essential parts of a general educational course.

There is no intention of "cramming too much science into the schools," but a strong case can be made out against the present cramming of classics, whether considered as a means of mental development or a preparation for life. The assumption that science is a special study, to be taken up after the age of sixteen or so, while what are called the "humanities," but are chiefly dead languages and literature, are not specialised, is a fallacy which advocates of literary learning persist in believing, though it has been exposed over and over again.

It is possible that a perverted view of Darwinism has been put forward in Germany in justification of the doctrine of "frightfulness," but naturalists as a body must not be held responsible for this conception, which was, indeed, repudiated completely by Huxley in his "Evolution and Ethics." The ancient and modern histories studied in schools and colleges are mainly concerned with wars and dynasties, and it is to these "humanities" rather than to science that we must look for the origin of the German mental condition and the conduct of the present conflict.—ED., NATURE.

The Frequency of Snow in London.

I THINK the number of days with snow in the early months of 1917, as quoted in Mr. Harding's article in NATURE of April 19 according to the records of an observer at Wandsworth Common, is too low for the metropolitan district generally, inasmuch as I have recorded snowfall, chiefly at Hampstead, but partly also at Kensington, on no fewer than forty-seven days during the past winter, distributed as follows: November, 1; December, 3; January, 20; February, 4; March, 11; April, 8; out of which forty-three belong to 1917—a figure nine in excess of that quoted by Mr. Harding. I do not think the discrepancy is due to Hampstead's height some three or four hundred feet above the more central parts of London, inasmuch as a difference of altitude of this small order tells more effectively upon the length of time snow lies on the ground than on its frequency of falling; but I suggest it may arise from the omission of days of very slight snowfall, of days with sleet, or, possibly, even from a failure to recognise uncommon varieties of snow.

An interesting case of an unusual variety of snow, which I heard superficial observers calling "sleet," in spite of the fact that the precipitation was entirely free from liquid drops, occurred during the week-end of January 20–21, when there fell in London a continuous frozen drizzle composed of fine crystalline particles, gradually whitening roofs and open spaces with a thin layer having the appearance of ordinary snow. Now, if the physical criterion of rain is the spherical drop of water, of hail the stone, pellet, or granule of compact ice, and of snow the individually formed crystal of ice, whether it falls alone, or stuck together with others in large flakes, or broken up by wind into powdery fragments, it is clear that the precipitation of January 20–21 had the essential character of snow, and was not a transition form between snow and rain or between snow and hail.

L. C. W. BONACINA.

30 Parliament Hill, Hampstead, N.W.3.,
April 28.

Scarcity of Wasps in Kashmir in 1916.

READING the correspondence in NATURE on the scarcity of wasps in England, and the interesting article by Prof. Carpenter (NATURE, January 25), suggested to me that it might be worth while to record my experience in Srinagar, Kashmir, during the years 1915 and 1916, because of the curious analogy.

During the autumn of 1915 two species of wasp were observed, one of these somewhat resembling *Vespa vulgaris*, and the other larger and more like a hornet. These were both excessively abundant in and around the house I occupied. The large suspended nests of both species, covered with active workers, were in almost every bush and shrub near the house and attached to the walls of the house, and it was only by repeated efforts that we could prevent the insects starting new colonies on the ceilings of the rooms in the house.

The abnormally dry season in Kashmir beginning in May, 1915, may have been specially favourable for the development of these wasps, but if so it is not easy to account for their subsequent scarcity. As in England, the year 1916 was remarkable for the rareness of wasps. The winter was mild and dry, and the shortage of rain persisted through the spring. Scarcely a single wasp of the smaller species was seen during the summer and autumn following. The only nests of the larger kind I saw were two very small ones suspended from the woodwork of the spectroheliograph, where I could daily watch the process of construction. This, however, was a most tedious operation, for after several months the nests were no larger than 1½ in. or 2 in. in diameter—that is, about a quarter the size attained in 1915—and instead of swarms of active workers, only one or two rather sluggish insects were seen on the nests.

The apparent despondency of the wasps in 1916 was in strong contrast with their energy during the previous season. Yet, so far as human beings could judge, the two seasons were equally inspiring as regards clear blue skies and brilliant sun.

Is it a mere coincidence that wasps of different species were one year abundant, the next year scarce, in such widely distant localities as England and Kashmir?

J. EVERSHED.

The Observatory, Kodaikanal, South India,
March 14.

Ceratonia Siliqua and the Carat Weight.

IT is usually stated that the carat weight of jewellers and diamond merchants is derived from the hard seeds of the locust tree, *Ceratonia siliqua*, which were anciently used as weights. Having had occasion to obtain some of the beans, I weighed several of the seeds to see what sort of error would be incurred if they were used as weights. Out of forty-four seeds, four were shrivelled and obviously abnormal, weighing from 0·037 to 0·064 grm. each; the remaining forty seeds varied from 0·120 to 0·268 grm. The average weight of a seed was 0·2004 grm., with a probable variation of ±0·0235. The median was 0·207, and the modal average 0·204. The variations were not well distributed. The old diamond carat, of which 151½ made 1 oz. troy, would weigh 0·205 grm.; the decimal carat now in use is 0·200 grm. It would appear, therefore, that the carat weight could be recovered with some approach to accuracy by weighing a number of seeds of the locust bean. It is also evident that the use of such seeds as weights must have given opportunities for fraudulent dealing in the precious commodities gauged by means of them, since deviations of from 30 to 40 per cent. from the average may occur. The variations in weight due to varying humidity of the air are not great; twenty-five seeds exposed to the air of a room for twenty-three hours in rainy weather gained 0·06 per cent. in weight, and after thirty-six hours over sulphuric acid lost 1·71 per cent. in weight.

J. H. COSTE.

Utopia, Teddington, April 23.

THE BRITISH SCIENCE GUILD.

THE eleventh annual meeting of the British Science Guild was held at the Mansion House on Monday, April 30, when the Lord Mayor presided. After the meeting had been welcomed by the Lord Mayor, Sir William Mather, president of the Guild, opened the proceedings, alluding briefly to the part taken by the British Science Guild in the encouragement of applied science during his tenure of office. He explained also the proposal of the committee of the Ramsay Memorial Fund to raise 100,000*l.* with the view of founding a chemical laboratory and a series of fellowships in memory of Sir William Ramsay at University College, London. In conclusion, Sir William Mather announced his retirement and the nomination of Lord Sydenham to succeed him as president of the Guild.

The election of Lord Sydenham as president, of the Lord Mayor as a new vice-president, and of the executive committee was moved by Sir Boverton Redwood and seconded by Prof. R. A. Gregory. The motion, which was carried unanimously, also included the adoption of the annual report. Sir Boverton Redwood referred to the valued services of Sir William Mather during his four years of office, and both speakers directed attention to the exceptional progress in the organisation of science during the past year. Prof. Gregory referred to the great step forward represented by the establishment of the Department of Scientific and Industrial Research, and pointed out that this action had led to similar developments in Australia, Canada, and the United States. In fact, many of the aims for which the Guild had been working were now in course of realisation.

The annual report contained a summary of the chief scientific and technical committees which are working in connection with various Government Departments, and a note on the report recently issued by the Board of Scientific Societies on "National Instruction in Technical Optics." An account was also given of the proceedings of the Metric System Committee, which is engaged in preparing two draft Bills such as would pave the way for the introduction of a metric system of weights and measures. Two appendices dealing with the work of the Canadian and South Australian branches of the Guild contain interesting accounts of the steps being taken in these countries for the encouragement of applied science. Under the title "The Promotion of Scientific and Industrial Research" the report also contains a particularly useful analysis of the various movements in this direction in this country, in France, and in the United States.

Following the adoption of the annual report, the chairman called upon Lord Sydenham to deliver his address on "National Reconstruction," the main part of which appears elsewhere in this issue.

Lord Sydenham's address contained many illustrations of the results of neglect of scientific knowledge and method, not only as regards omission to utilise directly the scientific resources of the country, but also in respect of a failure in the grasp and foresight such as sound scientific training would confer. Attention was directed to some latent sources of power in the British Isles awaiting development, and to the great resources of the Empire, which can not only produce all the great food staples and raw materials of every kind, but has almost a monopoly of some of the rarer metals and earths utilised in industry. While emphasising the paramount importance of allotting to science a larger place in national education, Lord Sydenham also expressed the hope that one result of the war would be a wider and loftier outlook on national problems and a greater willingness to sink individual claims in concerted action for the good of the community.

Mr. H. A. L. Fisher, President of the Board of Education, then addressed the meeting. Referring to the present methods of teaching science in our schools, Mr. Fisher said that he believed that such teaching was often quite efficiently conducted; and yet experience showed that we had not been successful in conveying the instruction in such a way as to grip the imagination of the children, and lead them to follow up and utilise scientific knowledge and method in later life. This was an old country, with old-established businesses, following traditional lines of development and having palpable defects. In the future it would be necessary for industries to be organised on a far greater scale, and with a fuller degree of co-operation between those interested; and also for science to be applied to these businesses in a much more complete manner than hitherto.

He had noticed a tendency to assume that scientific and technical instruction was necessarily divorced from the "humanities," and even inferior in its results from the point of view of making good citizens. He did not believe that there need be any such antagonism between these different branches of national instruction. It should be possible to give young people a scientific or technical training which, if conceived on broad and imaginative lines, would produce a sense of discipline and a development of character quite equal to that ascribed to the older discipline of orators and poets. Forms of technical training which did not equip the whole man were bad forms.

In conclusion, Mr. Fisher remarked that outside criticism, while sometimes needful, should be applied with discrimination and knowledge. An instance he had in mind of uninformed criticism was the charge not infrequently levelled against workers of slackness. No one who had not first-hand knowledge of the conditions under which work was being done at the present time should make such criticisms. He believed a great deal of harm had been done by workers being urged to efforts which were excessive and productive of overstrain.

Mr. H. G. Wells, who followed Mr. Fisher, said that he had long been an enthusiast for education, on which any attempt at reconstruction

must ultimately be based. If the education was right everything else would follow. He had followed the course of education in England for thirty years, and he was satisfied that all was *not* well with education in England. To defective education was due the general neglect of science and the habit of "muddling through." The radical defect, both in the schools and in the universities, was the undue predominance of classical studies. In the school the classical side had received almost all the encouragement, obtained the best masters, and was allotted the best boys. There was no room for science, modern languages, or knowledge of potential industrial value when so many hours were allotted to Latin and Greek. The effect was constantly perpetuated by the encouragement given to classical studies in the form of scholarships, and the greater opportunities given in the public service to men trained in classics. As a result those responsible for the country's destinies were mainly without knowledge or appreciation of science. When one considered that during an average youth's period of education he could not get in more than 5000 hours of real solid educational work, the importance of utilising these hours judiciously was evident.

Mr. Wells did not underrate what was wise and beautiful in Latin and Greek and ancient philosophy, and he regarded it as unfortunate that such knowledge was needlessly barred from the ordinary man by the insistence of pedants that it could be obtained only through the vehicle of the Latin and Greek languages. It was this insistence upon the rigid study of ancient languages which had raised a barrier between scientific and literary studies so that men of science and scholars tended to be separated into two camps, neither able to sympathise with or appreciate the aims of the other.

