THURSDAY, MAY 17, 1917.

ELEVEN BRITISH MATHEMATICIANS.

Mathematical Monographs. No. 17. *Lectures on Ten British Mathematicians of the Nineteenth Century.* By Alexander MacFarlane. Pp. 148. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd., 1916.) Price 5*s.* 6*d.* net.

THE lives of mathematicians, as a rule, are free from sensational episodes, and provide no material for spicy biographies. But these unobtrusive beings form a quaint and varied set; and many people would be surprised to hear how many good stories are on record about their oddities, their accomplishments—nay, even their displays of wit.

The author of these lectures was himself a noteworthy man. A Highlander, and a pupil of Tait, he became an ardent quaternionist, and helped to found the International Association for Promoting the Study of Quaternions. Tait was a prejudiced and pugnacious champion of quaternions as against all other vector algebras, and he infected with his enthusiasm quite a considerable number of people. MacFarlane, in the land of Willard Gibbs, shook off most of this obsession, but there are traces of it even in these addresses, as on p. 45, where he says "most analysts are still crawling in Flatland," after a reference to Hamilton's application of quaternions to three-dimensional space. One might have thought this a place for some reference to Grassmann, whose calculus applies to space of any number of dimensions; not so, and although the index gives twenty-three references to Hamilton and fifteen to Tait, Grassmann is not so much as mentioned.

Apart from this blemish, the lectures deserve the warmest praise. In the first place, the list is truly representative, consisting of Peacock, De Morgan, Hamilton, Boole, Cayley, Clifford, H. J. S. Smith, Sylvester, Kirkman, and Todhunter. A few remarks may be offered on these worthies, each in his turn, and as each lecture suggests a reflection.

George Peacock will always be associated with the "principle of equivalent forms." As a principle it is as dead as a doornail, at any rate as it used to be appealed to; but, all the same, Peacock was one of the first to realise the general character of pure algebra as an abstract symbolism with more or less arbitrary fundamental rules. More than this, he was able, by his position at Cambridge, to make a vast improvement in the study of mathematics there. It was in his time that Leibniz's notation in the differential calculus obtained official recognition in England, partly owing to the efforts of the Analytical Society, "the object of which was stated to be to advocate the *d*'ism of the Continent versus the *dot*-age of the university." Peacock's "Examples" and "Symbolical Algebra" are still worth consulting, even apart from their historical interest.

The lecture on De Morgan is very good, but after our recent review of the reprint of the "Budget," we content ourselves with quoting his description of himself as *homo paucarum literarum*, apparently as a man who declined to be either F.R.S. or LL.D.[1]

As might be expected, the lecture on Rowan Hamilton is well-informed and appreciative, though the reference to his work in dynamics is meagre indeed as compared with the account of his calculus of quaternions. It may be noted that both Salmon and Cayley attended Hamilton's first course of lectures on quaternions.

George Boole, in some ways, is typically English. He may fairly be called the inventor of symbolic logic, and his work on the so-called symbolical method of solving differential equations is that of a pioneer. His predecessor is Peacock, and we may be proud to think that among his successors are Russell and Whitehead, even if the former, in a fit of just indignation, should become an American citizen. MacFarlane's comments on Boole's logical calculus are, technically, the weakest things in his course; on pp. 57–58 he shows that he has not appreciated the modern meaning of "class," and pp. 59–62 are simply "obfuscation," except to a man who cannot improve on the old Euler diagrams.

Cayley comes next, and the gem of the lecture is Clerk Maxwell's poem on the occasion of Cayley's portrait being presented; we cannot help quoting a stanza, if only to show that *some* mathematicians appreciate the witchery of words:—

> First, ye Determinants, in ordered row
> And massive columns ranged, before him go,
> To form a phalanx for his safe protection.
> Ye powers of the *n*th root of −1!
> Around his head in endless cycles run,
> As unembodied spirits of direction.

Cayley's presidential address to the British Association receives a proper amount of attention; oddly enough, Cayley either never read v. Staudt's "Geometrie der Lage" or did not appreciate it, for he seems to have died without realising an "imaginary point" as an actual geometric entity, although he did so much to found the projective theory of metrics. Cayley's kindness and courtesy and help to young mathematicians are duly recorded.

Clifford, owing to his early death, is an unsolved problem. All his mathematical work is brilliant, and, considering his years, original; but his philosophy was as bad as Herbert Spencer's, if not worse, and his cocksureness was irritating, even to his friends. But the author of "Commonsense of the Exact Sciences" deserves immortality, even though (or because) we agree with MacFarlane where he says: "The 'Phædo' of Plato is more satisfying to the mind than the 'Unseen Universe' of Tait and Stewart."

If we were asked to name the Admirable Crichton among British mathematicians, we

[1] And, we may add, who was accustomed to spell *littera* with one *t*.

should hesitate between Clerk Maxwell and H. J. S. Smith. Both are mathematicians of the first rank; both are cultured, witty, and childlike; one has all the virtues of the Irishman, the other all those of the Scot. Smith is the more elegant and careful writer; Maxwell is in closer contact with Nature, and possibly has done more to raise her mysterious veil. But Smith's very aloofness, his fondness for what "has no possible practical application," may only mean that he approached the sanctuary by a different road. Of his mordant wit the lecturer gives various samples; he even has the shameless audacity to quote: "—— sometimes forgets that he is only the editor, and not the author, of Nature." Smith's practical common sense, shown in dealing with university and college affairs, illustrates the fact that a mathematician is not always a nincompoop outside the range of his science.

Sylvester is one of the many Jews who have distinguished themselves as pure mathematicians. Self-conceited, irritable, careless as he was, he was eminently original, inspiring, and generous. His unbroken friendship with Cayley is no doubt mainly a credit to the latter, but it is very touching; and although Sylvester was not a model teacher he was stimulating, and had great influence on the best of his hearers. MacFarlane's account of him is, as it should be, both amusing and pathetic; it contains, among other things, Sylvester's brilliant retort to Huxley's depreciation of mathematics; this was one of the few cases in which Huxley was conclusively refuted.

The remaining two lectures are in some ways the most valuable of the ten, especially that on Kirkman. We wonder how many of our readers ever heard of Kirkman and his work; yet he was really a very brilliant mathematician, although comparatively unknown—partly from his own fault, partly from that of others. He used to send scores of ingenious problems to the *Educational Times* (many of them in doggerel verse); these would be quite worth looking up. Besides this, he did some very important work on the classification of polyhedra; the result was communicated to the Royal Society, and we are told here (p. 127) that only two of the twenty-one sections were published in the Philosophical Transactions. If this is true, it is little short of a scandal, and the rest of the MS. should be sent to Prof. Burnside, as the subject is closely connected with group-theory. We are also informed that there are papers on groups by Kirkman embedded in the Proceedings of the Manchester Philosophical Society [the R.S. subject index, p. 65, gives references to vols. i., iii., iv. (1862–65) and to vols. iv., v. of the later series (1891–92)]. Current English text-books on the subject give no reference to Kirkman at all; yet our lecturer says: "So far as British contributors are concerned, Kirkman was the first and still remains the greatest." Whether this is true or not, the matter requires investigation.

On p. 132 we have Kirkman's delightful paraphrase of Spencer's definition of evolution, and a reference to his work on knots; and on p. 133 his neat little problem:—

> Baby Tom of baby Hugh
> The nephew is and uncle too;
> In how many ways can this be true?

which we leave for our readers to solve. The lecture ends with a quotation from one of Kirkman's letters: "What I have done in helping busy Tait in knots is, like the much more difficult and extensive things I have done in polyhedra or groups, not at [all] likely to be talked about intelligently by people so long as I live. But it is a faint pleasure to think it will one day win a little praise."

All of us remember Todhunter as a coach and the author of text-books which in their time were thought the embodiment of perfection and are now unduly depreciated. But Todhunter was much more than a writer of text-books; his mathematical histories are deservedly accounted classics, and in them he was able to display his learning, accuracy, and acumen. We are very glad that a lecture was devoted to him, and that it is so sympathetic. Of course, we have the famous passage on experimental science, with its doctrine of taking everything on the word of "a clergyman of mature knowledge, recognised ability, and blameless character," but we have much more than that. Isaac had no ear for music, but he had a sort of dry humour of his own, as when he quotes the words of a Tripos candidate who was ploughed: "If there had been fairer examiners and better papers I should have passed; I knew many things that were not set."

The book ends with a quotation from Prof. (J. E. B.?) Mayor: "Todhunter had no enemies, for he neither coined nor circulated scandal; men of all sects and parties were at home with him, for he was many-sided enough to see good in everything. His friendship extended even to the lower creatures. The canaries always hung in his room, for he never forgot to see to their wants." May we all have as good an epitaph!

G. B. M.

THE FRESH-WATER FISHES OF RUSSIA. Les Poissons des Eaux douces de la Russie. Par L. S. Berg. Pp. xxvii + 563 + 365 text-figures and a map. (Moscow: Department of Agriculture, 1916.)

PROF. BERG'S work on the fresh-water fishes of the Russian Empire, complete in one volume, will be welcomed by all ichthyologists, for the author's knowledge of Palæarctic fishes is unrivalled. In plan this work is more condensed than the very elaborate monograph ("Faune de la Russie: Poissons") on which Prof. Berg was engaged, and of which three parts had already appeared, when in 1914 he gave up the curatorship of fishes in the Imperial Academy of Sciences at Petrograd to become the first professor of ichthyology in the Academy of Agriculture at Moscow.

The book is written entirely in Russian, and

is evidently intended mainly for the author's countrymen, to whom an acquaintance with the fresh-water fishes is of considerable practical use, for the Russian fresh-water fisheries are very valuable. The true fresh-water fishes, indeed, are not of much account, but the migratory fishes, such as the salmon (quinnat, humpback, etc.) of the North Pacific, the char (Salvelinus) and whitefish (Coregonus) of the Arctic Ocean, the sturgeons, trout (*Salmo labrax*), and shad (Caspialosa) of the Black and Caspian Seas, are of great economic importance. The value of these anadromous fishes is due to two causes: first, they draw their food supply from the abundance of the sea and so are superior in size and numbers to the permanent inhabitants of the rivers, and, secondly, they concentrate at certain seasons to ascend the rivers to their breeding-grounds, when their capture in large quantities is easy enough.

An introductory chapter deals with structure and classification; this is up to date, and recent research on the morphology of the teleostean fishes is appreciated. In the systematic part of the work 281 species and about 100 sub-species are described, and the majority of them are figured; this is followed by a table illustrating in detail their geographical distribution, whilst a final chapter deals with the Palæarctic region and its division into sub-regions and provinces.

Prof. Berg recognises six sub-regions, Mediterranean, Arctic, Baikal, central Asiatic, Manchurian, and Chinese. In this classification considerable importance is attached to the anadromous fishes, and if these be neglected, and only the true fresh-water fishes, the bulk of which are Cyprinoids, be considered, a somewhat different result may be arrived at. The first three divisions might then be united to form a single sub-region, comprising Europe, with northern and western Asia; the fourth, the mountain region of central Asia, would stand; and the fifth and sixth might be added together to make an eastern sub-region, including the greater part of China, with Manchuria, Corea, and Japan. In each of the three areas just delimited the majority of the Cyprinoid genera and species are endemic.

The Manchurian (or Amurian) sub-region is established as transitional between the Arctic and Chinese sub-regions. A certain number of Siberian fishes occur in the Amur, but Chinese types are more numerous. The migratory Salmonidæ of the Okhotsk Sea also help to characterise this division. An interesting example of discontinuous distribution is the presence in the Amur of the European bitterling (*Rhodeus sericeus*), which is not found elsewhere east of the Volga.