A vote of thanks to the Lord Mayor and the speakers closed the proceedings.

THE PUBLIC SERVICES OF INDIA.

IT is just thirty years since a Commission last reported on the Public Services of India. They have been years of remarkable social and intellectual progress, years in which the self-consciousness and political aspirations of educated Indians have developed surprisingly. It was time, doubtless, that a fresh stock-taking should be made.

The present report (Cd. 8382, price 4*s*. 2*d*. net) deals with all public posts carrying a salary of 200*l*. or thereabouts and upwards. These posts are roughly 10,000 in number, and since they all require a knowledge of English, they have to be shared between the Englishmen needed to maintain British control or required because Indians have not yet sufficient technical aptitude, and the $1\frac{3}{4}$ millions of Indians who have had an English education. Some 285 millions must, as matters at present stand, go without any share of the official loaves and fishes as represented by the 200*l*. limit, because they are illiterate in English. On the other hand, there is keen competition among them for the minor posts in which a knowledge of English is still not always required. After all, 200*l*. a year, in spite of a 30 per cent. rise in prices in ten years, is a comfortable competence in rural India.

The problem to which the Commission has addressed itself is that of giving a larger proportion than at present of the 10,000 better-paid posts to natives of India, including domiciled descendants of Europeans. It is a little surprising that, in dealing with the grievance that a large share of the official prizes falls to foreigners, the Commission has not noted the point, which any anthropologist would grasp at a glance, that the classes who, by their knowledge of English, share the 10,000 higher posts with Britons are, in fact, Indian cosmopolitans. They call themselves "Indians," not Parsis, Bengalis, Gujaratis, etc. They use English in their communications with one another. English, for instance, is the language of the National Congress. But in their intercourse with the 285 millions they must needs, like English officials, use the local languages. These, it must be remembered, are many more in number than the languages of Europe, and, unlike these, belong to five wholly separate families of tongues. It follows that an Indian serving out of his native province is every whit as much a foreigner, and, with regard to local observances and customs, may have as much to learn, as an Englishman. In the case of the semi-barbarous tribes of the hills and the N.E. frontier, educated Indians have been admittedly less successful than Englishmen in dealing with the people. To put it in another way, it were surprising, surely, if Europe were governed by benevolent Martians, that Englishmen should assert a claim to administrative posts, say, in Serbia or Bulgaria on the ground of their proficiency in Martian literature!

It must be admitted, on the other hand, that of the 10,000-odd better-paid posts only 42 per cent. are held by Indians. As the salary (and the responsibility) rises the proportion of Indians diminishes. At 500*l*. a year it dwindles to 19 per cent.; above 800*l*. it is only 10 per cent. This, put thus statistically, may seem a somewhat serious grievance. But the Commissioners themselves assert, as the result of two years of inquiry, that in the case of the Indian Civil Service (1411 posts) and the Police (926 posts) it is necessary to maintain a high proportion of Europeans in order to ensure the maintenance of British policy and prestige. They might have added, without excessive indiscretion, that a large part of the work of the Civil Service and the Police is precisely the protection of the mute millions from the classes from which the English-speaking Indians are drawn. Others of the twenty-four services into which the administration is divided, such as survey, railways (in the engineering branch), assay and mint, etc., are still chiefly recruited from the West because Indians with adequate technical training are not available.

It must be remembered, too, that the 10,000

coveted posts are divided between the Supreme Government and nine great provinces, each larger than most European States. This would give an average of 1000 posts to each, and an allowance of 500 or 600 Europeans to Delhi and each of the nine subordinate Governments does not seem excessive, especially when we recall the fact that there is a large European population in the great cities and in the planting and mining districts. It is well to give every scope, in reason, to the ambitions of the $1\frac{3}{4}$ millions. But the security and tranquillity of the country at large have to be considered.

The figures given by the Commissioners as to the rapidly extending amenities of life in India, of prosperity and education, are very striking. In twenty-four years the railway mileage had increased from 15,245 to 33,599 miles; the passengers carried from 111 to 437 millions; the freight tonnage from $22\frac{1}{4}$ millions to 87 millions. A deficit in earnings had been converted into a comfortable net profit of 4,750,000*l*. In twenty years the number of post offices had grown from 8349 to 18,789. In twenty-six years Indian exports jumped from 60,000,000*l*. to 166,000,000*l*., and imports (a better guide to the spending powers of the people) from 43,500,000*l*. to 127,000,000*l*. So, in twenty-five years, the pupils in schools rose from $3\frac{1}{2}$ millions to 7 millions, and girl students from 278,000 to 1,000,000. Other branches of national life show the same marked and sustained progress.

The point for consideration is simply that the spread of prosperity and education tends to multiply the candidates for Government employment so enormously that the resulting feeling of grievance would not be wholly removed even if no imported agency were employed. The Commissioners have, however, suggested the recruiting of 25 per cent. of the Civil Service in India itself. With regard to the many services (smaller, of course, in their numbers) in which there is no question of maintaining British authority, and from which Indians are at present excluded only by want of scientific or technical training, the Commissioners have rightly said that the training should be supplied in India. But the means thereto, now that India is fairly prosperous and on the way to be more so, is to import well-paid European teachers under satisfactory conditions of service and pension. Men of the best type will be needed at home, and if they are to give their services to India, they should receive a sufficient wage. It will be money well spent in the long run, and, in fact, is the only feasible means of creating a large body of scientific technicians and experts in India.

THE NATIONAL IMPORTANCE OF FARM VERMIN.

SLOWLY but surely the public mind is awakening to the fact that the knowledge that has been obtained through long years of study and observation upon the life-history and habits of animals of all kinds that are injurious to crops is of real importance, and is likely during the next few months to be brought home very vividly even to the most casual. Scientific workers have for long pointed out that all facts hitherto unknown elicited from Nature were of value. Prof. Tyndall nearly fifty years ago told us to keep our sympathetic eye upon the originator of knowledge, but until quite recently such advice has been ignored, if not openly flouted.

For many years past it has been pointed out that the so-called balance of Nature was being disturbed by the thoughtless and ignorant action of certain individuals who openly destroyed owls and kestrels, sparrow-hawks, and other raptorial birds; in like manner the unrestricted increase of such birds as the wood-pigeon, house-sparrow, rook, starling, and blackbird was not only entailing a cruel hardship upon the farmer and fruit-grower, but these very same depredators were reducing the number of our beneficial or insect-eating birds to an alarming extent.

At last we have begun to realise that a *laissez-faire* policy is a mistake, and although somewhat late in the day, the different county, rural, and urban councils are endeavouring to take concerted action to destroy injurious birds and mammals. Excellent as such a movement is, if it has to have a permanent and beneficial effect a mandate from the Board of Agriculture or some other Government Department is needed that will not only permit of the destruction, but, what is equally important, compel the preservation, and to this end much more severe penalties are desirable for those destroying owls, kestrels, lapwings, and the truly insectivorous species of wild birds.

In view of the present shortage of food, which is likely to continue, in probably a lesser degree, for at least a year or two, it is highly important that we should realise the financial loss occasioned by the different species of wild birds and mammals. A recent writer estimates that the loss due to the house-sparrow reaches the incredible figure of 8,000,000*l*. per annum. We shall be well within the mark if we allow double that sum for the depredations of wood-pigeons, rooks, starlings, blackbirds, and other injurious species. It has been computed that the brown rat entails an annual loss to the United Kingdom of upwards of 15,000,000*l*. The losses due to voles and mice are difficult to arrive at, except in particular years, but it must be considerable. Indeed, it cannot be regarded as an outside estimate if we place the total losses due to the above pests at something like 40,000,000*l*. annually.

Now it is patent to any thinking man or woman that we are not doing all that we might, or even anywhere near what we might do, to lessen the enormous national loss. So long as wanton destruction of known beneficial animals is permitted, the unrestricted increase of known and proved injurious species ignored, and an apathy and indifference accorded by the powers that be to those who are endeavouring to awaken the

public mind on such matters, this enormous waste will continue, and in all probability increase.

It cannot escape observation that for many years past farmers, fruit-growers, and others have annually implored action, but it would seem that the very people who should have been primed with accurate information, and able quickly and decisively to have remedied the situation, are rather disabled than qualified for work of this character, which is of vital importance to the nation, and calls for immediate action.

WALTER E. COLLINGE.

NOTES.

WE learn from the "Political Notes" in the *Times* that Lord Balfour's Committee on After-War Trade has been strengthened by the addition of Sir William Pearce, Sir Charles Henry, Sir Archibald Williamson, and Sir William Priestley. The committee is now investigating the question of the possible introduction of the metric and decimal systems for our coinage, weights, and measures.

WHILE the wastage of the Yorkshire cliffs is to be deplored, the result is sometimes of advantage to the geologist and antiquary. Recently, in the vicinity of Scarborough, a fall of the cliff has revealed a hoard of twenty bronze weapons, which consisted of battle-axes, spears, chisels, gouges, portions of a sword, etc. Twelve of the axes, of the socketed type, are perfect. One shows the unusual feature of a rivet-hole in place of a loop for secure hafting; another contained a portion of the original wood shaft. Some of the axes are in the rough state, as if just turned out of the mould; others have obviously been in use. The collection evidently formed the stock-in-trade of a metal-worker of the Bronze Age, at least a thousand years before the Christian era. Mr. T. Sheppard, who has made a special study of the relics of this period, is figuring and describing the specimens, which have found a permanent home in the museum at Hull.

UNTIL recently our supplies of acetone, of which enormous quantities are now required in the manufacture of propellent explosives, have been largely obtained from foreign countries, where cheap supplies of waste wood were available for destructive distillation for acetone production. Since the outbreak of war, however, this position has been radically altered, and acetone is now produced in this country on a large scale by the distillation of wood and in other ways. The question is also being taken up in other countries of the Empire; it is proposed, for instance, to erect a factory for this purpose in Natal, where wattle wood will be used as a raw material. The possibility of similarly utilising the wattle wood accumulated in connection with the wattle bark industry of the East Africa Protectorate is also under consideration, and at the Imperial Institute an exhaustive series of trial distillations with this wood, and also with olive wood from the same protectorate, used locally as fuel, has just been concluded. The results show that the yield of acetone and acetic acid from both woods is satisfactory. A good yield of acetic acid is also being obtained in Ceylon from the distillation of coconut shells and various local woods. Attention is also being given to the subject in the Indian State of Mysore, and it seems likely that in a short time the Empire will be able to produce all the acetone and acetic acid it requires.

THE death is announced, in his seventy-ninth year, of Dr. H. B. Wheatley, who was clerk to the Royal Society from 1861 to 1879, and assistant secretary to the Royal Society of Arts from 1879 to 1908.

WE regret to see in the *Morning Post* of April 27 the announcement of the death of Sir Marc Ruffer, president of the Sanitary, Maritime, and Quarantine Council of Egypt, and formerly director of the British Institute of Preventive Medicine—now the Lister Institute.

THE *Nieuwe Courant* announces the death of Prof. Morjan Raciborski, professor of botany in the University of Cracow, and formerly for many years engaged in work on sugar-cane and tobacco in the Buitenzorg Botanic Gardens, Java.