Prof. Berg's Arctic and Mediterranean sub-regions are distinguished by the absence of certain Cyprinoids from the former, but chiefly by the difference between the anadromous fishes of the Arctic Ocean and those of the Black and Caspian Seas. This difference is of considerable interest in its bearing on the theory that the Caspian Sea was directly connected with the Arctic Ocean in comparatively recent times. The fish fauna of the Black Sea has two principal components: (1) an old Sarmatian fauna, also represented in the Caspian, and (2) recent immigrants from the Mediterranean, unrepresented in the Caspian. Similarly, the Caspian fishes have a double origin, including (1) genera or species that are peculiar to the Black and Caspian Seas, and (2) fresh-water species that have entered it from its tributaries and that live in those areas where the salinity is sufficiently low. The fishes give no support to the theory of a recent Arctic-Caspian connection, and there does not appear to be any definite geological evidence in its favour.

Lake Baikal has most of the true fresh-water fishes of the Yenisei, including a number of our most familiar British species, roach, dace, minnow, pike, perch, etc.; it also has a char and two Coregoni, relict forms of anadromous Arctic species; but the Baikal fish fauna is characterised by the presence of nearly a score of Cottidæ, which have found the vast area and great depths of the lake favourable to their evolution and have even given rise to a genus, Comephorus, which is generally regarded as the type of a distinct family. These Baikal Cottids seem to have come from an older and more primitive stock than the other Palæarctic species of the family, and they bear witness to the antiquity of the lake; but there is no evidence that they were directly of marine origin.

We are grateful to Prof. Berg for this fine volume; in its preparation he has studied a very complete material, comprising series of specimens from every lake and river in the Russian Empire, and the result is a work that is authoritative and of permanent value. C. T. R.

CHEMISTRY BOOKS FOR SCHOOL AND LABORATORY.

(1) *Text-book of Elementary Chemistry.* By Dr. F. Mollwo Perkin and Eleanor M. Jaggers. Pp. vii+384. (London: Constable and Co., Ltd., 1916.) Price 3*s.* net.

(2) *Elementary Practical Chemistry.* Part ii. By Prof. F. Clowes and J. Bernard Coleman. Eighth edition. Pp. xvi+255. (London: J. and A. Churchill, 1916.) Price 3*s.* 6*d.* net.

(3) *Technical Chemists' Handbook. Tables and Methods of Analysis for Manufacturers of Inorganic Chemical Products.* By Dr. George Lunge. Second edition, revised. Pp. xvi+264. (London: Gurney and Jackson, 1916.) Price 10*s.* 6*d.* net.

(4) *Chemistry for Rural Schools.* By E. Jones and A. Jones Griffith. Pp. 184. (London: Blackie and Son, Ltd., 1916.) Price 2*s.* 6*d.* net.

(5) *A Text-book of Quantitative Chemical Analysis.* By Drs. A. C. Cumming and S. A. Kay. Second edition. Pp. xv+402. (London: Gurney and Jackson, 1916.) Price 9*s.* net.

(1) ALMOST at the beginning of this little volume the student is directed to make an experiment, whereby he may find out for him-

self certain properties of chalk and gypsum. Experiment, in fact, is the keynote of the book. The authors teach mainly by experiment, and endeavour, as they put it, "to lead from fact to fact in an interesting and logical sequence." This setting of the student to "do things" straight away will awaken his interest, if anything will; and the experiments are well devised to make him absorb knowledge at his fingers' ends—the kind of knowledge which comes to stay. Quantitative experiments are introduced early in the course, and even though these are, sometimes, approximative only in the results, they have considerable educative value. No special syllabus has been followed, but the book treats of the inorganic substances usually included in an elementary course. A chapter on technical processes at the end, however, gives short accounts of some classes of carbon compounds—oils, soaps, coal-tar dyes, and perfumes; and this adds to the comprehensiveness of the volume. The description of the experiment with iron filings (p. 93) needs revision, as also does that with sodium chloride and silver nitrate (p. 233, fifth line from the bottom). Sulphuric acid, moreover, can scarcely act upon the *formula* of formic acid (p. 180).

(2) In this edition of Messrs. Clowes and Coleman's well-known work the subject-matter has been increased and rearranged. For the information of readers not familiar with the book it may be said that Part ii., now under notice, deals with elementary analytical chemistry, both qualitative and quantitative. It is arranged in four divisions. In the first, descriptions are given of the reactions of the commonly occurring metals and acid-radicles, together with methods for their detection. This portion includes the usual analytical tables, and forms the larger part of the book. Volumetric analysis is dealt with in the second division, and gravimetric determinations in the third. Acidimetry, alkalimetry, and determinations by means of oxidation, reduction, and precipitation operations are included in the volumetric processes; whilst in the gravimetric section the student is given exercises which initiate him into the methods of estimating the common metals and acids with the aid of the chemical balance. In the fourth and concluding division directions are given for the preparation of various classes of inorganic compounds by operations involving crystallisation, precipitation, sublimation, and distillation. The descriptions are lucid, and the information generally trustworthy; and no doubt the volume will continue to be a favourite text-book with students. In the ideal text-book, however, the student would not be told (p. 216) to "use 197·2" as the atomic weight of platinum for the purpose of correcting his results. Nor would the ideal text-book show quite so much small print, or be quite so economical of paper, as the present volume, even in war-time.

(3) Of Lunge's "Handbook" it must here suffice to say that it comprises tables of general chemical and physical data, such as molecular weights, specific gravities, and vapour densities, together with analytical methods used for the control of the operations in various chemical industries, including the manufacture of sulphuric acid, alkali, ammonia, coal-gas, and cement. In the new edition the analytical factors have been recalculated on the basis of the international atomic weights for 1916, and the tables of specific gravities have been revised, checked, and extended. The author's name is a guarantee that the data are trustworthy and the methods judiciously selected.

(4) Is there any reason why an elementary treatise on chemistry written "for rural schools" should differ from the ordinary run of text-books on the subject? The authors think there is, inasmuch as for such a treatise examples can be taken from the farm, the garden, and the dairy to illustrate chemical principles. Thus the science can be brought more directly home to the students, and they are helped both to apply their knowledge to farm work and the better to comprehend agricultural literature. Copper sulphate, for instance, is not treated merely as a collection of blue crystals to be shown on the lecture-table. To the authors' students it is the fungicide sprayed in cornfields to kill charlock; it is the remedy for foot-rot in sheep; it is the chief ingredient of the Bordeaux mixture used for spraying potatoes. These facts invest the "blue stone," which the rural student is directed to prepare from copper and sulphuric acid, with a very real interest for him. In pursuance of this idea the illustrative examples in the text are drawn from agriculture rather than from manufactures. To make the book serve not only as a foundation for the study of pure chemistry, but also as an introduction to agricultural chemistry, the authors have included chapters on assimilation by plants, on proteins and animal nutrition, on fermentation, and on the constituents of soil. The collections of questions provided are a useful feature, and the book will be found very serviceable in rural schools.

(5) Messrs. Cumming and Kay's volume has been revised in this, the second, edition, and additional methods of analysis have been included. It is intended for university and college students, for whom it provides a very satisfactory introduction to the various branches of quantitative chemical analysis. The experiments described include simple electrolytic processes, gas analysis, and molecular-weight determinations, as well as the ordinary volumetric and gravimetric estimations. The authors rightly emphasise the educative value of volumetric methods, and point out the desirability of accustoming the student, from the commencement, to the examination of substances the composition of which is unknown to him. The directions they give are clear and precise; the examples are well chosen; and everything is done to inculcate cleanliness and accuracy in manipulation. As an introduction to the art and mystery of finding out "how much" of a substance the experimenter is dealing with, and of doing it with precision, this book can be unreservedly recommended.

C. S.

OUR BOOKSHELF.

Science Française—Scolastique Allemande. Par Prof. G. Papillault. Pp. iv+154. (Paris: Librairie Félix Alcan, 1917.) Price 2.50 fr.

THIS volume is one of the well-known series "Bibliothèque de Philosophie contemporaine," and the author is professor of sociology at the School of Anthropology of Paris. There has been a great mass of literature that is inspired by a form of patriotism, published in France and over here, on the defects of German character and the incompetence of the Germans in science, so that it is a relief to have the author's assurance (p. 3) that this is not the case with his book. His object is to estimate scientifically the value of German thought as shown in its principal philosophical systems and in its most evident general tendencies. The methods used are two: one is to regard a philosophy as an effect of psycho-social causes, and the other is to regard it as a cause. It is impossible not to feel that regarding Kant or Hegel or Nietzsche as a cause of the ideals of the State current in Germany is somewhat of the nature of wisdom—if it is wisdom—after the event. In this book it is Kant who comes in for blame.

The second part of the book deals with the sophisms made by the rational instincts, chiefly of Germans, and the third part is a comparison of the great philosophical systems with scientific and sophistical methods. German thought is, we hear, "scholastic" and "sterile"; certain rather inferior Germans used to say very much the same thing about what was too subtle for them. ϕ

The Chemists' Year Book, 1917. Edited by F. W. Atack, assisted by L. Whinyates. In 2 vols. Pp. 1030. (London and Manchester: Sherratt and Hughes, 1917.) Price 10*s.* 6*d.* net.

THE general character of the contents of these excellent volumes was described in the review of the 1916 issue published in NATURE for June 15 last (vol. xcvii., p. 320). In the present edition, in addition to general revision, the sections on gas analysis, sulphuric acid, oils and fats, fuels and illuminants, and photography have been thoroughly revised; and that on textile fibres has been rewritten. New sections have been added on the analysis of essential oils, the efficiency of boiler plant, cement, and paints and pigments. It is hoped in next year's issue of the Year Book to include articles on ceramics, lubricants, and metallurgy and metallography, which had unavoidably to be held over this year.

The thorough editorial work has well maintained the trustworthiness and up-to-date character of this comprehensive compilation.

X-rays. By Dr. G. W. C. Kaye. Second edition. Pp. xxii+285. (London: Longmans, Green and Co., 1917.) Price 9*s.* net.

THE first edition of Dr. Kaye's book was reviewed in the issue of NATURE for March 25, 1915 (vol. xcv., p. 87); and it will be enough to say of the new edition that, so far as his military duties have permitted, the author, who now ranks as a captain in the Royal Engineers (T.), has thoroughly revised the text and incorporated all important original work published up to June of last year. An additional chapter on X-ray equipment and technique by Mr. W. F. Higgins has been incorporated.

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.*]

Classical Education and Modern Needs.

IN his reply to Mr. Livingstone's letter in NATURE of May 10 Mr. Wells makes a point which classical apologists, especially those who have not had experience in teaching boys, seem incapable of grasping. Mr. Livingstone, on his own showing, would seem to have fallen into a like error. For more than twenty years it has been my lot to teach science to boys, most of whom are graded on their proficiency in linguistic studies, chiefly Latin and Greek. Experience has convinced me that it is a fundamental mistake to suppose that boys even of fifteen or sixteen show marked taste or ability for science or mechanics as opposed to linguistics, or *vice versa.* Those that do are the exceptions that prove the rule.

The boys who are best at classics are also best at science. It is a question of general ability and nothing more. The fallacy that success in, or aptitude for, science denotes the possession of a special kind of intelligence, rarely forthcoming, but always clearly marked at an early age where it does exist, needs uprooting now and for ever; its prevalence is widespread, and the mischief it has done is great.

Every intelligent boy must be given equal opportunities in science and languages in the widest sense of the word, until he is old enough to show which line of study he can most profitably follow. Until this is done, and while only those boys who show a want of literary faculties are encouraged to "take up science," so long will the best brains of our rising generation be imperfectly trained, and the potentialities of the nation towards achievement in science stunted and handicapped. M. D. HILL.

Eton College, Windsor, May 13.

Aeroplanes and Atmospheric Gustiness.