THE valuable material collected by the special commission appointed to investigate the flora, fauna, and hydrology of Lake Baikal is to be published by the Imperial Academy of Sciences, Petrograd, in one volume, of which an edition of five hundred copies will be issued.

WE regret to note that *Engineering* for April 27 records the death of Mr. Andrew S. Biggart, in Glasgow, on April 26. Mr. Biggart was associated with the late Mr. William Arrol for thirty-four years, and took a prominent part in the construction of the plant used in connection with the Forth Bridge. He was a member of the Institution of Civil Engineers, and was noted for his interest in his workers. His death will be regretted by many who have benefited by his philanthropic schemes.

AT a meeting held at the Institute of Chemistry on April 27, the president and council presented a silver rose bowl to Mr. R. B. Pilcher, registrar and secretary, in appreciation of twenty-five years' faithful service. The meeting was well attended, and the presentation was made by the president, Sir James Dobbie, principal of the Government laboratories. Mr. Pilcher, who joined the staff of the Institute as clerk in 1892, was appointed assistant secretary in 1894, secretary in 1895, and has held the joint offices of registrar and secretary since 1900.

IT is announced that the next triennial prize of 300*l.* under the will of the late Sir Astley Cooper will be awarded for an essay or treatise on the subject of "Gunshot Wounds of the Lungs and Pleura." Candidates (who must not be members of the staffs of Guy's or St. Thomas's Hospitals, or their relatives) must send their essays, written in English, addressed to the physicians and surgeons, Guy's Hospital, London, S.E., on or before January 1, 1919. Full particulars concerning the conditions of the competition are obtainable from Mr. C. H. Fagge, Guy's Hospital.

THE sixteenth biennial Dutch Congress of Natural and Medical Sciences was held at The Hague on April 12 and following days. In connection with this, the geography section had organised an interesting historical exhibition, mainly of the work of Mercator and the Dutch cartographers of the seventeenth century. The chief general lecture was delivered by Prof. H. A. Lorentz, of Leyden, on "Einstein's Gravitational Theory and Fundamental Ideas in Physics." From a discussion, in one of the sections, on chemical industry in Holland, it appears that the manufacture of aniline and other intermediate materials for the dye industry was started in 1916.

THE annual meeting of the members of the Royal Institution was held on May 1, the Duke of North-

umberland, K.G., president, in the chair. The annual report of the Committee of Visitors for the year 1916, testifying to the continued prosperity and efficient management of the institution, was read and adopted. Sixty-two lectures and nineteen evening discourses were delivered in 1916. The following gentlemen were unanimously elected as officers for the ensuing year:—*President*, the Duke of Northumberland; *Treasurer*, Sir James Crichton-Browne; *Secretary*, Col. E. H. Hills; *Managers*, H. E. Armstrong, Sir W. Phipson Beale, Bart., C. V. Boys, J. H. Balfour Browne, J. Y. Buchanan, W. A. B. Burdett-Coutts, Sir J. Mackenzie Davidson, D. W. C. Hood, the Rt. Hon. Viscount Iveagh, Sir Charles Nicholson, Bart., the Hon. R. C. Parsons, Sir James Reid, Bart., Alex. Siemens, S. West, and the Rt. Hon. Lord Wrenbury; *Visitors*, Ernest Clarke, J. F. Deacon, E. Dent, Lt.-Col. H. E. Gaulter, J. Dundas Grant, W. B. Gibbs, W. A. T. Hallowes, H. E. Jones, H. R. Kempe, F. Legge, J. Love, R. Pearce, Sir Alex. Pedler, H. M. Ross, and J. Shaw.

THE *British Medical Journal* announces the death on March 30, at sixty-two years of age, of Count Karl A. H. Mörner, professor and rector of the Royal Karolinska Medico-Chirurgical Institute, Stockholm. We learn that Count Mörner matriculated in 1872, and, after studying at Uppsala and Stockholm, qualified as a practitioner of medicine in 1884. Two years later his thesis on the pigments of melanotic tumours gained him the doctorate of medicine, and at the same time he was appointed professor of chemistry and pharmacy at the Karolinska Institute. In 1892 he was appointed rector of the institute in succession to Keys, and it was as the central figure of the institute that he was best known to the Swedish public. As rector he participated in drawing up regulations for the Nobel Prize Committees, and he was president of the Nobel Medical Committee.

WE regret to learn that Major Alasdair C. B. Geddes, R.F.C., a young naturalist of great promise, eldest son of Prof. Patrick Geddes, of Dundee, was killed in action in France on April 19. Mr. Geddes was commissioned in 1915, and gained very rapid advancement. He was recently awarded the Military Cross. His naturally fine powers of observation, cultivated by a singularly varied and active education, stood him in good stead in the discharge of his military duties. Alasdair Geddes kept up the tradition of the wandering student, learning at Montpelier and Paris, as well as at Dundee and Edinburgh, accompanying Dr. W. S. Bruce to Spitsbergen and his father's town-planning exhibition to India. He was keenly interested in botany and zoology, but perhaps geography held his heart. He graduated B.Sc. in Edinburgh in 1914, and was awarded the Vans Dunlop scholarship as the most distinguished science graduate of his year. He was passionately fond of music and the open country, and had an extraordinary power of compelling affection. All sympathy will go to his parents, who are in India, where Prof. Geddes has been doing Government work for three years in connection with town-planning. Major Geddes was only twenty-five years of age.

DR. S. TOLVER PRESTON, whose death took place in March at the hospital at Altona, near which town he had resided for many years, was educated at the University of Aberdeen, and while serving his articles with a London firm of engineers was employed on one of the Atlantic cable ships. He soon after retired from the profession, and in 1875 published his "Theory of the Ether," in which he attributed the gravitational attraction between two bodies to the oscillations of their molecules, which interact with the ether and set it in oscillation in turn. From about this period he appears to have lived abroad, chiefly in Germany, and in 1894 took his doctor's degree at Munich with a dissertation on the theories of gravitation. During this period he wrote several papers dealing with the kinetic theory of gases. He was the first to point out the possibility of obtaining work from a porous piston, separating hydrogen and oxygen at the same pressure from each other in a cylinder, by the more rapid diffusion of the hydrogen through the piston. Later papers dealt with cosmical physics. In one he pointed out that a rotating plastic solid would take a planetary form, and that it is not necessary to assume that the planets have at any time been liquid or gaseous.

DR. GEORGE CHRISTIAN HOFFMANN, formerly assistant director, chemist, and mineralogist of the Geological Survey of Canada, died in Ottawa on March 8. From an obituary notice contributed to *Science* by Dr. H. M. Ami, we learn that Dr. Hoffmann was born on June 7, 1837, in London, and studied at the Royal School of Mines. He spent several years as chemist in research laboratories of England, and later worked in Natal, Mauritius, and Australia. In 1872 he joined the technical staff of the Geological Survey of Canada, Montreal, under Dr. Alfred R. C. Selwyn. He was a fellow of the Institute of Chemistry, of the Royal Society of Canada, and of many other distinguished bodies. While in Australia he devoted considerable time in the phyto-chemical laboratory attached to the Melbourne Botanic Garden in Victoria; inquiries into the tanning properties of the barks of native trees; investigation into the amount of potash in various indigenous trees, besides experiments in reference to various acids, tar, and other products. His bibliography contains valuable reports and papers of analyses and determinations of Canadian ores, minerals, and economic products characterising the rock formations of Canada and elsewhere, including rare and new species.

WE regret to learn from the *Revue générale des Sciences* of the death of M. Henri Bazin. Born at Nancy in 1829, M. Bazin was among the earliest of modern investigators into the phenomena of hydraulics, and his name is inseparably associated with the mathematical enunciation of the laws of fluid flow. In collaboration, at Dijon, with his chief and colleague, M. Darcy, and later, on the premature death of the latter, alone, he engaged in the preparation of a monumental memoir dealing with the flow of water in open channels and with the movement of waves. This was completed after seven years' labour, submitted to the Académie des Sciences, and published in 1865. It was his best and most prized work, and he returned to the subject again and again. In 1886, whilst still engaged at Dijon, he commenced experimental observations in connection with weirs, which lasted over a period of ten years. The results appeared in a series of communications to the *Annales des Ponts et Chaussées*. Nor did he content himself with applied science alone; in 1868 he found time to translate Salmon's treatise on algebra. Bazin enjoyed a great and well-deserved reputation as an experimentalist of the first rank; he was patient, indefatigable, and thorough. The science of hydraulics, in the noteworthy development which it has undergone during the past fifty years, is indebted to him for careful and painstaking explanations of many of those contradictory features in hydraulic phenomena which are the despair of the engineer, and render it so difficult

to reconcile satisfactorily the results of theoretical calculation with actual observation.

THE newly formed Russian Botanical Society held its annual, and also a special, meeting at Moscow on December 16–19, 1916, and its organisation was then completed. The following officers were elected: *Honorary President*, A. S. Famincyn; *President*, I. P. Borodin; *Vice-Presidents*, V. I. Palladin and S. G. Navašin; *Chief Secretary*, N. A. Buš; *Treasurer*, V. N. Suchačev; *Members of the Council* in Petrograd, V. L. Komarov, S. P. Kostyčev, and V. A. Tranšel. In addition, the following were elected on the council as representing cities containing a minimum of five members of the society: M. I. Golenkin (Moscow), E. F. Votčal (Kiev), V. M. Arnoldi (Charkov), B. B. Grinevečkij (Odessa), V. V. Sapožnikov (Tomsk), Ja. S. Medvědev (Tiflis), and V. M. Arcichovskij (Novočerkassk). The number of the acting members of the society now exceeds 280. Notwithstanding the present unfavourable conditions, more than eighty members attended the four days' meeting in Moscow, and, in addition to the discussion and settlement of various questions of organisation, sixteen scientific reports were read. The next extraordinary meeting is fixed for December, 1919, again in Moscow. Thanks to a subsidy of 3000 roubles received from the Ministry of Public Instruction, it was possible towards the end of the year 1916 to proceed with the publication of the Journal of the Russian Botanical Society, and the first issue (Nos. 1–2) was placed before, and approved by, the Moscow meeting. The second issue (Nos. 3–4) is in the press and finishes the year 1916. For this year a subsidy of 10,000 roubles is being applied for, and it is intended to publish eight numbers of four to five sheets each. Thus the scientific amalgamation of Russian botanists, for which they have long striven, may be considered as achieved, and the formation under the auspices of the Imperial Academy of Sciences of the first all-Russian learned society is an accomplished fact.

IN the Journal of the Royal Anthropological Institute (vol. xlvi., July–December, 1916) Sir James Frazer's Huxley memorial lecture, "Ancient Stories of a Great Flood," is published. This subject was suggested by Huxley's article, "Hasisadra's Adventure" ("Collected Essays," vol. iv., London, 1911). He deals first in detail with the Babylonian and Hebrew versions of the story, and then passes on to consider the Greek myth of Deucalion. In regard to the last, he advances the interesting suggestion that the cleft in the Thessalian mountains, which is said to have been rent by Deucalion's flood, was no other than the gorge of Tempe. Indeed, it seems probable that the story of this flood was suggested by the desire to explain the origin of this deep and narrow defile. If this conjecture be accepted, the Thessalian story of Deucalion's flood, like that of Samothrace based on the tradition of the vast Ponto-Aralian sea and its desiccation through the piercing of the dam which divided it from the Mediterranean—in other words, through the opening of the Bosphorus and the Dardanelles—was an inference drawn from the facts of physical geography. In short, both were what Sir Edward Tylor has called "myths of observation" rather than historical traditions.