THE invitation of Prof. McAdie to readers of NATURE (April 12, p. 125), to offer suggestions on the above subject, is one to which I, for one, am very glad indeed to respond, although I may not be able to add much of value to what has already been said in previous writings regarding gusts.

It is a common matter of agreement, I think, that the gust condition is associated, not with mere velocity of the air—which is already identified with the idea of wind—but with *changing* velocity of the air. The simplest record of that, and so, on this view, of the gust, seems to be the instantaneous acceleration of the air, moment after moment. Accordingly I would suggest that continuous observatory records of gustiness might already be obtained, by first obtaining ordinary anemograph records of the wind, with time scales open enough to show distinctly whole seconds; and by then graphically differentiating such records

at every ordinate, so as to provide the data for drawing what I will call, for brevity in reference, the "gustograph" record. That something in the way of truth has then been obtained appears from the reflection that a man who had the air acceleration under his control for a given five minutes and a gustograph or acceleration record for some previous five minutes, would be able to reproduce the gusty phenomena of the air for that previous five minutes by controlling the air acceleration according to the gustograph record. He would not, of course, necessarily reproduce the actual *wind* of the previous five minutes, unless he happened to *start* the five-minute reproduction with the right wind value, but that agrees entirely, I believe, with the distinction there is between gustiness and wind in connection with aircraft.

As regards the safe "flyability" of the air by aircraft, I hazard the guess that it may be found convenient to connect it with such a quantity as the *maximum* gust over a random minute run of the gustograph, or perhaps with the *average* gust over the same period.

The proposal Prof. McAdie mentions—using the exponent of an exponential equation as the measure of the sharpness of a gust—looks easier to apply in examining the influence of particular classes of gusts than in obtaining continuous records from instant to instant. For the latter purpose it is, I submit, desirable that the gust should be defined by instantaneous conditions, independently of knowledge of things at a finite time either before or after the given instant. I may, however, be misunderstanding the exponential proposal in this connection.

If principles like those I suggest found acceptance, the question of having standard gustograph instruments would soon be likely to arise; for graphical differentiation of anemograph records is tedious, and discouraging to progress. I think gustographs may be designed on two broad principles: in the first there is an anemometer in which the *rate of change* of the reading is continuously recorded, and in the second there is an arrangement of fans and flywheels with torque-recording couplings between.

I shall be very pleased if what I have written contributes to the discussion anything which needed, in any case, to be brought under consideration.

S. L. WALKDEN.

London, N., April 25.

The Preparation of "Blood Charcoal."

PURE "blood charcoal" is a reagent of considerable importance to the physiological chemist. It is not only required for the decolorisation of liquids, but also for selective adsorption in an important series of quantitative estimations of animal fluids.

My stock of Merck's blood charcoal is nearly exhausted, and I cannot obtain a supply of any home-made article that is suitable.

I should be most grateful if any of your readers could give me any information as to the method of preparation of blood charcoal, or the name of a firm that would be willing to manufacture and supply the article. Material as good as Merck's would command a ready sale at home as well as in America, where they have had to abandon rapid and accurate methods of analysis owing to the lack of the necessary charcoal. Folin states, in a recent number of the *Biochemical Journal*, that no other charcoal will adsorb creatinine. I have got perfect results with two other specimens of charcoal, but inquiry reveals the fact that both of them came originally from Germany. Surely our technical chemists can produce articles as good as those of the Germans.

SYDNEY W. COLE.

Biochemical Laboratory, Cambridge, May 9.

STUDIES IN GENETICS.[1]

(1) PROF. CASTLE was fortunate enough to secure in Peru a number of specimens of a wild species of guinea-pig, *Cavia cutleri*, Bennett, which is the probable ancestor of the numerous domesticated races which have had their origin in that country and have been introduced elsewhere. He found that this wild species produced completely fertile hybrids when crossed with various races of domesticated guinea-pigs, and the results of the hybridising experiments go to show that all the domesticated colour-varieties have arisen from *C. cutleri* by loss-variation or loss-mutation. It does not follow, however, that wild species have arisen in this way, as some believe, for it is significant that the Brazilian wild species, *C. rufescens*, yields sterile hybrid males when crossed with the domesticated varieties, while similar crosses between *C. cutleri* and domesticated varieties yield completely fertile hybrids. One of the general results of Prof. Castle's hybridisation experiments is to confirm his previous conclusion that size inheritance is blending and does not mendelise. It is not denied, however, that in special cases mendelising factors may exist that affect size.

In another study Mr. Sewall Wright deals with the genetic factors determining coloration in guinea-pigs and with the conditions which may account for continuous series of variations. "Intermediates between varieties which mendelise regularly have been found to follow very definite modes of inheritance, which, however, are very different in different cases, and could not possibly be predicted *a priori*." He shows that a complex of the most varied causes may underlie an apparently simple continuous series of variations.

Of great interest, again, are the prolonged breeding experiments that Prof. Castle has made with hooded rats. It is shown that the factor for hooded colour pattern may vary in genetic value. There may be genotypic variation in grade as well as phenotypic fluctuation—a conclusion which brings us back to a familiar Darwinian doctrine. "Racial changes," Prof. Castle writes, "may be effected through selection by the isolation of genetic fluctuations, as well as by the isolation of mutations. Moreover, genetic fluctuation makes possible *progressive change* in a particular direction, repeated selection attaining results which it would be quite hopeless to seek by any other means." The study of the hooded rats, previously reported on by Castle and Philipps in 1914, has been carried through three or four additional generations. "The additional genera-

[1] (1) "Studies of Inheritance in Guinea-pigs and Rats." By W. E. Castle and Sewall Wright. Pp. 192+7 plates. Carnegie Institution of Washington, Publication No. 241 (1916).

(2) "Gonadectomy in relation to the Secondary Sexual Characters of some Domestic Birds." By H. D. Goodale. Pp. 52+7 plates. *Ibid.*, Publication No. 243 (1916).

(3) "The Jukes in 1915." By A. H. Estabrook. Pp. vii+85+26 charts. *Ibid.*, Publication No. 240 (1916).

(4) "Fecundity *versus* Civilisation: A Contribution to the Study of Over-population as the Cause of War and the Chief Obstacle to the Emancipation of Women. With Especial Reference to Germany." By Adelyne More. With an Introduction by Arnold Bennett. Pp. 52. (London: G. Allen and Unwin, Ltd., 1916.) Price 6*d.* net.

tions of selection show a continued progressive movement of the racial character in the direction of the selection, and indicate the existence of no natural limit to the progress which selection can make in changing the hooded character." Prof. Castle's experiments show that there has been over-hastiness in generalising from the results reached by Johannsen and others.

(2) The influence of the reproductive organs on the secondary sex-characters differs in different groups of animals. A male crab that has suffered parasitic castration puts on a number of feminine characters and develops a small ovary. In insects, on the other hand, the secondary sex-characters seem to be quite independent of the gonads. In male mammals the castration may not be followed by any marked peculiarity in the development of the secondary sex-characters, though some of them may remain in an arrested infantile condition. In the female mammal the removal of the ovaries has very little effect on the secondary sex-characters. What Mr. Goodale has shown in regard to female birds (ducks and hens) is just the opposite of what holds in mammals. If the ovary be completely removed the female puts on the secondary sex-characters of the male—sometimes with startling completeness. Some individuals, as the fine coloured plates show, become nearly perfect replicas of the male; others are imperfectly masculine. It is interesting to notice that the masculine characters induced on the ovariotomised female are always like those of the male of the same breed. With male birds the case is different. If the gonads be removed, the majority of the secondary sex-characters of the male develop, though a few may remain in an infantile condition. What have been sometimes called feminine characters in castrated or abnormal males almost always turn out to be juvenile characters. Another interesting general fact is that castrated drakes lose the power of developing the summer plumage.

In thinking of the results of this carefully worked-out piece of experimental investigation, we see clearly that the internal secretions of the gonads have a specific morphogenetic influence on growing or active cells of the body. As Mr. Goodale says, the secretions must be considered part of the influential environment of each cell. But the further question arises whether the secretion acts as a "modifier" affecting the factors of a feminine character so that the result in development is a masculine character; or whether the secretion acts as an "inhibitor" on one of two alternative groups of factors, respectively masculine and feminine, both present in the female's genetic constitution. Thus in the duck or hen the ovarian secretion inhibits the developmental expression of the masculine plumage; in the absence of the secretion the masculine features find expression. It is too soon to decide between these views; Mr. Goodale appears to incline to the former. It may be noticed incidentally that there is no conclusiveness in Mr. Goodale's argument against Darwin's theory of sexual selection. "According to Darwin's theory the start was made from a dull-coloured monomorphic species, an assumption that is not in accord with the nature of the female as shown by castration, since the brilliant male colours are only suppressed in her. The only possible effect of selection, then, would be the uncovering of a condition already present. But, by hypothesis, this condition did not pre-exist." But it is impossible to argue from the constitution of a Rouen duck of 1916 to what may have been the constitution of the female of distant ancestral types, before masculine mutations—probably enough arising in male-producing gametes—began to be included in the common complement of hereditary factors, forming a contingent of characters that normally lie latent in female soil, and are normally patent in male soil.

(3) Nearly a century and a half ago there drifted into an isolated valley in Z county in the United States "a number of persons whose constitution did not fit them for participation in a highly organised society." Much of the original stock was unsound, and in the relaxation of a primitive environment many of their progeny went from bad to worse. Constant inbreeding accentuated the deterioration. In 1874 the close blood-relationship of a number of criminal types in the area referred to attracted the attention of Mr. R. L. Dugdale, an Englishman settled in New York, who was keenly interested in questions of social reform. In 1877 he published his well-known study, "The Jukes," in which he showed that a bad inheritance associated with deteriorative environmental conditions had resulted in a deplorable multiplication of criminality, harlotry, and pauperism. The names he used in his investigation were fictitious, but the chance discovery of his original manuscript has made it possible for Dr. A. H. Estabrook to follow the later history of the strains which Dugdale studied. Starting from five sisters 130 years ago, the Jukes have become 2094, of whom 1258 were living in 1915. "One-half of the Jukes were and are feeble-minded, mentally incapable of responding normally to the expectations of society, brought up under faulty environmental conditions which they consider normal, satisfied with the fulfilment of natural passions and desires, and with no ambitions or ideals in life. The other half, perhaps normal mentally and emotionally, has become socially adequate or inadequate, depending on the chance of the individual reaching or failing to reach an environment which would mould and stimulate his inherited social traits." It must be noted that some have become good citizens.

Dr. Estabrook's study shows that cousin-matings of defective stock result in defective offspring; that there is an hereditary factor in licentiousness; that pauperism indicates physical or mental weakness; that all the Juke criminals were feeble-minded; that penal institutions have little beneficial influence upon these; and that ameliorative environment has markedly improved

a certain number of the individual members of the stock. The investigator has worked with patience and carefulness; his most feasible practical suggestion is the permanent custodial care of the feeble-minded Jukes.

(4) In a clear and courageous essay Adelyne More points out the advantages of a deliberate reduction of the birth-rate. Only thus can women secure independence; it is the chief way of reducing infantile mortality; it is the only way by which struggling parents can attain economic security; it forms part of the prophylaxis against venereal disease; and it is the most effective way of ensuring the cessation of war. "An undue fecundity promotes international pugnacity of precisely the kind which was operative in bringing about the present war." In a slashing preface—admirable in its exposure of our Anglo-Saxon false shame—Mr. Arnold Bennett deals, somewhat too cavalierly, we think, with the hygienic, religious, political, and industrial arguments against the use of contraceptives. He does not consider the ethical difficulties—perhaps transitional, but already real enough—involved in being able at will to evade the natural consequences of sexual intercourse, nor the social difficulties involved in the unequal birth-rate in different sections of the community, and in the likelihood that birth-control would tend to be adopted most among thrifty, far-sighted, controlled, and "individuated" types, of whom a progressive nation wishes more, not fewer. J. A. T.