IN the *Review of Applied Entomology* (vol. iv., A and B, parts xi. and xii.; vol. v., A and B, parts i. and ii.) useful summaries of recent papers continue to be published. Those extracted from Russian and Scandinavian sources will be especially valued by British workers with a limited linguistic aptitude.

DR. ANGEL GALLARDO continues his studies of ants in the *Anales del Museo de Historia Natural de Buenos Aires* (vol. xxviii.), contributing systematic notes on the Attinæ of the Argentine, and a special illustrated account of *Trachymyrmex pruinosus*, with descriptions of observation nests.

TWO recent numbers of the *Bulletin of Entomological Research* (vol. vii., parts ii. and iii.) are noteworthy for some further papers by the Rev. Jas. Waterston on tropical chalcids; some of the new forms described are parasitic on injurious scale insects. There are also valuable papers by Dr. J. W. Scott Macfie on "West African Mosquitoes," of which one on the changes observed in the four larval stages of *Stegomyia fasciata* is of general interest to entomologists; the author points out the practical importance of trustworthy characters for the determination of such disease-carrying insects in the larval stage.

A VERY useful pamphlet on the destruction of the rodent pests of the farmer has been issued by the U.S. Bureau of Biological Survey. The rodents of North and Middle America include about 1350 forms; but of this number only a few species are actually troublesome to the farmer. When these pests become unduly numerous trapping is found impracticable, and the use of poison has to be resorted to. Careful instruction as to the employment of this is given. But the protection of hawks and owls, as well as of non-venomous snakes, is strenuously advocated. A number of photographs afford the reader a vivid idea of the widespread havoc these creatures may cause, if allowed to increase unchecked. British farmers might read these pages with profit.

IN the *Journal of the Franklin Institute* for March Prof. Ulric Dahlgren contributes a further instalment of his studies on the "Production of Light by Animals." He treats now of the Lampyridæ, known in this country as "glow-worms," but which Prof. Dahlgren calls "fire-flies," a term reserved by British coleopterists for another family, the Elateridæ. Both larval and adult forms are described in regard to their powers of luminescence, and the suggestion is made that the light-producing powers are dependent on the tracheæ, controlled by the nervous system, a conclusion already arrived at by Wielowiejski, of whom he makes no mention. Nor is the work of Dubois, who studied the luminescence of the true fire-flies, referred to. The last-named author believed that the light was evoked by the emission of blood, charged with "luciferine," to the luminous organs, where it combined with "luciferase," an enzyme formed in the luminous organs themselves.

THE current number of the *Quarterly Journal of Microscopical Science* (vol. lxii., part ii.) contains an interesting paper by Dr. S. F. Harmer on that hitherto very imperfectly known member of the British marine fauna, *Phoronis ovalis*. This species was described so far back as 1856 by Strethill Wright, in the same papers in which the genus Phoronis was first established, a genus which has since given rise to an immense amount of discussion on account of its very problematical relationships. Curiously enough, up to the date of publication of Dr. Harmer's memoir, the species in question had never again been recorded, and considerable doubt had been thrown upon its validity. Its mode of life, rather than its rarity, is probably responsible for its having escaped re-discovery for more than half a century, for it inhabits burrows in the shells of mollusca, along with numerous boring animals, such as Cliona and Polydora. The original specimens came from the Firth of Forth, those examined by Dr. Harmer from the Northumberland coast. A detailed description of the anatomy is given, with numerous illustrations, and stress is laid upon

the striking powers of regeneration and multiplication by transverse fission. It is suggested that *Actinotrocha pallida*, found at Heligoland and Wimereux, is the larval form of *Phoronis ovalis*.

THE trustees of the British Museum have just issued the fourth report on Cetacea stranded on the British coasts. This is the work of Dr. S. F. Harmer, the keeper of the department of zoology in the British Museum (Natural History), and contains the records for 1916. In his preface Dr. Harmer tells us that the number of stranded Cetacea reported has continued to be adversely affected by the war, but it has reached twenty-nine, which is one more than in 1915. With the exception of a Sowerby's whale, from Lincolnshire, all the most interesting specimens have been obtained from the western, or south-western, coasts of England, Scotland, and Ireland. The value of these reports is beyond dispute, and it increases annually, since by the accumulation of such records an immense amount of material will become available, both as to the character of the Cetacean fauna of our seas and in regard to the migrations of these animals. Already it has become apparent that Cuvier's whale (*Xiphius cavirostris*) is not, after all, a very rare visitor to our seas, and what seems to be the first record of a specimen of this species recorded from the English coast is registered in this report. It was stranded in June last, at Watergate, Cornwall. A Sowerby's whale (*Mesoplodon bidens*) from Lincolnshire, a white-sided dolphin (*Lagenorhynchus acutus*) from Co. Mayo, and a young sperm whale (*Physeter catodon*), with uncut teeth—apparently a "sucker"—from Co. Galway, are other subjects of importance in this report. Finally, mention must be made of the stranding of a huge grampus, *Orca orca*, in the Solway Firth in May last. The flippers of this animal were of enormous size, and have been secured for the museum, where they have been dissected and casts, for exhibition purposes, have been made from them. They show many surprising structural peculiarities, which are to be described in detail in the near future.

MR. W. BICKERTON, in the Transactions of the Hertfordshire Natural History Society (vol. xvi., part iii.), records some interesting facts about the feeding habits of the greater and lesser spotted woodpeckers, which, during the months of December, January, and February, haunt osier-beds for the sake of feeding on the larvæ of some small fly which lives in burrows in the stems of willow twigs. To obtain these the bark is stripped from the twigs, enabling the larva to be extracted by the invader's tongue. So far the species to which this larva belongs is not known, but the authorities of the British Museum (Natural History) are said to be investigating the matter, from materials supplied by Mr. Bickerton. He believes that in this habit of bark-stripping we have an indication of the significance of the extreme density of the horny sheath of the woodpecker's beak. That is to say, this is not due in the first place to the needs of hewing tunnels through sound wood to secure a nesting-hole in hollow trees. Two other papers in this number will repay careful perusal. One of these is on the "Hertfordshire Bourne in 1916," by Mr. John Hopkinson, the other on the "Satyrid Butterflies of Hertfordshire," by Mr. A. E. Gibbs.

THE Cotteswold Naturalists' Field Club, with the assistance of the Rev. H. I. Riddelsdell, is making good progress in the collection of material for the compilation of the flora of Gloucestershire. As an instance of the new material collected up to the present, it may be noted that the chairman of the committee, the Rev. Walter Butt, announces, in vol. xix., part ii. of the Proceedings, that a collection of violets from the county was sent to Mrs. Gregory, of Cambridge, the leading authority on this flower, with the result that twelve new varieties were established for Gloucestershire, including, it is believed, *Viola rupestris*, Schmidt, the rarest violet in Great Britain, hitherto found only in Teesdale. Mr. Charles Bailey, who has recently presented his splendid herbarium to the Manchester University, has examined the list and describes it as "amazing."

THE Danish Meteorological Institute has published its annual survey of the state of the ice in Arctic seas for 1916. The publication, as usual, is in both Danish and English, and is supplied with charts for every month from April until August. No observations for the year were received from the Bering Sea, Beaufort Sea, north of Siberia, or Hudson Bay. Information is also wanting for the Kara Sea, despite the fact that a British steamer crossed it last summer. The abnormal conditions of the Spitsbergen ice, already noted in NATURE, were closely related with the conditions in the Barents Sea. After an abnormal westward extension of the ice, the pack receded in April almost to the coast of Novaya Zemlya, but advanced again in May and June. Even in June there was ice in the White Sea, and it was not until August that the Barents Sea was clear of ice to Nova Zembla and Hope Island. On the other hand, Iceland was unusually free of ice throughout the year, except during June and July. The Danish Meteorological Institute has also issued, as a separate publication, a useful summary of the ice conditions for the last twenty-one years in the Kara, Barents, Greenland, and Bering Seas, Davis Strait, and Baffin Bay. Charts are included for the months from April to August, showing the average limits, together with the maximum and minimum limits of the ice, and tables are given of the ice-covered area in the Barents and Greenland Seas for each of those months throughout the series of years.

ACCORDING to a paper published in the *Bulletin des usines de guerre*, the change in volume produced by hardening (quenching) steel is small if the hardening temperature is kept below a certain limit. Hardening in oil gives less variation in volume than hardening in water. Special metals, such as nickel-steel, show less diminution in volume than the carbon-steels. Eutectic steels "crack" more frequently than carbon-steels, which latter undergo considerable changes of volume. Finally, from experiments carried out, in flat pieces the tension is distributed uniformly in every direction, while in cylindrically shaped pieces the ends contract and become hollow, the piece bellying out.

DR. JOHN AITKEN'S well-known papers on "Dust, Fogs, and Clouds" and on "Dew," originally published in the Transactions of the Royal Society of Edinburgh (1880, 1887), have been re-issued as one pamphlet by the council of the Royal Society of Edinburgh. The steady demand by the scientific world for copies of these papers having almost exhausted the parts of the Transactions in which they were published, the council felt it a duty to reprint them together as one pamphlet with the original paging. The importance of these papers has long been recognised by all workers in meteorology. They form together a pamphlet of ninety quarto pages, and copies may be obtained through the society's publishers, Messrs. Robert Grant and Son, 107 Princes Street, Edinburgh, and Messrs. Williams and Norgate, 14 Henrietta Street, Covent Garden, London, W.C.2, at a cost of 7*s*. 6*d*.

IN *Scientia* for January Mr. Philip E. B. Jourdain discusses the function of symbolism in mathematical logic. He maintains that until comparatively recently, symbolism in mathematics and the algebra of logic had the sole aim of helping reasoning by giving a fairly thorough analysis of reasoning and a condensed form to the analysed reasoning, which should, by suggesting to us analogies in familiar branches of algebra, make mechanical the process of following the thread of deduction; but that, on the other hand, a great part of what modern mathematical logic does is to increase our subtlety by emphasising "differences" in concepts and reasonings instead of "analogies." He points out the confusion of thought which has led many to believe that mathematical logic seeks to displace the free spirit of discovery or invention in mathematics, and the misunderstanding of the particular form of "economy of thought" used throughout mathematics and symbolic logic. He then deals with the function of this kind of economy and the necessity of observing the distinction between logic and psychology, and concludes by sketching some of the results of modern mathematical logic.

WE have received from the Cambridge Scientific Instrument Company List 134, which describes a measuring microscope for workshop use which can be arranged to measure horizontal or vertical lengths up to 4 cm. with an accuracy of 0·0001 cm. List 191 describes a thermo-couple potentiometer capable of reading up to 90 millivolts with an accuracy of a microvolt. List 912 describes the various forms of recording and index thermometers reading up to 540° C. They depend on the expansion of mercury enclosed in a steel bulb, a fine bore flexible steel tube, and a Bourdon spiral which actuates the pointer of the direct reading or the pen of the recording form of instrument.

"CHEMISTRY and Technology of Oils and Fats," P. J. Fryer and F. E. Weston, and "Naval Architecture," J. E. Steele, are in the press for appearance in the *Cambridge Technical Series* (Cambridge University Press). The following works are in preparation for inclusion in the same series: "Architectural Building Construction," W. R. Jaggard and F. E. Drury, vols. ii. and iii.; "Electrical Engineering," Dr. T. C. Baillie, vol. ii.; "Automobile Engineering," A. G. Clark; "Electro-Technical Measurements," A. E. Moore and F. Shaw; "Paper: Its Uses and Testing," S. Leicester; "Mining Geology," Prof. G. Knox and S. Ratcliffe-Ellis; "Textile Calculations—Materials, Yarns, and Fabrics," A. M. Bell; "Laboratory Note Book for Applied Mechanics and Heat Engines," F. Boulden; "Elements of Applied Optics," W. R. Bower; "Electric Installations," C. W. Hill; "Accounting," J. B. Wardhaugh; "Chemistry for Textile Students," B. North and N. Bland; "Dyeing and Cleaning," F. W. Walker; "Experimental Building Science," J. L. Manson, vol. ii.

OUR ASTRONOMICAL COLUMN.

PERSISTENT AURORA.—By taking advantage of the sensitive spectroscopic method of detecting faint aurora, Dr. V. M. Slipher has obtained further evidence of a permanent illumination of the night sky by auroral light (*Popular Astronomy*, vol. xxv., p. 274). A large percentage of the luminosity is concentrated in the yellow-green line about λ 5572, and exposures of only a few hours were sufficient to give impressions with the small spectrograph employed. From June, 1915, to November, 1916, upwards of fifty exposures were made at Flagstaff on different parts of the sky, and the characteristic line appeared in all the photographs. The observations suggest that the auroral light is more intense towards the horizon, and possibly towards the sunrise and sunset points of the sky, but more extensive observations are necessary in this connection.

A NEW CATALOGUE OF DOUBLE STARS.—An important catalogue of the double stars discovered visually since 1905 has been published as vol. lxi. of the Memoirs of the Royal Astronomical Society. The author is Mr. Robert Jonckheere, a well-known observer of double stars, who was director of the observatory of the University of Lille until the events of the war drove him to England as a refugee in October, 1914. The exile thus abruptly forced upon him has given Mr. Jonckheere the opportunity of completing the present catalogue. Most of Mr. Jonckheere's own observations were made at Lille with an equatorial refractor of 14-in. aperture, but since his arrival in this country he has made extensive use of the 28-in. refractor at Greenwich. The catalogue, however, is not exclusively devoted to the author's discoveries and measurements. It includes all the double stars to the year 1905 which were not included in Burnham's general catalogue of 1906, and all the pairs discovered from that date to the end of 1916, the term "double star" here being applied only to those of separation less than 5″. The limit of N.P.D. is 105°, and the positions are given for the epoch 1920. The total number of entries is 3950. The catalogue is conveniently planned, and will doubtless greatly facilitate the work of double-star observers.

REPORT OF MOUNT WILSON OBSERVATORY.—Prof. Hale's report on the work at Mount Wilson during 1916 records new and significant advances in several departments, many of which we have already noted. The first place is naturally given to the spectroscopic method of determining the distances of stars, which is now considered to be established as a fundamental contribution to practical astronomy, and has already afforded valuable confirmation of the conclusions of Russell and Hertzsprung regarding the existence of giant and dwarf stars. Scarcely second in interest is the investigation of periodic spectral changes in the Cepheid variables, which must have a significant bearing upon the interpretation of stellar types as well as upon the nature of the variables of this class.

The use of the new 13-ft. spectroheliograph has revealed the vortex structure about sun-spots in exquisite detail, and certain other investigations have suggested that the forms recorded represent hydrodynamic phenomena rather than lines of force of the magnetic fields underlying the spots. No trustworthy evidence of the Stark effect in the sun has yet been obtained, but further work on the general magnetic field of the sun has confirmed the conclusion that the magnetic axis does not coincide with the axis of rotation; it is inclined at an angle of 5·2°, and revolves in a period of 31·51 days ± 0·62 day. A new map of the sun-spot spectrum has been completed for the region λ 6450 to λ 6000, and the large scale of 1 cm. to the Ångström is sufficient to show the chief Zeeman phenomena.

Important results have also been obtained in studies of star clusters and nebulæ, and in laboratory investigations.

Good progress has been made with the 100-in. reflector, and it is hoped that this giant instrument will be in actual use in the near future.

THE PAY AND SUPPLY OF TEACHERS.

THE striking facts and figures given in the presidential address recently delivered by Mr. T. H. J. Underdown to the National Union of Teachers, and published in NATURE of April 19, show that the whole fabric of our primary educational system is seriously threatened with disaster. Unhappily, the secondary and technical schools of the country are faced with the same danger from precisely the same causes. The systematic underpayment of the teachers and the resultant shortage of the supply must cause grave misgivings to all who have a real conception of the value of a good secondary education and its necessity, if success is to be achieved in the future in the various branches of commercial and scientific activity. Our national efficiency depends to a large degree upon the quality of our secondary education, and any such education worthy of the name will be impossible unless the present conditions of service obtaining in the teaching profession are radically and speedily altered.

It is characteristic of our national indifference towards education that, not merely the man in the street, but apparently also the leading members of scientific and commercial circles, have no knowledge of the utterly insufficient salaries paid to those upon whom the important duty of training the future generation falls; or, at best, if they have cognisance, they throw the responsibility upon the local county or borough authority, and wash their hands of the whole business. A sufficient proof of the inability of the local authorities to manage education under present conditions is evinced by the figures quoted by Mr. Underdown, and by the fact that the average salary paid to the assistant-masters in the aided and maintained secondary schools of the country, as shown by an inquiry made by the Incorporated Association of Assistant-masters just prior to the outbreak of war, is 175*l.* 10*s.* If the nation expects to continue to get highly trained, competent teachers, necessarily men of culture and education, who have laid out a large amount of ability and close study, to say nothing of money, for 3*l.* 7*s.* 6*d.* per week, the nation is making a huge blunder. Like any other business concern, it will get, in the long run, just what it pays for. Much has been written during the past year concerning the lack of science and scientific training in secondary schools in general, but is it to be expected that a really able and scientific expert will take up teaching with the above figures before him? The difficulty is accentuated by the ever-increasing demand for these experts from the various branches of manufacture and industry, and by the migration of teachers generally into more remunerative and less arduous spheres of work.

A large number of authorities and schools make no provision for systematic increase, while the following tables show the inadequacy of the scales that do exist :—

Maxima	England			Wales
	County Councils	County Boroughs	"Published" Schools	
Above 250*l.*	1	1	2	—
201*l.*–250*l.*	6	12	5	5
200*l.*	7	12	11	2
Above 180*l.* and below 200*l.*	3	6	2	1
180*l.* and below	—	14	26	10

Notes—(i) Figures for July, 1914.
(ii) Special cases excepted as being outside the range of the ordinary qualified assistant.

To quote a typical case, the maximum for honours graduates after sixteen years' service is 190*l.* Another has 160*l.* as the ultimate reward for ten years' service. Other "scales" have Gilbertian maxima. Two are as low as 130*l.*, and five are below 150*l.*

The actual salaries received will show that our educational experts have been trying to run education upon the principles of lowest tender and cut prices. Some seven or eight university graduates receive less than 100*l.* a year. One Oxford M.A., after fifteen years' service, gets 120*l.* Only 18 per cent. of the masters receive more than 200*l.*

The grudging and meagre response to the demands of the teachers for a war allowance affords a glaring insight into educational administration and its reaction upon its employees. To quote, or, rather, misquote, from one of our most successful and popular teachers: "Those who polish the floors and those who survey the roads can be generously treated, but those who polish the brain are asked to wait for more opportune times, or are put off with a dole equal to an office boy's increment of wage—forsooth, because they are so many and the rates must be kept low!"

We note with pleasure and endorse thoroughly the recent statement of the President of the Board of Education that "the calling of secondary-school masters has yet to be made reasonably attractive to a really able man. . . . Somehow or other we must attract these men"—and may *we* add "keep them"? The proposed remedy—an additional grant of 433,900*l.*, of which a part is to be handed over to the authorities and schools, of which a part again is to be allocated to more or less spasmodic increments of salary—will cover only a portion of the recent increase in the cost of living. The sum is admittedly only a beginning, but the situation demands methodical measures even more urgently than it does money. Before it is too late, the country should insist upon the establishment of a regular and national system of payment, if the prospects and status of the profession are to be raised to such a level that it can fairly compete with the other professions for the best intellects from all classes and spheres of life.

Experience shows that the majority of the local authorities fail to realise the national unity of education. The average councillor thinks in terms of bricks and mortar, and so long as he regards education as one of the branches of architecture, so long will the real management remain in the hands of highly paid clerks and secretaries, who, however zealous they may be, work in watertight compartments, and have no interest in making education a national concern. Efficiency in education stands or falls with the man who actually teaches, and no amount of expensive inspectorial or administrative officialdom will compensate for the cheeseparing policy of underpaying the teachers.

Amongst the multiplicity of reforms rightly being advocated at present are included the extension of the school-life and the expansion of the facilities for secondary education. Official figures show that there are only 84,000 pupils between the ages of fourteen and eighteen in England attending grant-earning secondary schools, of which merely 21,000 remain at school to an age beyond sixteen years—an age of expanding receptive faculties, at which moral training is of inestimable benefit. It has been estimated that an army of 20,000 teachers of the secondary school type will be required, in addition to the 10,000 already available, to staff the secondary schools proper, the junior technical schools, the day continuation schools, and the part-time trade schools of the near future. A great part of this number must have expert scientific knowledge combined with training. Under the existing conditions, the supply of teachers is quite

inadequate and is rapidly diminishing. The supply of teachers in grant-earning schools is at present largely derived from the pupils passing from the primary schools to the secondary schools, there to be maintained out of public funds almost entirely throughout their scholastic career. Education authorities, in their endeavours to obtain the necessary staffs, have adopted the doubtful policy of attracting pupils to the profession by the offer of educational facilities and increased maintenance allowances, in some cases despite the moderate standard of ability displayed.

However anxious the Government may be to embark on far-reaching schemes, it will fail unless the supply of the men who are to carry out those schemes is present; and the supply of men of the right type will not be forthcoming unless (1) a national minimum salary scale of really adequate terms is established for all teachers in secondary schools; (2) teachers are free to move from one area to another without loss of position, salary, and pension rights.

Such a system would do away, once for all, with the present enormous disparity in the salaries of different men with the same qualifications engaged in the same work and in similar areas.

The present time affords an excellent opportunity of introducing a system obviously necessary and long overdue. It is to be hoped that the Government will not adopt the futile policy of trying to patch up here and there, but will lay the foundation of a national structure in which every child shall enjoy, as a birthright, the most suitable and valuable education compatible with its capability.

G. D. DUNKERLEY.
ALEX. BLADES.

SOIL AERATION IN AGRICULTURE.