ENGINEERING EXPERIMENT STATIONS.

A MEMORANDUM prepared for the Governor and the General Assembly of the State of Illinois, concerning the work of the College of Engineering and the Engineering Experiment Station of the University of Illinois, has lately reached us. It is partly a statement of the work of the college, which gives degrees to more than 200 engineering students annually, with photographs of some of the large engineering works executed under the direction of its graduates, and partly an appeal for a large extension of its buildings. It is pointed out that the growth of a State in population, wealth, and influence depends chiefly on its success in the development of engineering industries.

It is known that the "State universities" of the United States have engineering laboratories more largely staffed and more completely equipped than those in this country, and that they carry on research work very directly associated with industrial needs. Lately there has been a movement to develop these as "experiment stations." In the case of the Illinois University the control is vested in the heads of departments of the college; the ordinary equipment of the laboratory is used, but there are nine investigators devoted to research work and fourteen research fellows who give half-time to research. All results are published and 106 bulletins have been issued.

In a short account of the more important researches carried on, it is stated that Prof. Talbot's tests of reinforced concrete have supplied information on which standard practice has been based. They are well known in this country. In the case of iron alloys, researches have been made with an electric furnace permitting melting *in vacuo*. These, it is claimed, have led to the production of iron alloys having magnetic properties far superior to anything hitherto known—for example, specimens with a permeability seven or eight times higher than any other alloy. A new law bearing on steam-engine practice has been discovered by Mr. Clayton, connecting the form of the indicator expansion curve with the quality of steam in the cylinder. This makes it possible to predict the economic performance of an engine from the evidence of the indicator diagram. Prof. Goodenough has deduced values of the constants for steam which, it is stated, give the means of calculating steam tables of far greater accuracy than any hitherto published. Prof. Parr has devised a new low-temperature process of carbonisation of the non-coking Illinois coal of great importance, with the advantage that valuable by-products are recovered.

The building programme put forward will involve an expenditure of nearly 1,000,000*l*., exclusive of land and equipment. In the last two years the expenditure of the college has been 152,000*l*., and the budget for the next two years is 300,000*l*. Some account is given of the Massachusetts Institute of Technology, now incorporated with Harvard University, which has purchased land and erected buildings and provided equipment at a cost of 1,400,000*l*.

The most important experiment station in the United States is, no doubt, the Bureau of Standards—a Federal institution which has relations with many industries, and receives from the Government 125,000*l*. annually. A remarkable development is the Mellon Institute attached to the University of Pittsburgh. There any industry can endow a fellowship for a specific research. The University selects a suitable investigator and provides the laboratory. When results are obtained a small unit factory is established near the institute and the process worked on a small but commercial scale. The annual expenditure is 30,000*l*.

PROF. EMIL VON BEHRING.

IN NATURE of April 26 a short chronological survey was given of the career of Emil von Behring, whose death was recently announced. In the early eighties of last century, whilst a military surgeon at Bonn, Behring commenced a series of investigations which ultimately led him to the discovery of anti-toxins. This work merits fuller notice than could be given to it within the limits of a paragraph in the Notes columns of NATURE.

The fact that white rats were generally immune against anthrax, whereas ordinary wild

rats were susceptible to the disease, had excited the curiosity of bacteriologists. With the view of discovering the cause of the resistance of white rats, Behring tried the effect of their serum upon anthrax bacilli *in vitro*, and found that anthrax bacilli were killed by a short sojourn in fresh serum. This observation, together with those of Nuttall upon the similar properties of the fresh serum of man and several animals, formed the foundation of the humoral theory of defence against the invasion of microbes into the animal body.

In 1888 Behring went to Berlin and became an assistant to Koch at the Hygienic Institute. There he was associated with Loeffler and Kitasato, who had recently discovered the microbes causing diphtheria and tetanus respectively, diseases apparently brought about by the local multiplication of the organisms and without the penetration of the bacilli into the body generally. These were important steps in the interpretation of zymotic disease, and indicated that microbes manufactured soluble poisons which, being absorbed, acted upon the cells of the nervous system and other essential organs. The demonstration of the accuracy of this interpretation followed in 1888 when Roux and Yersin grew diphtheria bacilli in broth, removed the bacteria by filtration through unglazed porcelain, and produced the characteristic effects of diphtheria with the sterile filtrate. To this bacillary poison they gave the name "toxin."

Following up his earlier researches, Behring, by repeated small inoculations of certain microbes, immunised animals against large doses, and showed that their serum possessed the property of destroying *in vitro*, in an enhanced degree, the microbes to which they had been accustomed.

The psychological moment for the discovery of anti-toxic immunity had now arrived, and in 1890 Behring and Kitasato announced the discovery that an animal, immunised against tetanus and diphtheria by graduated injections of killed broth cultures of these microbes, produces in its blood substances which are capable of neutralising the toxic actions of these bacteria. They also showed that an animal previously injected with the serum of such an immunised animal withstood an otherwise fatal dose of bacilli or toxin, and, further, that when treated with the serum, even after symptoms had developed, it could be cured. To the substance in the serum of immunised animals they gave the name "anti-toxin." These fundamental observations were carried a stage further by Behring and Baer, and the serum tested on children with favourable results.

The importance of the initial discovery by Behring and Kitasato was at once seized by Emil Roux, the present director of the Pasteur Institute, who, in collaboration with Louis Martin, developed a method for its practical application which has been changed in little else than detail up to the present day. They immunised horses and were thus able to produce anti-toxic serum in quantity. In collaboration with their colleagues at the Paris hospitals, a trial of the new remedy was made in such a manner and upon such a scale as to place the serum treatment of diphtheria upon a firm basis by 1894.

During the last twelve years Behring's scientific activity had been for the most part directed to the problems of the immunisation against and cure of tuberculosis in man and animals. Behring started with three theses. The first is that the bacilli of human and bovine tuberculosis are but varieties of the same organism; the second is that infection, in the case of both man and animals, takes place in early life *via* the alimentary canal, and that phthisis is a sequel to such intestinal infection; and the third is that few humans or bovines escape infection before becoming adult. The first and second of these views, although receiving support in some quarters, have not been generally accepted, and the assertiveness, unsupported by evidence, with which they have been expounded by their author has not conduced to their receiving even so much attention as they deserve. Assuming their correctness, however, it is obvious that prophylactic immunisation, if it is to be effective, must be undertaken in early life. Behring attempted this with cattle, using attenuated human tubercle bacilli, but the results were not commensurate with expectations.

The treatment of children with any form of living tubercle bacilli being impracticable, Behring endeavoured to prepare extracts of killed bacilli which might possess the desired properties. The difficulties of inquiries in this domain, and their possible value to humanity, can scarcely be exaggerated, and it is a matter for regret that Behring's efforts therein should have been shrouded in a certain mysteriousness which is inimical to the best interests of science. A product of tubercle bacilli called "tulase" was evolved, which, according to the author, immunised animals against living tubercle bacilli and was effective in the treatment of tuberculosis in man. The exact nature and methods of preparation of tulase have not been made known beyond the statement that it is produced by the prolonged action of chloral hydrate upon tubercle bacilli, and is different from tuberculin. As, however, no results of this remedy have been forthcoming, and as several years have passed since it was introduced, it has presumably proved disappointing.

From 1895 until shortly before his death Behring was professor of hygiene in the University of Marburg, and director of the Hygienic Institute. For his discovery of anti-toxin he was awarded in 1895 the prize of the Académie de Médecine and Institut de France, and he had many distinctions conferred upon him by learned societies. In 1901 he received the patent of nobility, and in the same year was awarded the Nobel prize.

C. J. M.

NOTES.

A FAMOUS American, who did much to promote friendly relations between Great Britain and the United States, died in New York on Tuesday, May 15, in the person of Mr. J. H. Choate, United States Ambassador to Great Britain from 1899 to 1905. His eloquence and his influence during this term of office made enduring impressions upon the British people, who will always associate him with Anglo-American goodwill. Mr. Choate was a trustee of the American Museum of Natural History, and a member of the American Philosophical Society. Honorary degrees were conferred upon him by many universities, among them being Edinburgh and Cambridge (1900), Oxford and St. Andrews (1902), and Glasgow (1904).

THE death is announced, at seventy-four years of age, of Prof. L. J. Landouzy, professor of clinical medicine in the University of Paris, and author of "Les Sérothérapies" and many other works.

ANNOUNCEMENT has been made already of the decision of the council of the British Association not to hold the usual annual meeting this year, on account of travelling restrictions and difficulties of accommodation at Bournemouth, caused by conditions of war. It is necessary, however, to hold a formal meeting in order to bridge over the gap between the meeting at Newcastle-upon-Tyne last year and that which it is hoped to hold at Cardiff in 1918. Arrangements have been made, therefore, for meetings of the council of the association, the General Committee, and the Committee of Recommendations to be held in London on Friday, July 6, in order to make appointments, receive the report of the council for the year, and transact other necessary business.

A FEW days ago a correspondent of the *Daily Mail* resuscitated a well-known quotation from George Gissing's "Private Papers of Henry Ryecroft," in order to associate science with the horrors of the present war. The words are as follows:—"I hate and fear 'science' because of my conviction that, for long to come, if not for ever, it will be the remorseless enemy of mankind. I see it destroying all simplicity and gentleness of life, all the beauty of the world; I see it restoring barbarism under the mask of civilisation; I see it darkening men's minds and hardening their hearts; I see it bringing a time of vast conflicts, which will pale into insignificance 'the thousand wars of old,' and, as likely as not, will whelm all the laborious advances of mankind in blood-drenched chaos." We have on several occasions pointed out that it is merely pandering to popular prejudice to make science responsible for German barbarity or for the use of its discoveries in destructive warfare. Chlorine was used as a bleaching agent for much more than a century before the Germans first employed it as a poison gas; chloroform is a daily blessing to suffering humanity, but it is also used for criminal purposes; potassium cyanide may be used as a poison or to extract precious metals from their ores; and so with other scientific knowledge—it can be made a blessing or a means of debasement. The terrible sacrifice of human life which we are now witnessing is a consequence of the fact that the teaching of moral responsibility has not kept pace with the progress of science. As in medieval times all new knowledge was regarded as of diabolic origin, so even now the popular mind is ever ready to accept such views of the influence of science as are expressed in Gissing's work. The pity of it is that the public Press does nothing to dispel illusions of this kind by urging that what is wanted is not less scientific knowledge, but a higher sense of human responsibility in the use of the forces discovered.

MR. HAROLD FIELDING-HALL, who died on May 5, was a coffee-planter in Burma, and later a distinguished political officer in that province. He was an ardent student of Buddhism from the idealistic point of view, and his chief work, "The Soul of a People," did much to encourage the study of Buddhism in Europe and America. But, in the opinion of practical observers, its tendency was to ignore the popular and less admirable development of the faith in the East, while insisting on the value of its philosophical aspects.

THE Government Central Control Board has appointed an advisory committee, consisting of Lord D'Abernon (chairman), Sir G. Newman, Dr. A. R. Cushny, Dr. H. H. Dale, Dr. M. Greenwood, jun., Dr. W. McDougall, Dr. F. W. Mott, Dr. C. S. Sherrington, and Dr. W. C. Sullivan, to consider the conditions affecting the physiological action of alcohol, particularly the effects on health and industrial efficiency produced by the consumption of beverages of various alcoholic strengths, with special reference to the recent orders of the Central Control Board, and further to plan out and direct such investigations as may appear desirable with the view of obtaining more exact data on this and cognate questions.

AT the general meeting of the members of the Royal Institution on May 7 a letter was read from the distinguished mathematician, M. Paul Painlevé, the French Minister of War. After thanking the members for electing him an honorary member of the Royal Institution, an honour which has been conferred on few Frenchmen, M. Painlevé went on to say:—"Ce qui me fait, ensuite et surtout, attacher un prix particulier à l'honneur d'avoir été choisi par vous pour faire partie de votre Assemblée, c'est que ce choix s'est manifesté en pleine guerre alors que nos deux pays combattent côte à côte le combat du droit. Puissent ainsi toutes les forces intellectuelles et toutes les ressources scientifiques de l'Angleterre et de la France hâter la victoire de nos armes et assurer pour jamais dans le monde la suprématie de la pensée sur la violence."

THE seventh annual report of the Illuminating Engineering Society was presented at the annual meeting on May 15. The society, dealing with scientific and industrial aspects of a wide subject, unites on common ground electrical engineers, gas engineers, manufacturers of lamps and shades, physicists, ophthalmic specialists, architects, and surveyors. This branch of engineering has been recognised by the appointment, under the Department of Scientific and Industrial Research, of a Joint Committee on Illuminating Engineering. The successful union of these various interests is largely due to the efforts of the hon. secretary, Mr. Leon Gaster, during the last ten years. Mr. Gaster is a British subject of Rumanian origin, and is thus doubly associated with the cause of the Allies. All the male members of his family in Rumania and in England who are of military age are fighting for this cause, and one of his nephews was recently killed in Rumania.

CONSIDERABLE progress has, we learn, been made with the proposal to establish a national memorial to the late Capt. F. C. Selous, D.S.O., who, it will be recalled, was killed in action while leading his men in an attack on a German post in East Africa early in January last. An influential and representative committee has been formed under the chairmanship of the Rt. Hon. E. S. Montagu, M.P., with Mr. E. North Buxton and the Hon. W. P. Schreiner, C.M.G., as vice-chairmen. Among others who have joined the committee are Viscount Buxton, G.C.M.G., the Earl of Coven-

try, Dr. David (Headmaster of Rugby), Lord Desborough, K.C.V.O., Viscount Grey of Fallodon, K.G., Col. T. Roosevelt, Lt.-Gen. J. C. Smuts, and representatives of the Royal Geographical Society, the Zoological Society, the Entomological Society, the British Ornithologists' Union, the Royal Colonial Institute, and the British South Africa Company. The committee has decided, with the permission of the trustees of the British Museum, to place a mural tablet in the Natural History Museum, where many of Selous's finest trophies are exhibited, but the very encouraging response which has been received to the proposal for a national memorial of the great hunter, explorer, and naturalist indicates that there is a general desire that some additional form of perpetuating his memory should be established. Several suggestions have been considered, and it is hoped that at least it will be possible to found a Selous scholarship at Rugby (his old school), for the sons of officers, primarily of those who have fallen in the war. The hon. secretary to the Memorial Committee is Mr. E. Stuart Baker, 6 Harold Road, Norwood. Subscriptions should be sent to Mr. C. E. Fagan, hon. treasurer, Selous Memorial, Natural History Museum, South Kensington, London, S.W.7.

WE learn with regret that on April 30 Arnold Lockhart Fletcher died in a Red Cross hospital at Rouen of wounds received some days earlier at the front. Prof. J. Joly writes:—Arnold Fletcher was born in 1889. He was a graduate of Trinity College, Dublin, and obtained the degree in civil engineering in 1909. Shortly afterwards he was appointed research assistant in the department of geology and mineralogy in Trinity College. In 1910 he took part in communicating a paper on "Pleochroic Haloes" to the *Philosophical Magazine*. In the same year he commenced work on the radium content of rocks. He dealt successively with the rocks of the Transandine tunnel (*Phil. Mag.*, July, 1910) and with the Leinster Granite (*Phil. Mag.*, January, 1911). In the latter materials he also made determinations of thorium content. He directed special attention to the remarkably uniform ratio between the quantities of the two radio-active families present, a peculiarity since noticed in other cases. The Antarctic rocks followed (*Phil. Mag.*, June, 1911). Finally, he undertook a very complete examination of the secondary rocks (*Phil. Mag.*, February, 1912). In this research the fusion method was used, and the utmost care taken to eliminate errors. This work is entitled to rank as the best that has been done on these materials. Fletcher contributed a paper on sublimates, obtained at high temperatures, to the Royal Dublin Society in 1913. In the same year an account of a method of finding the radium content of radium-rich minerals by fusion on a carbon hob appeared in the *Phil. Mag.* This last work was done in the Royal College of Science for Ireland. In 1913 Fletcher entered the service of the Irish Department of Agriculture and Technical Instruction as inspector, an institution of which his father—Mr. George Fletcher—is assistant secretary in respect of technical instruction. Shortly after the war broke out Arnold Fletcher applied for a commission, and was gazetted in the Leinster Regiment in April, 1915. At the time of his death he was attached to a machine-gun corps. Fletcher possessed qualities which contribute to success in scientific work: patience, enthusiasm, manipulative skill, determination, and the power of overcoming experimental difficulties. In his brief life he did work which must find permanent record among the data of science. Along with this claim, the claim of his sacrifice to his country must for ever remain. When the war is over men of science should see to it that some national memorial to such lives be raised.

THE *National Geographic Magazine* for February publishes a well-illustrated article by an anonymous writer on "Our Foreign-born Citizens," in which the past and future of emigration into the United States are discussed. The literary test recently imposed will turn back one-fourth of the Armenians, two-fifths of the Serbians, Bulgarians, and Montenegrins, more than a fourth of the Jews and Greeks, more than half the South Italians, more than a third of the Poles and Russians, and a fourth of the Slovaks. More than 33,000,000 of people have already crossed the Atlantic, of which Great Britain and Ireland have contributed 8,500,000 and Germany more than 6,000,000. Ireland with more than 4,000,000, Great Britain with about 4,000,000, and Scandinavia with 2,000,000 have, together with Germany, contributed more than half the emigrants since the beginning of the Revolutionary War. It is estimated that the United States will have a population of nearly 500,000,000 in 2217, or approximately 166 to the square mile. But there is little danger of congestion, as statisticians estimate that the country has a sustaining power of 500 to the square mile, and assuming that one-third of the country is occupied by waste land, it will, on this basis, have room for a population of 900,000,000.

MR. EDWARD CLODD contributes to the *Fortnightly Review* for May an interesting article on Dr. Johnson and Lord Monboddo. An attractive picture is given of the active-minded judge, who, in his "Origin and Progress of Language" (1773–92), was one of the first to suggest man's relationship with the higher apes. There was considerable absurdity in Lord Monboddo's statement of his theory, but that it was a flash of genius is indubitable. Laughed at by his contemporaries, and ridiculed by the conservative Johnson, Monboddo was far ahead of his time. "Some of his speculations were anticipations of discoveries which have revolutionised thought and opinion in all directions; his was the creeping of the dawn when old things were passing away and all things were to become new." There is something fine in the conclusion of his long exposition of the resemblances between man and the apes: "That my facts and arguments are so convincing as to leave no doubt of the humanity of the orang-utan, I will not take upon me to say; but this much I will venture to affirm, that I have said enough to make the philosopher consider it as problematical, and a subject deserving to be inquired into. . . ." Mr. Clodd shows the naturalness of Johnson's attitude to Monboddo's subversive views. "But that attitude should convey the lesson to keep an open mind towards all matters, especially those that collide with our prejudices and contradict our 'certainties.'" As a wise Frenchman said, "Because science is sure of nothing, it is always advancing."

MR. J. HAROLD WILLIAMS contributes a study of heredity and juvenile delinquency to the *Eugenics Review* for April (vol. ix., No. 1). Twelve family histories are considered, and indicate the extreme importance of heredity in delinquency. At the same time, even in feeble-minded children delinquency is directly a product of environment. In nature and nurture, therefore, not separately, but collectively, must we look for an improved social being. The discussion on the disabled sailor and soldier and the future of our race, celebrating the Galton anniversary on February 16, is also included in this issue of the review.

THE National Clean Milk Society has issued a report of an investigation into the hygienic quality of the milk supplied to babies attending certain schools for mothers. The milk was supplied by twenty-seven dealers, and a sample from each was examined. Only six of the samples contained not more than 500,000 bacteria per cubic centimetre; one contained more than 100,000,000. Two of the samples contained tubercle bacilli. Hints are also given how to inquire about the domestic milk supply, and details are given of the milk supply in certain American cities. The National Clean Milk Society (2 Soho Square, W.1) is doing good work and national service in trying to raise the standard of our milk supply. Its membership is open to all, and additional members are much needed.

A BEE disease entitled "Sacbrood" is described by G. F. White in Bulletin 431 of the U.S. Department of Agriculture. This is not a new disease, but appears to have been included by bee-keepers under "pickled brood," a term which has acquired a very comprehensive meaning. "Sacbrood" attacks the larvæ in various stages, and is shown by the author to be transmitted in a "filterable virus"; no definite micro-organism can be detected.

A COMMUNICATION has reached us from Mr. Timmler, a civil servant in British conquered territory, German East Africa, New Langenburg, on the subject of the destruction of tsetse-flies. It is the somewhat surprising one of "gassing" the flies with a gas preferably innocuous to man, but fatal to the flies, or if deadly to man and flies, the use of masks, etc., would become imperative while operations were proceeding. The suggestion is that the monsoons would carry the gas across the fly-infested areas. We regard the proposal as impracticable, but an experiment would be better than any expression of adverse opinion.

AN interesting lecture by Mr. Govindam, Deputy Director of Fisheries for Madras, is published in the "Book of the Madras Exhibition, 1915–16." Huge quantities of the Indian "oil sardine" have always been available on this coast, and formerly these fish were converted into a manure by simple drying on the beach. An intolerable nuisance, described as "the first line of coast defence," was the result, and the fertiliser produced was poor in quality. In 1909 the Fisheries Department introduced a simple method of expressing the oil and drying the resulting fish-cake to form a kind of guano of value as a fertiliser, since it contained little oil. The method was extensively copied by the natives, with the result that the value of the oil obtained rose from Rs.52,630 in 1910–11 to Rs.2,29,014 in 1913–14, while the corresponding values of the fish guano produced were Rs.13,648 and Rs.4,03,787.

UP to the present this year we have only received the first number of the *Kew Bulletin*, and it contains articles mainly of importance for the Colonies and India. There is a long systematic account of the fungus flora of the Uganda forests, which is the first attempt to give a comprehensive account of the fungi of this region, and is a useful step in the direction of the preparation of a fungus flora of tropical Africa. As regards India, several new species of plants are described by Mr. Gamble, which will be incorporated in his "Flora of Madras," now in course of publication.

THE fungus diseases of Para rubber, *Hevea brasiliensis*, appear to be assuming rather large proportions, and are occupying the attention of mycologists in the East to a considerable extent. The species of Phytophthora which attacks the tapped areas of the stems forms the subject of a paper by Mr. J. F. Dastur in the Memoirs of the Department of Agriculture in India (vol. viii., No. 5, 1916). The fungus which is known as "black thread" causes black stripes on the tapping area, and is a serious disease in preventing the proper healing of the tapped surfaces. The black thread of Burma appears to be distinct from the disease of the same name recorded from Ceylon, which is due to *Phytophthora Faberi*, also the cause of a bad cocoa disease, and this fungus not only occurs as a canker on the stems, but also badly affects the seeds of Hevea. Remedial measures are discussed for the Burmese species, but the most efficacious measure appears to be to abstain from tapping the diseased trees during the rainy season. Accounts published of other fungus diseases of Para rubber in the Federated Malay States show that the future of the rubber industry may cause some anxiety.