SOME time ago (NATURE, February 24, 1916, vol. xcvi., p. 716) we directed attention to a paper by Mr. and Mrs. Howard, of the Agricultural Research Institute, Pusa, on the ventilation of Indian soils. "More air and less water" was then set before the native cultivator as the secret of successful crop production. With characteristic enthusiasm for his subject, Mr. Howard has since developed this idea in a lecture given during a meeting of the Board of Agriculture at Pusa, and now published as Bulletin No. 61 of the Agricultural Research Institute. Although discussed chiefly in relation to Indian conditions, and particularly the alluvial soils of the Indus and Ganges valleys, the subject in its broader aspect is of universal importance to agriculture. The heavy rains of the monsoon falling on these soils, which consist largely of small particles of fairly uniform size, cause the surface to run together and form a crust; the soil loses its porosity and aeration is impeded. The remedy advocated is the incorporation with the first foot of soil of *thikra* (tile fragments) at the rate of 50 tons per acre. Leguminous plants like gram respond at once to the improved aeration. Nothing is said as to the cost of this treatment, or if it can be applied commercially over considerable areas.

Java indigo is another leguminous plant of special interest, and about this Mr. Howard has a great deal to say in relation to soil aeration. He holds that the variable dyeing power which has greatly handicapped the natural indigo in competition with the synthetic product of the German factories is due to defective and irregular aeration. The indigo plantations of Bihar lie on the higher ground of an undulating country with rice in the valleys between. During the monsoon all the country becomes more or less waterlogged except the crest of the ridges, and occasionally some of these go under. The high-water mark is said to be rising at the rate of 3 in. a year, owing to increasing interference by embankments (canal, rail, and road) with the natural drainage of the country. Mr. Howard suggests that "when a railway has to run across a broad, shallow drainage line, it might pay to lay it flat and to let the water run over it. At most the interruption of traffic would not be a very long one." It would be interesting to hear what the permanent-way departments and traffic superintendents of the Indian railways think of this idea. Whatever the cure, it is evident that the activities of the civil engineer have been harmful to agriculture in some ways, and a good case is made out for a thorough study of the drainage systems of India from this point of view.

With regard to water supply, the author goes even further than in his previous paper, and suggests that some of the money now wasted on over-irrigation might more profitably be spent on aerating stations for the supply of oxygen to the insufficiently aerated water of the rice swamps. In this connection a sharp distinction is drawn between rice and other plants which is difficult to follow. It is said that while the former takes up its oxygen in the dissolved state from the swamp water, other plants, *e.g.* wheat, assimilate it as free oxygen. As the root-hairs of the wheat plant must be in contact with moisture if they are to function properly, it is probable that oxygen, like other plant foods, passes in solution through a film of water surrounding the roots. Wheat, barley, and peas all grow well in water culture so long as the nutrient solution is kept aerated. If the supply of dissolved oxygen falls off, the plant suffers at once, even if the upper roots have access to free oxygen. The distinction between swamp rice and wheat seems rather to be that the former requires much water and relatively little oxygen, while the latter needs a moderate amount of moisture and much oxygen. Under favourable conditions wheat obtains this by the rapid passage of the gas through the water films surrounding the roots and soil particles.

Turning homewards, the variation in the quality of malting barleys grown on different British soils is shown to be due to soil aeration. The best malt comes from the light land where natural aeration is good. One effect of the expensive organic manure used by market-gardeners and hop-growers is to increase the aeration of the soil and encourage root development. It is suggested that a permanent aerator like the Indian *thikra* might achieve the same result at a lessened annual charge for manure.

We have only touched on a few of the many interesting points raised in Mr. Howard's lecture, which deals with one of the most important factors in crop production. Although the necessity for soil aeration has been unconsciously recognised ever since man first drove a spade into the earth, because of its very obviousness agricultural science has scarcely given the subject the attention it deserves. E. H. R.

THE INDIAN ASSOCIATION FOR THE CULTIVATION OF SCIENCE.[1]

THE genetic relation between the serious pursuit of natural science and the profession of medicine is nowhere better illustrated than in British India, and in British India nowhere better than by the Asiatic Society of Bengal (the original "Asiatick Society"), and by its autochthonous congener, the Indian Association for the Cultivation of Science, founded in 1876

[1] Report of the Indian Association for the Cultivation of Science for the Year 1914. (Calcutta, 1916.)

by Dr. Mohendro Lal Sircar, a practitioner of medicine in the Indian quarter of Calcutta.

At a time when Indian universities were the purely examining bodies so dear to the Philistine soul, when secondary education in India was mainly bookmongery (to call it "literary" would be a fault to heaven), and literary gentlemen were brought from England to feed raw Indian youths with husks of commentary laboriously ground from the English classics, Dr. Mohendro Lal Sircar, a medical man immersed in the anxieties of a private practice, was probably the only educated Indian in Bengal whose ideas of education were approximately those held generally to-day by men of science in Great Britain.

Dr. Sircar, being beyond his learning and accomplishments a man of great sagacity and urbanity, did not agitate or make a noise, but, with single-minded devotion to higher issues, he set a-going in a convenient part of his native town, and for many years carefully fostered, a society much of the style of the Companies of Friends of Natural History, the aim of which, to begin with, was, and had to be, generally educative. This society was appropriately called an association for the cultivation of science. By degrees, and by the accretion of laboratories for particular studies, the institution, while retaining an educational character, advanced to the differentiated technical stage; and now, beyond its educational purpose, it has become a well-organised and well-equipped institution for original experimental research.

The report for the year 1914, lately received, shows that in addition to the seven regular courses of lectures on different branches of science delivered to students, there emanated from the association ten original papers—four on physico-mathematical subjects, five chemical, and one biological.

NATIONAL RECONSTRUCTION.[1]

THE British Science Guild, during the twelve years of its existence, has earnestly endeavoured to promote the public and official recognition of scientific research and of scientific organisation and methods as essential factors in national progress. Our journal and our annual reports show the matters to which we have striven to direct attention. It is not our object to secure the advancement of any particular branch of science; each has an association created for that purpose. We seek to provide what may be called a clearing-house of progressive thought, in order that activities which are mutually dependent may be harmonised for the welfare of the State and the Empire, and that the application of scientific knowledge not only to industries, but also to every department of public life, may become a reality. We believe that thus only can our future national advancement and the well-being of our people be placed upon a sound and an enduring foundation.

These are objects which in the past have powerfully appealed to men of science whose vision extended beyond the horizon of their labours to the conception of a State in which research was not only encouraged as a primary necessity of progress, but the results were quickly applied to the direction of energy, the prevention of waste, and the conservation of the forces on which the prosperity of mankind mainly depends.

Before the war, these were voices "crying in the wilderness." Governments and Parliament, which is supposed to control and inspire them, cared for none of these things. In our great public offices science was apt to be regarded as an abstruse mystery which possibly concerned business men and might sometimes obtrude itself inconveniently upon public attention, but had no part or lot in the administration. Speaking broadly, we have been ruled by men for whom scientific conceptions and scientific methods had little or no interest; and partly from this cause our industries were being stealthily undermined and were passing into the control of another people which had laboriously organised all its public and private activities, had been carefully trained quickly to turn scientific discoveries—largely borrowed—to material advantage, and had become obsessed with the mad ambition of imposing its theories of life and conduct by force upon the world.

The war has had the effect of turning a strong searchlight upon the innermost workings of our national life. Our weakness and our potential strength stand plainly revealed. We can see how severely we have suffered and must still suffer from our neglect in the past; and if we strive to ascertain causes, we cannot fail to reach the conclusion that our lack of appreciation of all that science, using the term in the broadest sense, could have conferred upon us lies at the root of many present difficulties. When the question of contraband was being considered, science could have told us what was vital to the prosecution of war by an enemy, and what, therefore, we should use every effort to exclude from his territories. Sir William Ramsay, whose loss, as one of our greatest leaders of scientific thought, we deplore, pointed out the gross fallacies which were permitted to mislead our policy in regard to cotton. Lard was assumed by one of our rulers to be innocuous, because he was unaware that its use for the manufacture of glycerine was an old discovery. The painful revelations of the Dardanelles Commission establish the facts that a fateful decision was arrived at by methods which flagrantly violated scientific principles, and that a complete misunderstanding as to some elementary artillery matters was allowed to exist. And now in the handling of the difficult question of man power there is an evident want of the grasp which sound scientific training can confer.

It would be easy to multiply instances of the ways in which the absence of scientific habits of thought have prejudiced the conduct of the war; but there is another side which must not be forgotten. If we have too often failed in foresight and in the application of orderly methods to the direction of policy, the national genius for improvisation has been strikingly manifested. On the basis of a small Army, the best we ever possessed, we have built up, transported across the seas, equipped, and supplied vast national forces which have shown fighting power unrivalled in our military annals, and have determined the final victory of the cause of the Allies. And further, under the stress of war, we brought science to bear on military requirements in such a way as not only to overtake, but to surpass, German appliances laboriously prepared in years of peace. On a different plane, the war savings propaganda is a good example of well-conceived and successful effort. Nothing can be more certain than that we possess organising capacity, which, if turned to full account, can perfectly respond to the future needs of the Empire.

Reconstruction is now beginning to occupy the minds of all thoughtful men and women. After-the-war problems are being widely discussed, and amid their baffling complexities some great principles stand out as signposts along the path which we must follow.

The material prosperity and the financial stability of the country can be restored only by an increase of production and interchange. This implies the creation of new industries and the economic development of those which exist, combined with a firm hold on old markets

[1] From the presidential address delivered at the annual meeting of th British Science Guild, held at the Mansion House, London, on April 30, by the Right Hon. Lord Sydenham, F.R.S.

and the development of new ones. If our national resources were exhausted, we might well despair of the future; but the resources of the Empire are almost inexhaustible, and their utilisation is only beginning. The Empire can produce all the great food staples—grain, meat, sugar, and fats—sufficient for the supply of a far larger population than it now contains. The fish supply could be very largely increased from Ireland and the banks of Newfoundland. Raw materials of every kind, coal, and mineral oil abound. The Empire has almost a monopoly of some of the rarer metals and earths of which science is making more and more use. We have first to make certain that never again shall Germany obtain control of our raw materials and our key products, and then to ensure that our materials are, so far as possible, manufactured within the Empire. Before the war, almost the whole of the Imperial production of palm kernels went to Holland and Germany, and the oil expressed from them was exported to the United Kingdom as such, or in the form of margarine and other prepared fats. The story of the Australian zinc concentrates is well known. They and the output of Australian copper were discovered to be in German hands when war broke out, as was a great part of the manganese and hides of India. The resources of the Empire amply suffice for the rebuilding of our national prosperity, if by the unstinted application of science in the laboratory, in the workshop, and in the superior direction of commerce and industry they are turned to the fullest account.

The handling of the great question of the supply of power cannot be left to piecemeal treatment. We now have a Board of Fuel Research, which, in co-operation with the British Asociation, is investigating economics, and already an annual saving of fifty million tons of coal is known to be possible. Mr. Newlands estimates that in Scotland more than 1,000,000 electrical horse-power could be obtained from water, and he points out that, in Switzerland, one electrical horse-power obtained from water costs 1*l.* 19*s.* per annum, as compared with 4*l.* 11*s.* 8*d.* in England from coal. The economic advantage of employing water power, wherever practicable, is manifest, and in parts of India, as elsewhere within the Empire, there are resources which need to be turned to account. In matters of such broad importance as power, lighting, and heat, research on the widest scale is necessary, and when conclusions have been reached their application can be secured by the active co-operation of the interests involved assisted by intelligent legislation.