THE council of the Royal Agricultural Society has just issued the first of a proposed series of "Occasional Notes," by means of which it is hoped that the members may be kept more or less continuously in touch with the work carried on by the scientific officers of the society. The first number includes a note by Sir John McFadyean on joint-ill in foals; notes by Prof. Biffen on seeds, eradication of weeds in meadowland, and the spraying of potatoes for the prevention of "blight"; notes on insect pests by Mr. Cecil Warburton, and on certain points of interest in connection with fertilisers and feeding-stuffs by Dr. J. A. Voelcker. The matters dealt with are such as have previously been dealt with only in the annual reports of the officers, but through the medium of these periodical notes a more rapid and timely dissemination of information and advice will be secured, and the efficiency of the society's advisory work correspondingly increased. Reference may also be made to an excellent leaflet on the ox warble-fly, or bot-fly, which has been drawn up by Mr. Warburton and issued by the society.

AN interesting report by Prof. V. H. Blackman and Mr. I. Jörgensen on the results obtained in 1916 in field investigations into the effect of overhead electric discharge upon crop production appears in the April number of the *Journal of the Board of Agriculture*. The experiments, which are a continuation of those initiated by Prof. J. H. Priestley, were carried out, as in previous years, at Lincluden Mains Farm, Dumfries, under the supervision of Miss E. C. Dudgeon. A uniform field of nine acres was used for the purpose, one acre being selected as the electrified area and two half-acre plots as controls. In comparison with previous years the charged wires were lower and closer together, so that the intensity of the discharge received by the crop was much increased. Oats were sown on March 27, and by May 16 the crop on the electrified area had established a marked lead, which it retained to the end. The discharge was applied for 848 hours during the season, being used only in the daytime and discontinued during actual rain. The final results showed for the electrified area the astonishing increases over the average of the control areas of 49 per cent. in grain and 88 per cent. in straw, the increased value of the crop being estimated at 6*l.* 7*s.* per acre. The cost of the current used, if taken at 1*d.* per unit, amounted to only 11*s.* The further interesting observation was made of a marked "after-effect" on the electrified area used in the previous year the clover crop which succeeded the oats

being much better on this area than on the rest of the field. It is pointed out in conclusion that many points still remain to be investigated before the use of the overhead electric discharge can be definitely recommended as a sound extension of agricultural practice.

THE growing importance of magnesite as a refractory material and for use in magnesian cement has led to its exploitation at the mining township of Bulong, in the N.E. Coolgardie Goldfield of Western Australia (F. R. Feldtmann, in Ann. Report Geol. Surv. of W. Australia for 1915). The material requires picking from the serpentine in which it occurs, but veins up to 2 ft. in thickness have been traced. In this, as in other instances, the magnesite is held to have been formed by waters containing carbon dioxide permeating a decomposing igneous complex of basic character.

WE have received from Mr. David Currie a letter relating to the article on "Empire Development and Organisation" which appeared in our issue of April 26. He directs attention to the fact that, although Canada is by far the largest producer of raw asbestos, Russia mines a substantial amount of this mineral, and Rhodesia is being developed as an important field. He regards the statement that the United Kingdom is largely dependent on outside sources, especially the United States, for its manufactured asbestos as incorrect, affirming that the imports from the States are "insignificant and even less than our exports to the States, in spite of the prohibitive tariff." The authority for the statement challenged by Mr. Currie is contained in paragraph 336 of the Blue Book Cd. 8462. Moreover, in the appendix (p. 172) the Commissioners state:—"It is to be noted that the United Kingdom, although possessing the most up-to-date plants and methods, is largely dependent on foreign sources for the manufactured asbestos it uses. In 1913 the net imports of asbestos manufactures were valued at 232,000*l.*, while the exports of asbestos manufactured in the United Kingdom (excluding engine packing) were valued at 105,000*l.* Quantities and countries of origin are not recorded."

THE *Revue générale des Sciences* for March 15 contains a clearly written and readable article on telemeters by Prof. H. Pariselle, of the French Naval School. It explains the principles on which telemeters act and describes the best-known instruments of each type. For infantry fire a simple and robust instrument is necessary, and no high degree of accuracy can be expected. A triangular slit in a small sheet of metal, held at arm's length and moved until a soldier seen at a distance fills the interval between the top and bottom edges of the slit, is a popular form of instrument, and is fairly accurate at small distances. For greater distances some form of double-image field glass or telescope has been much used. The two images of a soldier may be arranged to fall in the same vertical line, and the point on the upper image, at which the top of the head of the lower appears, may be noted, and the distance determined from its position. For the use of the artillery much more accurate instruments are necessary, and some form of double-image instrument, using a short base from the ends of which the two views of the object are taken, has come into universal use. The Barr and Stroud instruments use bases from 80 cm. to 274 cm., the shorter in field work and the longer in the Navy. Recently the Lawford-Copper instrument, on similar lines to the Barr and Stroud, but with a variable base, has been introduced.

WRITING in the *Scientific American* for April 21, Mr. Ellwood Kendrick deals with recent chemical developments in America. He points out that in treating metals the manufacturer has gone ahead by leaps and bounds, the reason being that, beginning with Andrew Carnegie and the Pittsburgh ironmasters, the chemist has been called in. He has also been welcomed in the petroleum industry, in the making of explosives, and latterly in the manufacture of coal-tar and other products. In other fields the chemist has not been wanted; the dread of the theorist has kept the doors of certain industries closed to him, with consequent waste and loss. After reference to the growing use of ferments and bacteria in chemical industry, Mr. Kendrick deals with a recent article on nitro-starch as an explosive. The difficulties with this nitro-product have been, in the first place, lack of stability when made by any practical method, and, secondly, difficulties in nitration owing to clotting, etc. It is claimed that the problem of producing a permanent nitro-starch has now been solved. By working up 80 to 85 per cent. with nitroglycerine a suitable explosive is obtained, and comparison is made between it and dynamite. Nitro-starch is claimed to be the cheapest of all high explosives. With present food problems, however, it can have no immediate interest for Europe. It is also stated that a licence has been granted in Switzerland for the manufacture of alcohol, primarily for industrial purposes, from calcium carbide. The works will be built at Visp.

THE annual general meeting of the Society of Chemical Industry is provisionally fixed to be held at the University of Birmingham on July 18–20. The following papers are promised:—"Chemical Porcelain," H. Watkins; "Duro-Glass," Dr. M. W. Travers; "British Sources of Sand for Glass and Metallurgical Work," Dr. P. G. H. Boswell; "Refractory Materials," W. C. Hancock; "Synthetic Nitrates," E. K. Scott; "Nitrates from the Air," Dr. Maxted; "Low-temperature Distillation Fuel," Prof. O'Shea; "Industrial Fuel from Gas Works," E. W. Smith; "Calorific Value of Industrial Gaseous Fuel," W. J. Pickering; "High-pressure Gas for Industrial Purposes," Mr. Walter; "Some Sources of Benzol and Toluol for High Explosives," T. F. E. Rhead; "Artificial Silk," L. P. Wilson; "Activated Sludge Process," E. Ardern; "Organisation of Industrial Research," H. W. Rowell; "Scheme for Co-operative Industrial Research," H. W. Rowell; "Vulcanisation of Rubber," Dr. D. F. Twiss.

OUR ASTRONOMICAL COLUMN.

COMET 1917*a* (MELLISH).—The following revised ephemeris for this comet, based upon a new orbit calculated from observations made on March 21, April 4, and April 20, has been received from Copenhagen:—

1917	R.A.	Decl.	Log Δ	Mag
	h. m. s.	° ′		
May 27	1 56 28	−12 56·2	0·2236	7·2
June 4	2 7 28	14 11·5	0·2419	7·5
12	16 53	15 31·8	0·2559	7·8
20	24 45	16 59·8	0·2666	8·0
28	31 5	18 37·3	0·2748	8·2
July 6	35 46	20 25·6	0·2810	8·4
14	38 46	22 24·2	0·2859	8·6
22	2 39 54	−24 33·1	0·2901	8·7

The comet is now too far south for observation in Europe. It was apparently this comet which was observed in Australia on April 19, and described as a new comet (see NATURE, April 26, p. 172).

DISPLACEMENTS OF SOLAR LINES.—In continuation of previous work on iron, Dr. Royds has recently made an extensive series of comparisons of the spectra of the sun and arc for nickel and titanium, and has also investigated the displacements at the negative pole of the arc in the case of these elements (Kodaikanal Bulletin, No. 51). Unsymmetrical lines of nickel and titanium, as indicated by their behaviour at the negative pole, and by records of their appearance under pressure, were found to be very numerous, and it was only possible to confirm to a limited extent the conclusions arrived at from the lines of iron. It is considered, however, that the new results are not inconsistent with the conclusions deduced from iron by Mr. Evershed, namely, that the displacements at the centre of the sun's disc, and at the sun's limb, are Doppler effects due to descending motion in the line of sight, and that the solar pressure is of the order of three-quarters of an atmosphere. The spectrograph employed in these investigations has been provided with a new Anderson grating having 75,085 lines on a ruled surface of 9·7×12·8 cm.

THE PROBLEM OF SPIRAL NEBULÆ.—The view that spiral nebulæ may be distant galaxies, or "island-universes," is discussed in an interesting article by Dr. Crommelin in the May number of *Scientia*. In recent years this hypothesis has received considerable support from the discovery that a large proportion of the non-gaseous nebulæ are of spiral form, and by the accumulation of evidence that our own system has a somewhat similar structure. One of the chief difficulties with regard to it is the fact that such nebulæ are mainly concentrated in the vicinity of the galactic poles, thus suggesting a connection with our system, but Dr. Crommelin considers that this apparent avoidance of the galactic plane by the spirals may be explained by assuming the existence of patches of obscuring matter which become more numerous as the galactic plane is approached. Moreover, if the spirals were inside our system, their grouping would probably be about an axis through the centre of the galaxy, and not about an axis through our sun at right angles to the galactic plane. The alternative view that the spirals may be emanations driven out of our system by some agency seems to be rendered untenable by the recently discovered fact that their radial velocities are greatly in excess of any velocities which have been observed within the system. Dr. Crommelin concludes that most of the evidence seems to favour the extra-galactic position of the spirals, and if this view be adopted, it follows that they are of dimensions comparable with those of our galaxy. They are probably at a comparatively early stage of development, much of their matter being still scattered and diffused in clouds which reflect some of the starlight.

ELIAS ASHMOLE, F.R.S., FOUNDER OF THE FIRST PUBLIC MUSEUM OF NATURAL HISTORY.

MAY 23 next will be the three hundredth anniversary of the birth of Ashmole, antiquary, herald, and man of science. He included among his interests not only the entire world of Nature, but, like some physicists of the present day, he delighted to explore the regions of the preternatural. He has often been blamed, and we think unjustly, for devoting so much time to astrology and alchemy, which were the "scientific" pursuits in fashion at that period; but we should dwell upon what has lasted of his work rather than upon what was trivial and ephemeral. So far as science is concerned, the outcome of his lifework will always be memorable, for he became the founder of the first public museum of natural history in Great Britain; next, he must be regarded as the founder of the first university chemical laboratory; and, thirdly, he founded the first chair of chemistry in Oxford.

Ashmole was born at Lichfield, and received his early education at the local Grammar School. At the age of twenty-seven circumstances brought him, in the character of a commissioner of excise, to Oxford, where he continued his education in physics and mathematics as a member of Brasenose College, and imbibed from a Capt. George Wharton that taste for the study of astrology and alchemy which led him to give these subjects so much of his time. In October, 1646, he moved to London, and there for the next ten years eagerly assimilated the experimental facts and visionary lore of Lilly, Booker, and Martin Backhouse. He vigorously pushed forward his studies in astrology, chemistry, and botany; was a guest at "the mathematical feast at the White Hart"; edited Dr. Dee's writings; published the "Theatrum Chemicum," and, to quote Selden, "was affected to the furtherance of all good learning."