In trade, the first requisite is sound information kept up to date, to which the Germans owe much of their success. We now have four Trade Commissioners representing the Dominions, and India must be similarly provided; but the whole system of consuls and commercial attachés in foreign countries requires complete reorganisation, which Government can carry out only by seeking and following the advice of experienced leaders of commerce.

The Dominions Commission has shown the immense resources of the Empire, and in its final report it directs attention to the importance of cheap, speedy, and efficient transport between Imperial ports. Some years ago I proposed the establishment of an "Imperial Maritime Council," composed of fifteen representatives of the various parts of the Empire, and financed by a 1 per cent. *ad valorem* surtax upon all foreign imports into Imperial ports, which in 1904 would have provided an annual income exceeding 4½ millions. The council was to deal with all matters relating to the maritime communications of the Empire, to build up inter-Imperial transport, and to ensure close study of the means of developing Imperial trade as a whole. The Dominions Commission has now recommended the formation of an Imperial Development Board for these and other analogous purposes. This would be a great step in Imperial reconstruction, leading to far-reaching results, provided that the board were executive, amply provided with funds, and completely severed from politics at home and overseas.

We have now a Department of Scientific and Industrial Research with a State endowment of one million, which will be able to exercise some of the functions of the Board of Science that the British Science Guild has strongly advocated. Each of the Dominions and India will require the same machinery, and Mr. Hughes has undertaken that Australia shall be thus provided, while the Canadian Government has appointed an advisory council to advise a committee of the Cabinet on all matters relating to scientific and industrial research. We have also a Board of Scientific Studies which is carefully investigating our requirements. Systematic and co-ordinated research on a large scale is a primary need, and waste or duplication of effort can be prevented only by such general direction as to ensure that problems are attacked in the localities most favourable to their solution. Special attention must be given to chemistry, which has many important secrets to yield. "The country," said Sir William Ramsay, "which is in advance in chemistry will also be foremost in wealth and general prosperity." We have certainly fallen behind Germany in this vitally important branch of science, not in the ability and insight of our chemists, but in numbers and in the application of chemical discoveries to industry. It is upon chemistry, the use of power, and co-operative methods that agriculture must mainly depend for advancement.

National reconstruction will require in the future the sustained stimulus which education alone can supply. In our public schools and colleges science must take the place to which it has been long entitled. While trained specialists will always be relatively few, all who are destined to play a part in national affairs must receive such a grounding in the natural sciences as to ensure that physical laws and facts will appeal to them, and that scientific methods of thought will become habitual. For this reason, the British Science Guild has strongly urged that a knowledge of science should be required of all candidates in examinations for the Civil Service. There need be no conflict with what are not well described as "humanistic studies." A broad general education is the best foundation for science training, and in so far as literary studies develop breadth of vision and clearness of style, they are valuable helps to the future specialist. Conversely, such subjects as history take new form when they are approached in a scientific spirit.

A Parliament or a Government composed of specialists would be unsuited to its duties; but both need an intelligent appreciation of the relation of science to national life which is now conspicuously lacking. "Mankind," writes Prof. Dewey, of Columbia University, "so far has been ruled by things and by words, not by thought. . . . If ever we are to be governed by intelligence, not by things and by words, science must have something to say about *what* we do and not merely about *how* we may do it more easily and economically."

Apart from what we understand by science teaching, there is the technical training which is needed by foremen and workers in industries, which should be such as to help the abler man to rise. The Departmental Committee on Juvenile Education and Employment has recently reported, and its main proposals are the retention at school of all children up to the age of fourteen, with attendance at continuation classes of

at least eight hours a week up to eighteen. These classes are "to include general, practical, and technical education," and they will probably in many cases take the form of trade schools carrying on the education of young workers who have found employment. The advantages of manual training in primary schools are not sufficiently emphasised in the report. Manual dexterity can be acquired at an early age, and boys might thus gain a truer conception of the dignity of hand labour, while experience shows that technical or elementary scientific knowledge, if attained by practical work, becomes a permanent possession. Greater differentiation between the work of rural and of urban schools is another pressing need.

No one can maintain that our system of primary education has been a failure. As the President of the Board of Education pointed out the other day in his admirable speech, we owe to it, in part at least, the new armies which have brilliantly upheld our national honour on many stricken fields. But we believe that education can do more in the future in developing moral strength and in inculcating the sense of duty and good citizenship. Mr. Fisher has laid down as the ideal of his office that it should build the foundation "for a patriotic and social education worthy of the genius of our people, and a fitting monument to the great impulse which is animating the whole people in the war." We all hope he will be spared to realise that high ideal.

In the tremendous tasks which lie before the nation, Government can play an important part. Statesmanship worthy of the name must lead, inspire, direct, and initiate. In guiding education, assigning defined functions to experts carefully selected for special purposes, exercising their enormous patronage with a single eye to knowledge and efficiency, as well as in encouraging the progress of applied science, and guarding against legislation which may hamper trade and industrial activity, there is ample scope for the action of Governments. Interference in the management of business enterprises will usually be harmful, since, for well-known reasons, the conduct of business affairs by officials in democratic countries is rarely efficient.

Some tariff adjustments may be found desirable; but the idea that national prosperity can, in the long run, be assured by fiscal devices is baseless. In so far as tariffs can stimulate the operation of natural laws, they may be beneficial. When they aim at producing artificial conditions in defiance of law, they usually defeat their ends. They may be used legitimately, and we have been told that they will be used to further the development of the resources of the Empire, and the object having been attained, they can be dispensed with.

I have only dealt with reconstruction in the material sense, which cannot alone guarantee the purer and happier national life which we all earnestly desire. That can be reached only if the whole nation will, in the difficult times that lie before it, follow the shining examples of duty, discipline, and self-sacrifice which have been set by our heroes on the seas, in the field, and in the air. The men who have constantly faced death and shared in dangers and hardships will come back with a new outlook on life. In the trenches there have been no party divisions, no attempts to set class against class, but only shared efforts which are bringing certain victory to a sacred common cause. May we not hope that the great lessons learned by our best manhood in the storm and stress of war will react upon the nation as a whole and render the forms of politics to which we have grown accustomed impossible in the future? The strife of parties and of individuals contending for office and power, the intrigues which have not wholly ceased during this crisis in our fate, the machinery by which party chests are filled and constituencies are manipulated, the false discipline which, by preventing men from voting according to their knowledge and conscience, vitiates the decisions of Parliament upon vital issues, the triumph of words over experience and powers of action—all these things and more have had their day, and we begin to realise the inevitable results.

Reconstruction in the highest and fullest sense can be achieved only by a great national party, seeking solely the welfare of the commonwealth, examining every public question from the view-point of the interests of the community as a whole, and choosing leaders irrespective of class or party, who can be trusted to bring a lofty patriotism and trained intelligence to bear upon the vastly complex and far-reaching problems with which we are now confronted. If these are only visions, then I see no certain prospects of restoring the shaken fabric of the State, of rebuilding our prosperity on a broader and an enduring foundation, of healing the open wounds in our body politic, and of wresting lasting good from the gigantic evils of war.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ST. ANDREWS.—The University museum has just received the entire collection of local and other birds, many very rare, made by Misses Baxter and Rintoul (of Largo and Lahill), for years known as authorities on ornithology, and joint editors of the *Scottish Naturalist*. They have, moreover, in interpolating these, gone over the entire University collection of birds and rearranged and labelled them. Accompanying this noteworthy and valuable gift, for most are exquisite examples of the taxidermist's art, are eight cases with drawers containing named collections of the eggs of birds and of Lepidoptera and other insects, as well as a few skulls and stuffed mammals.

DR. P. MARIE has been appointed to succeed the late Prof. Dejerine as professor of clinical neurology in the University of Paris.

FRÄULEIN A. M. CURTIUS, recently appointed lecturer in French by the philosophical faculty of Leipzig, is, according to the *Nieuwe Courant*, the first woman on the staff of a German university.

THREE research fellowships in, respectively, pathology and bacteriology, medicine, and surgery have been endowed in the University of Chicago by Dr. F. R. Logan, who has given a sum providing an income of 600*l*. a year for the purpose.

IN his presidential address to the Institution of Mechanical Engineers on April 20, Mr. Michael Longridge considered the provision in this country of technical education for engineers. Many persons, he said, still fail to understand that the manual training which enabled an apprentice to become a master craftsman in times gone by does not suffice to turn a schoolboy into an engineer to-day. Differentiation is needed now in the training of the various classes of engineers and workmen, and it is this lack of differentiation which seems to be one cause of the inefficiency of our technical education relatively to its cost. The education available for the higher ranks of engineering is fairly satisfactory in Mr. Longridge's opinion, but that provided for the workman, both general and technical, is most unsatisfactory. "Yet the workman must have better education to qualify him to rise if capable, and to give those who have not the ability to rise some interests outside their daily work and football matches, and also to lessen drunkenness. The need will become

greater as repetition work and automatic machinery replace varied jobs and manual skill. Unless an antidote be provided, the monotony of this kind of work will crush initiative and mental vigour, and instead of skilful craftsmen we shall breed incompetent machines." The address insists that either the school-leaving age must be raised or a system of part-time instruction during working hours of engineering apprentices must be introduced.

THE April issue of the Proceedings of the Institute of Chemistry contains the presidential address delivered by Sir James J. Dobbie on March 1. In it is discussed at length the question of the general education of chemists. Sir James defines the aim of education on its intellectual side as the evenly balanced training of all the faculties of the mind, and claims that this aim can never be attained by the study of science exclusively on one hand, or of the subjects commonly classed as the humanities on the other. At the same time, science must form part of every person's education. Dealing with the question what science subjects should be taught in schools, he lays it down that the one way to obtain satisfactory results is to concentrate on a limited number of subjects, carefully selected with reference to the pupil's age and stage of mental development and to their suitability to serve as an introduction to further science studies. He selects as most suitable subjects for study the facts and principles of biology and those of physics and chemistry as lying at the root of all the other sciences. The study of the properties of matter and of mechanics should, the address maintains, precede the study of the special branches of physics and the study of chemistry. Any scheme of science teaching would be unsatisfactory which does not make some provision for chemistry, and the study of chemistry should be taken next after mechanics. Work such as this should, Sir James Dobbie thinks, be supplemented by wide reading in other branches of science so as to widen the interests of the pupils and to extend their knowledge.

SOCIETIES AND ACADEMIES.

LONDON.