Ashmole lacked the touchstone of modern training which renders a student competent to discriminate between false and true learning; it was beyond the power of any one man to investigate every recipe for the philosopher's stone, and discover for himself the futility of this and similar quests. But during those years of research in London Ashmole arrived at the best method of stimulating interest in scientific matters, knowledge which was put to the best use some years later. We will not therefore regard him as a scientific observer nor as a successful experimentalist, but as the promoter of one of the most effective methods of primary scientific education, which aims at awakening and developing the intellectual activity of the young by putting before their eyes remarkable objects of natural history. Prof. Tyndall well expresses the essentials of the method in his address on "The Importance of the Study of Physics as a Branch of Education for all Classes"; he points out the great value of the incentive that the exhibition of natural objects and phenomena supplies in the stimulating of mental activity:—"As the nurse holds her glittering toy before the infant she would encourage to take its first step, so it would appear as if one of the ends of the Creator, in setting those shining things in heaven, was to woo the attention and excite the intellectual activity of His earth-born child." Without going so far as the distinguished physicist, in attributing motives to the Creator, we would insist that the more strongly the senses of the observer can be arrested by objects or phenomena of curious or unusual nature, the more vivid are the images of thought which are conjured up in the mind. When objects become commonplace, or operations a part of our everyday life, they lose this power of stimulation. Impressions arising from accidental circumstances often exercise so powerful an effect on the young as to determine the direction of a career. Humboldt relates that his early desire to visit tropical countries sprang partly from seeing some pictures of the shores of the Ganges in the house of Warren Hastings in London, and from the sight of a colossal dragon-tree in the old tower of a botanic garden. To a mind susceptible to impressions of this kind such object-lessons have the greatest educational value. And it is for this reason that Ashmole, as the founder of the first public museum of natural history, has the greatest claim to our consideration.

The oldest specimens in his museum had been collected by John Tradescant the elder (died 1638) during his travels in Holland, Russia, and Barbary, about the end of the sixteenth century. He left the collection to his son John (died 1662), who enriched it by adding new specimens collected on his travels in Virginia,

and, under the persuasion of Ashmole, published a catalogue of the whole collection. Although this catalogue appeared under Tradescant's name, allusions in the preface and the more definite statement of John Evelyn, "printed in his catalogue by Mr. Ashmole," make it almost certain that Ashmole was not only the instigator but also part compiler and editor of this, the first English, catalogue of a natural history museum. The keen interest Ashmole took in the collections would explain why Tradescant should have drawn up a deed of gift in 1659 making over the whole cabinet of rarities at his death to his friend, who, in 1674, after twelve years of controversy and litigation with the widow, moved the collections to his house in South Lambeth, where they were so carefully and methodically preserved as to elicit praise from Izaak Walton.

In 1677 Ashmole offered the whole collection, with the additions he had made to it, to the University of Oxford, on condition that a suitable building was provided for their display. His offer was accepted, a museum was built, the rarities were "put up in cases," and on March 14, 1683, the last loads "were sent to the barge" for transport to Oxford, and Ashmole "relapsed into the gout."

The preamble to his statutes, orders, and rules for the governance of his museum shows clearly that his intention was to provide the University with a museum of natural history, which should be primarily a scientific institution and not a "knick-knackatory," or a collection of historical relics and antiquities, such as has now come to be exclusively associated with his name at the New Ashmolean Museum, of which Sir Arthur Evans was the practical founder. The advancement of natural knowledge was Ashmole's first object; the accumulation of objects of art was not his purpose except in so far as those art objects served to illustrate the application of natural products. The preamble runs as follows:—

"Because the knowledge of Nature is very necessarie to humaine life, health, and the conveniences thereof, and because that knowledge cannot be soe well and usefully attain'd, except the history of Nature be knowne and considered; and to this is requisite the inspection of particulars, especially those as are extraordinary in their Fabrick, or usefull in Medicine, or applyed to Manufacture or Trade: I, Elias Ashmole, out of my affection to this sort of Learning, wherein myselfe have taken, and still doe take, the greatest delight; for wch cause also, I have amass'd together great variety of naturall Concretes and Bodies, and bestowed them on the University of Oxford, wherein my selfe have been a student, and of which I have the honor to be a Member. Lest there should be any misconstruction of my intendment, or deteriorating of my donation, I have thought good, according to the Acts of Convocation, bearing date Jun: 4: Ao 1683 and Sept: 19: Ano 1684, to appoint, constitute, and ordaine as follows." Then follow eighteen orders.

Order 6 is an example of his judicious foresight. It enacts "That whatsoever naturall Body that is very rare, whether Birds Insects, Fishes, or the like, apt to putrefie and decaye with tyme shall be painted in a faire Velom Folio Booke, either with water-colors, or at least design'd in black and white, by some good Master, with reference to the description of the Body itselfe, and the Mention of the Donor in the Catalogue; wch Booke shall be in the Custody of the Keeper of the Musaeum under Lock and key."

In these days of cheap photography the execution of this order would be a simple matter. Order 7 provides for the exchange or donation of duplicates, and by Order 8 old specimens are to be removed to cupboards.

The new building was constructed so as to include a lecture-room and a chemical laboratory, and for more than a century and a half it was the centre of scientific life in Oxford. For the further advancement of science Ashmole founded the first chair of chemistry in Oxford, and Robert Plot was appointed first Ashmolean professor, and also keeper to the museum. Unfortunately the founder's schemes for the adequate advancement of his favourite subjects were longer than his purse, and he did not live long enough to collect sufficient capital endowment to put the new professorship upon a permanent footing.

Ashmole is not likely to be forgotten in Oxford, yet the destiny that so often militates against just recognition in science has brought it about that his name, the museum and officers he created, are no longer used in accordance with his original ordinances. The museum in which he took so much pride no longer exists as such; even the knick-knacks to which his name is attached can no longer be seen in the building which he persuaded the University to provide; the old Ashmolean building, sadly in need of repair, is degraded to class-rooms, offices, and book stores; the greater part of the scientific specimens which he so greatly valued have been destroyed, and the few fragments that remain distributed; and Ashmole's keeper, relieved of the duties that were put upon him by the founder in respect of the natural history collections, is now in charge solely of the few curiosities which did not in Ashmole's opinion constitute the central feature of his museum.

A fitting commemoration of his name is to lay stress upon the fact that he was one of the pioneers of scientific education in England, that he earnestly endeavoured to promote learning, and that it is only by an error that his name has survived as a collector of curious antiquities. Of the old Tradescant and Ashmole collection some score or two of zoological specimens have survived from the seventeenth century. It is to be hoped that they may once more be brought together in accordance with their donors' wishes and their great historic value.

R. T. GUNTHER.

PUBLIC SCHOOLS AND NATURE STUDY.

THE unusual interest attaching to the report of the Rugby School Natural History Society for the year 1916 warrants our directing attention to the great service which our public schools may render to the cause of natural science. It is the jubilee number, and in addition to the usual features contains much other matter of exceptional interest. Special mention may be made of the racy and valuable paper by Canon Wilson, of Worcester, in which his personal reminiscences of the early history of the society, and, indeed, of the prehistoric period, are set forth with much humour and enthusiasm.

Though the fiftieth anniversary of the founding of the society was celebrated in March last, thus carrying us back to the year 1867—the tercentenary of the school—yet we learn that work on similar lines to those which the society follows to-day was carried on for some years previously. The geological museum dates from the time of Dr. Arnold. Canon Wilson went to Rugby as a master in 1859, and found a large collection of dusty and unnamed specimens in the Arnold Library. But one goes back yet another decade, and finds the year 1849 specially worthy of note. It was then that Dr. Sharp, a resident medical man, gave the first lectures on natural philosophy. Rugby School thus proclaims itself, not abreast, but in advance, of public opinion in regard to the position which natural science ought to occupy in liberal education.

In 1847 the British Association met in Oxford. Shortly afterwards a memorial was drafted for presenting to the University urging greater facilities for the study of natural history and science. It was, however, strangled in the birth, even so great an advocate of science as Buckland refusing to sign it. "Some years ago," he wrote, "I was sanguine, as you are now, as to the possibility of natural history making some progress in Oxford, but I have long come to the conclusion that it is utterly hopeless." We shall agree that it required some courage on the part of Dr. Tait to start the teaching of science at Rugby in the face of the almost universal condemnation of the study as frivolous and dangerous.

Between the years 1859 and 1864 Canon Wilson and others did some good voluntary work in geology. About this time a Royal Commission recommended that every boy should receive instruction in one or other of the sciences, and Dr. Temple engaged a science master from Birmingham with the view of carrying out the recommendation at Rugby. But Hutchinson could not enter on his duties till 1865, so Canon Wilson and Kitchener, who two years later became the first president of the Natural History Society, undertook to teach botany. Sir J. D. Hooker planned a course of study, and as the masters were not experts in the subject, they devoted their holiday to a six weeks' course at Barmouth, with Henslow as their coach. Such enthusiasm merited the reward it received.

The way was thus prepared for the inauguration of a society which should undertake the voluntary study of Nature, independently of the school curriculum, and on March 23, 1867, the Natural History Society was founded by a little group of eight boys and one master. The portrait of the master, Kitchener, is given as frontispiece to the current report. Some idea of the good work which the society has since accomplished may be obtained by reference to the pages dealing with natural history which give such value to the "County History of Warwickshire," in which the annual reports of the school are laid under frequent contribution.

Most young people probably have an inherent love of Nature, but it depends largely on early environment whether it will die or develop. More than one old Rugbeian has, in the course of the last half-century, made his mark in one department or other of natural history. Thus Longstaff, whose delightful book on "Butterfly Hunting in Many Lands" carries us round the world, writes: "As long as life lasts I shall be grateful to Mr. F. E. Kitchener and Canon Wilson for the substantial addition to my happiness that their instruction provided." Dr. Lucas, F.R.S., whose death last October was so greatly deplored, was another Rugby boy, and acted as curator and secretary in 1898, while the report for 1896 contains a paper by him on photomicrography. Worthington, whose interesting papers on "The Splash of a Drop" won for him election to the Royal Society, first developed his love for this subject while at Rugby.

And what shall we say of that famous Nimrod of modern times, Capt. Selous, whose "African Nature Notes" and other books reveal the perfect naturalist? His obituary, with an excellent photograph, finds a place in this report, but we owe to Canon Wilson a most romantic story of his successful attempt to obtain eggs from a heronry at Coombe Abbey, and the price he had to pay for his daring. We regret that we cannot find space to repeat the anecdote, with others of a similar kind.

That the work of the society is well maintained, and that the interest does not flag, is shown by the original papers as well as by the sectional reports. Without being invidious, we should like to direct special attention to the work of Greg and Bevington in ornithology. Such studies are of inestimable value to young people. They develop the powers of observation, teach patience, sympathy, endurance, and kindness, divert the mind from base pursuits, and open out a fairy realm of beauty and delight, which cannot fail to ennoble, as well as entertain, those who pursue them. Any public school not already in the possession of such an institution may be heartily recommended to follow the example of Rugby.

HILDERIC FRIEND.

AN INSTITUTE OF APPLIED OPTICS FOR FRANCE.

A SCHEME is on foot in Paris to establish an Institute of Applied Optics, with the object of securing closer co-operation between theory and practice in the optical trade. It has been suggested, according to an article in *La Nature*, that the scope of the institute should fall into three sections, viz. (i) a college of optics, providing a thorough theoretical and practical training for opticians, and promoting among its students a taste for optical research; (ii) a central optical laboratory, where tests of glasses and optical instruments would be made for men of science, public bodies, and manufacturers, and research work of general interest carried out; and (iii) a special trade school in which the students could obtain a thorough training in the practical branches of the trade.