Zoological Society, April 17.—Dr. A. Smith Woodward, vice-president, in the chair.—E. **Heron-Allen**: The mussel-fishery and Foraminifera of Esnandes (La Rochelle), and the early work of Alcide d'Orbigny. A series of slides was exhibited illustrative of the early studies of Alcide d'Orbigny at Esnandes (near La Rochelle), and the mussel-fisheries established there since the year 1035 The experiments of Prof. W. A. Herdman on the west coast of England were referred to, and those of Prof. A. Meek at Holy Island on the east coast. A further series was shown illustrating some of the notable d'Orbignyan species found in the neighbourhood, not recorded from there by d'Orbigny in 1826, but recorded from other localities at that date, and from distant seas between 1839 and 1846. A third series of slides illustrated well-known species from the locality which had been recorded and described by earlier authors, but were not apparently identified by d'Orbigny from the neighbourhood of La Rochelle.

Linnean Society, April 19.—Sir David Prain, president, in the chair.—Dr. D. H. **Scott**: The Heterangiums of the British Coal Measures. Heterangium, Corda, is a genus of Carboniferous plants, based on specimens with the structure preserved, and now classed with the Pteridosperms. It is proposed to group *H. shorense*, *H. tiliaeoides*, and *H. Lomaxii* (of which *H. cylindricum* is only a form) in a new subgenus, Polyangium. It is probable that the Upper Coal Measure species from Autun described by Renault also fall under this subgenus, while most of the very interesting Silesian species, of Millstone Grit age, recently discovered by Dr. Kubart, appear to belong to the simpler type which may be called Euheterangium.—E. S. **Goodrich**: The development of Hatschek's pit and the ciliated organ on the roof of the buccal cavity in Amphioxus from the left anterior cœlomic sac and from an ectodermal preoral pit in the embryo and larva. Following Bateson, the author compared the opening of Hatschek's pit with the proboscis-pore of Balanoglossus and water-pore of Echinoderms.—Miss Nina F. **Layard**: Wooden scratching-tools made by an African parrot. Notes have been taken by the author of the behaviour of a grey African parrot, first in choosing out natural tools, such as pointed seeds and quills, for use as poll-scratchers, later in pointing up a match for the same purpose, and finally shaping up wood in such a way as to appear to warrant the bird's claim to be described as a tool-maker. The contention is that if it can be proved that the parrot, requiring an implement that would penetrate the feathers to the scalp, purposely produced a point with this object, then the border-line between the mere tool-user and the tool-maker has been crossed.

PARIS.

Academy of Sciences, April 10.—M. A. d'Arsonval in the chair.—H. Le **Chatelier**: The National Research Council in the United States.—P. **Puiseux** and B. **Jekhowsky**: Study on the general form of the lunar globe. The moon appears to be slightly elongated in the direction of its axis of rotation. A tetrahedral deformation cannot be regarded as definitely proved.—J. **Bergonié**: The superiority of agricultural work medically prescribed and controlled to the physical therapeutic treatment of the hospitals in the treatment of after effects of war wounds. The results of a practical comparison of the two methods taken over a period of thirty months prove the superiority of the open-air natural treatment to combinations of electrotherapy, mechanotherapy, thermotherapy, kinesitherapy, mechanical and manual massage, hydrotherapy, etc. The superiority is especially marked in the case of men employed on the land previous to the war. Even in non-agricultural workers the superiority, although less marked, is still considerable.—G. **Julia**: The reduction of forms to indeterminate, conjugated non-quadratic forms.—G. **Arnaud**: The family of the Microthyriaceæ.—A. F. **Legendre**: The structure of the Sino-Tibetan massif.

April 16.—M. A. d'Arsonval in the chair.—A. **Lacroix**: The haüyne lavas of the Auvergne and their homogeneous enclosures.—H. Le **Chatelier**: The synthesis of ammonia. The author gives extracts from his patent of September, 1901, for the synthetical preparation of ammonia from its elements, work taken up seven years later by Haber and now made use of on the large scale in Germany.—A. **Gautier**: Increase in the curative properties of quinine and of mercury by the organometallic compounds of arsenic. The joint administration of arrhenal and quinine chlorohydrate cures cases of malarial fever which have resisted large doses of quinine alone. The association of arsenical compounds with salts of mercury enables effective cures to be produced with much reduced doses of mercury, and cases of syphilis respond rapidly to this treatment.—E. **Ariès**: The coefficients of thermo-elasticity at low temperatures and Nernst's hypothesis.—M. **Riquier**: A property of the analytical functions of any number whatever of imaginary variables.—M. **Mesnager**: The representation of concentrated charges by trigonometrical series.—C. E. **Guye** and C.

Stancescu: Explosive potential in carbon dioxide at high pressures. Experiments with carbon dioxide at pressures between five and forty-five atmospheres, and with striking distance between the plates (*d*) varying between 0·34 mm. and 2·24 mm., proved that the explosive potential $V = F(md)$, where m is the number of molecules in unit volume of gas.—P. **Woog** and J. **Sarriau**: A method of observation and measurement of rapidly periodic magnetic phenomena. An application of the Koenig manometric capsule.—M. **Trabut**: The hybrid origin of cultivated lucerne.—A. **Guilliermond**: The alterations and the characters of the chondriome in the epidermal cells of the tulip flower.

BOOKS RECEIVED.

The Secretion of Urine. By Prof. A. R. Cushny. Pp. xi+241. (London: Longmans and Co.) 9*s*. net.

The Borderlands of Science. By Dr. A. T. Schofield. Pp. viii+255. (London: Cassell and Co., Ltd.) 6*s*. net.

The Distribution of Attention. By E. N. McQueen. Pp. vi+142. (Cambridge: At the University Press.) 5*s*. net.

Electric and Magnetic Measurements. By C. M. Smith. Pp. xii+373. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 10*s*. 6*d*. net.

Science Française Scolastique Allemande. By Prof. G. Papillault. Pp. 154. (Paris: F. Alcan.) 2 fr. 50.

Theophrastus: Enquiry into Plants, and Minor Works on Odours and Weather Signs. With an English translation by Sir A. Hort. (Loeb Classical Library.) 2 vols. Vol. i., pp. xxviii+474; vol. ii., pp. ix+499. (London: W. Heinemann.) 5*s*. net each vol.

Stresses in Wire-wrapped Guns and in Gun Carriages. By Lt.-Col. C. d'H. Ruggles. Pp. xi+259. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 13*s*. 6*d*. net.

The Chemistry of Dyestuffs. By M. Fort and Dr. L. L. Lloyd. Pp. xi+311. (Cambridge: At the University Press.) 7*s*. 6*d*. net.

The Mexican Indians North of Mexico. By W. H. Miner. Pp. xi+169. (Cambridge: At the University Press.) 3*s*. net.

Ethnobotany of the Tewa Indians. By W. W. Robbins, G. P. Harrington, and B. Freire-Marreco. Pp. xii+124. (Washington: Government Printing Office.)

DIARY OF SOCIETIES.

THURSDAY, MAY 3.

ROYAL SOCIETY, at 4.—Election of Fellows. At 4.30.—Croonian Lecture: The Excitation Wave in the Heart: Dr. Thomas Lewis.

ROYAL INSTITUTION, at 3.—Pagan Religion at the Time of Coming of Christianity: Prof. Gilbert Murray.

MATHEMATICAL SOCIETY at 5.30.—Sir George Stokes and the Theory of Uniform Convergence: G. H. Hardy.—A Symmetrical Condition for ω-Apolar Triads on a Cubic Curve: Dr. W. P. Milne.

IRON AND STEEL INSTITUTE, at 10.30 a.m.—Steel Ingot Defects: J. N. Kilby.—Influence of Surface Tension on the Properties of Metals, especially of Iron and Steel: F. C. Thompson.

INSTITUTE OF METALS, at 8.30.—Seventh May Lecture: Researches made Possible by the Autographic Load-Extension Optical Indicator: Prof. W. C. Dalby.

LINNEAN SOCIETY, at 8.—A Monograph of the Genus Fumaria: H. W. Pugsley.—The Flowers of the Mahua, *Bassia latifolia*, Roxb.: G. M. Ryan.—An Autograph of Vice-Admiral Bligh (1754–1817): C. D. Sherborn.—Two Critical Plants of the Greek Flora: C. C. Lacaita.—(1) Paracubaris, a New Genus and Species of Terrestrial Isopoda from British Guiana; (2) The Oral Appendages of Certain Species of Marine Isopoda: Dr. W. E. Collinge.

CHEMICAL SOCIETY, at 8.—Researches on Asymmetric Nitrogen Compounds. I.: 5-Aminosalicylic Acid and Related Compounds; II.: Some Nitrated Oxydiphenylamines; III.: Oxyphenylglycine: The late R. Meldola. H. S. Foster, and R. Brightman.—Contributions to the Chemistry of Caramel. I.: Caramelan: Miss M. Cunningham, and C. Doree.

FRIDAY, MAY 4.

ROYAL INSTITUTION, at 5.30.—Some Guarantees of Liberty: H. Wickham Steed.

IRON AND STEEL INSTITUTE, at 10 a.m.—The Penetration of the Hardening Effect in Chromium and Copper Steels: L. Grenet.—Cementation by Gas under Pressure: F. C. Langenberg.—Origin and Development of the Railway Rail: G. P. Raidabaugh.—Case Hardening of Iron by Boron: N. Tschischewsky.—Determination of the Line S.E. in the Iron-Carbon Diagram by Etching Sections at High Temperatures *in vacuo*: N. Tschischewsky and N. Schulgin.

GEOLOGISTS' ASSOCIATION, at 7.30.—The Correlation of the Ingletonian Slates: J. F. N. Green.—The Landslips of Folkestone Warren and the Thickness of the Lower Chalk and Gault near Dover: C. W. Osman.

SATURDAY, MAY 5.

ROYAL INSTITUTION, at 3.—The Electrical Properties of Gases: Sir J. J. Thomson.

MONDAY, MAY 7.

VICTORIA INSTITUTE, at 4.30.—The Pre-requisites of a Christian Philosophy: Rev. Dr. Whately.

ARISTOTELIAN SOCIETY, at 8.—The Basis of Critical Realism: Prof. G. Dawes Hicks.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Race and Nationality: Dr. Marion Newbigin.

ROYAL SOCIETY OF ARTS, at 4.30.—The National Shortage of Iron Ore Supplies. II.: Oversea Iron Fields which Supply the British Market: Prof. W. G. Fearnsides.

SOCIETY OF ENGINEERS, at 5.30.—The Goods Clearing House System Explained: Lord Headley.

TUESDAY, MAY 8.

ROYAL INSTITUTION, at 3.—Rhythmic Action in Muscle and in Nerve: Prof. C. S. Sherrington.

WEDNESDAY, MAY 9.

ROYAL SOCIETY OF ARTS, at 4.30.—Works Organisation and Efficiency: Prof. W. Ripper.

THURSDAY, MAY 10.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Permanent Periodicity in Sunspots: Sir Joseph Larmor and N. Yamaga.—The High-frequency Resistance of Multiply Stranded Insulated Wire: Prof. G. W. O. Howe.

ROYAL INSTITUTION, at 3.—Pagan Religion at the Time of the Coming of Christianity: Prof. Gilbert Murray.

FRIDAY, MAY 11.

ROYAL INSTITUTION, at 5.30.—Radioactive Haloes: Prof. J. Joly.

ROYAL ASTRONOMICAL SOCIETY, at 5.

SATURDAY, MAY 12.

ROYAL INSTITUTION, at 3.—The Electrical Properties of Gases: Sir J. J. Thomson.

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