It is proposed that the institute should publish transactions in a form following, say, the *Zeitschrift für Instrumentenkunde*.

The students of the college of optics would be recruited from the educated classes—Army and Navy officers, students or ex-students of the universities and technical colleges, astronomers, illuminating engineers, manufacturers of optical instruments, and doctors interested in physiological optics. There would be two distinct branches of instruction, viz. general optics and instrumental optics. The courses would be supplemented by lectures on all modern optical questions. The period of study is suggested as one year.

The central laboratory would serve as a test laboratory for manufacturers of optical instruments and for glass manufacturers, as a practice laboratory for the students, and as a research laboratory for the college staff.

The professional, or trade, school would take young people for three years and give them a thorough training in (i) glass-working, and (ii) construction and fitting up of optical instruments.

The scheme has received the favourable consideration of various Government departments and of certain scientific and learned societies in Paris; indeed, the publication of the transactions of the institute is already assured.

While it would be difficult to install the machinery and plant necessary for the trade section of the institute, it is suggested that the programme of the courses should be considered and the principal courses commenced in the school year 1917–18.

E. S. HODGSON.

THE MAN OF SCIENCE IN THE COMMUNITY OF TO-DAY.[1]

IT is not too much to say that for the first time in the history of the British Empire Science is coming into her own. It is no doubt humiliating to have to confess that it was the misapplied science of our enemies which demonstrated to us how inferior was the place we had given science in our own national

[1] From an address delivered to the Nova Scotian Institute of Science on November 13, 1916, by Prof. D. Fraser Harris.

life. The land that produced Roger Bacon, Napier, Gilbert, Harvey, Newton, James Watt, Jenner, Faraday, Darwin, Kelvin, and Lister had to be shown by the exponents of science prostituted that science was nevertheless worth cultivating for its own sake.

Possibly nothing less terrific than this irruption of Teutonic brutality would have shaken the British race out of its comfortable mental inertia. But having been awakened, let us thankfully admit that our rulers are now doing something towards recognising the all-pervading importance of science in the national life. Committees of various learned societies have been formed; the British Science Guild is taking action; the Royal College of Science has recently presented a petition to Lord Crewe to have men of science adequately recognised; and the Government from early in the war has been consulting men of science on a large number of economic problems. Quite recently Sir J. J. Thomson has been elected chairman of an important committee to study the position of science in secondary schools and at the universities and its relations to trades, industries, and professions which depend on applied science.

It cannot be denied that science, as science, has only very recently been allowed to have an independent existence in our national intellectual system. The time is within the memory of some of us when the attempt to introduce laboratory teaching into the University of Oxford was met with a furious resistance; and when at length studies in practical chemistry were instituted they were alluded to as "stinks." History was repeating itself; for Leo Africanus, writing in the early part of the sixteenth century, thus described the chemical society of the learned Arabians at Fez: "There is a most stupid set of men who contaminate themselves with sulphur and other horrible stinks."

Science is of the very warp and woof of the web of human existence; ought we not to reckon with it officially, as it is called? Has not the time come to *admit* that science is as important as it really has become; for the existence of something and the official admission that it exists are two different things? Why should not science be taken under the care of a Cabinet Minister? It is no longer vulgar, it is no longer beneath the attention of the aristocratic intellect; it is of preponderating usefulness to the nation, and it is malevolent only when divorced from common sense and common morality by the obsessions of self-hypnotised Prussians. It is within a very little of being even a profession! Why not recognise the pursuit of something which is almost a respectable profession? Why not have the official interests and the economic aspects of science presided over by someone who knows something about them?

We need to make science the keynote of our public service and university system, as Humboldt did early in the nineteenth century, when Prussia was as yet under the heel of Napoleon. The peremptory necessity of better scientific organisation is apparent; it is now a question not only of our prosperity, but also of our existence.

Science, in short, must have a Department, a Government office, before the public will fully accord it its place of honour. We may regret that this sort of thing has to be, but our regret will not change public opinion; and it appears to be part of the British Constitution that nothing can be done, or should be done, without a very large body of public opinion behind it. But the official recognition of science cannot wait until the public has seen fit to render science the homage it deserves. To begin at the top, let there be a Minister of Science and a Ministry of Science with just as much prestige accorded it as the War Office, the Foreign Office, or the Home Office. The duties of the Minister of Science would be primarily to foster science in every way possible, to further its interests, to administer its affairs somewhat in the manner in which the Board of Trade looks after trade, and the Board of Agriculture and Fisheries after agriculture and fisheries.

By friendly and intelligent co-operation with the universities, technical colleges, and the leaders amongst the manufacturers, the relations of science to the State could be adequately safeguarded; scientific men would be known, encouraged, subsidised, promoted, rewarded, and pensioned.

For why should State recognition, encouragement, promotion, and rewarding be reserved for sailors, soldiers, diplomatists, and lawyers? Why should it be so entirely correct to be paid for legal opinion, and such "bad form" to be remunerated for scientific advice? Because, you may rely, the law is an ancient, respectable profession, and science is so modern that it is not a profession at all. But this medieval state of affairs cannot go on indefinitely; it was all very well for the day when there was no science to foster, and men quarrelled so much that lawyers were kept very busy, but now "nous avons changé tout cela"—or at least the earlier part of it. One need not here and now draw up an exhaustive list of the duties of the Minister of Science, but may merely remark that much that falls under the supervision of the Home Office could be transferred to the Department of Science. Had there been such a department, Edward Jenner, for instance, would not have had to struggle against every kind of obstacle and misrepresentation for so long a time as he did, or have had to wait so long as he had for the official recognition of what he had done for suffering humanity. Not from his own private house, but from a Government department would the vaccine have gone forth to eager Europe. He truly called himself "The vaccine clerk of the whole world."

The first concern of the Science Office would be the place of science in the schools of the Empire. And here we come up against the still burning question of the rival claims of science and the classics. Of course, it ought to be perfectly possible to instruct boys in as much of Greek and Latin as would make them know the origin of the words in English derived from those languages, without necessarily making the boys read entire Greek and Latin authors in the original. The practice in the past of educating boys as though they were all going to be teachers of the classics is analogous to the teaching of physiology to medical students as though they were all going to be professional physiologists.

Owing to our national physiological momentum, the teaching of boys has been continued on the same lines as those laid down by the educationists of the Revival of Learning in the sixteenth century. What Erasmus, Linacre, and Dean Colet planned was admirable for the day when America and printing had only just been discovered, but is possibly not so well adapted to the country which lights its cities by electric energy, speaks to America without wires, flies in high heaven like the eagle, and descends to the abyss like a sea monster.

The Science Office will see to it that science receives official recognition in all entrance examinations whatsoever, and that it is not handicapped by receiving fewer marks than the classics or any other subject. Science must have its place in the curriculum, not on sufferance or by-your-leave, but by right and in virtue of its inherent dignity and usefulness. Science cannot any longer be the under-fed maid-of-all-work; Science is the queen herself coming into her kingdom.

Science is no longer to be merely permitted, tolerated, apologised for; she must preside at the council board because she already rules the lives of the people.

The academic precedence of the faculties, in which theology, arts, and law come before medicine and science, may still be tolerated at the old universities as an interesting and significant relic of earlier times; but in all modern universities (as in the University of Birmingham from its foundation) science is the premier faculty and takes the first place. The world advances, not because of Church history or Homer or Virgil, but because of James Watt and Stephenson and Dalton and Faraday and Harvey and Jenner and Darwin and Kelvin and Lister. Better fifty days of Faraday than a cycle of Aristotle.

Why is a knowledge of science so useful to the modern community? Apart altogether from the way in which science makes for technical efficiency, it is a means second to none in the training of the intellectual powers. It trains us in accuracy of observation, in the power of drawing trustworthy conclusions, in habits of precise thinking generally; and these are not small things.

Science, the true, is the patient, loving interpretation of the world we live in; it is a striving to attain not merely to an understanding of the laws whereby the world is governed, but to the enjoyment of the beauty and order which are everywhere revealed. And the minds of men capable of attaining to such heights of appreciation, and the evidences around us of an all-pervading personality, are only so many additional phenomena to be apprehended as constituent elements of that vast, sublime, age-enduring cosmos which we call the universe.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LIVERPOOL.—The council has appointed Dr. P. G. H. Boswell as first holder of the George Herdman chair of geology. Prof. Boswell graduated with first-class honours in geology in the University of London, and obtained the degree of D.Sc. in 1915. He has for some years past been lecturer in geology at the Imperial College of Science and Technology, London, and has published many original contributions to geological science. The establishment of a chair of geology in the University has been long delayed, and is now possible owing to the generosity of Prof. and Mrs. Herdman, who have endowed the chair as a memorial to their son, the late Lieut. George Herdman. Prof. Boswell will enter upon his duties in October next.

PROF. C. R. RICHARDS, since 1911 professor of mechanical engineering in the University of Illinois, and head of the department, has been appointed dean of the College of Engineering and director of the Engineering Experiment Station of the University, to succeed Dr. W. F. M. Goss, who has resigned to become president of the Railway Car Manufacturers' Association of New York.

UNDER the will of the late Mrs. Denning, of South Norwood, property of considerable value has been left to form a "Frank Denning Memorial," with the object of promoting the application of modern scientific knowledge to the business life of the community. Mrs. Denning survived her husband only twelve months. The late Alderman Frank Denning was Mayor of Croydon at the time of his sudden decease, and was one of the leading directors of Welford's (Surrey) Dairies, Ltd. He was also a director of colliery companies in Gloucestershire. For some time before his death he was a governor of the Stanley Technical Trade Schools at South Norwood, and his interest had been aroused in the good work being done at these schools. It is not known at present how the terms of the trust will be carried out, but in view of the success of these schools, it is possible that some developments along the lines already laid down may be looked for. Mr. Denning was a business man before anything else, and the terms of the bequest seem to show that technical education is aimed at, and that pure science as a study had no large place in his mind.

THE report of the Vice-Chancellor on the work of the University of London during the year 1916–17 shows that the total number of commissions granted from the outbreak of the war to December 31, 1916, to cadets and ex-cadets of the University contingent of the Officers Training Corps, and to other graduates and students of the University recommended for commissions, was not fewer than 3111; and the honours and distinctions conferred upon officers and cadets during the same period included one Companionship of the Bath, two awards of the Victoria Cross, six of the Distinguished Service Order, 157 of the Military Cross, one of the Distinguished Service Cross, and 199 mentions in despatches, besides from the French Government three awards of the Croix de Guerre and one of the Médaille Militaire. It is recorded that 284 former officers and cadets of the contingent, and thirty-three other officers recommended for commissions by the University, have made the supreme sacrifice for their country. About 21,000 members of the University are, or have been, serving with H.M. Forces. The research work normally conducted in the laboratories attached to the University has been to an increasing degree directed to the assistance of Government departments or other agencies concerned with the requirements of the war. In addition to the response made by teachers and qualified students at the medical schools of our hospitals to the demands of the War Office for physicians and surgeons, considerable services have been rendered to the Government in the departments of physics, chemistry, physiology, pharmacology, bacteriology, metallurgy, and civil, mechanical, and electrical engineering.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, May 2.—Dr. Alfred Harker, president, in the chair.—Jane **Longstaff** (*née* Donald): Supplementary notes on Aclisina, De Koninck, and Aclisoides, Donald, with descriptions of new species. Since the publication of a paper by the Geological Society on Aclisina in 1898, knowledge has been gained of the species there described, and six others new to science have been discovered. The diagnoses of these are given. The total number of species of Aclisina is brought up to twenty-two. The genus is best represented in Scotland, where the specimens are generally well preserved. A table is appended giving the range and localities in the British Isles and Belgium. A small variety of *Aclisina pulchra,* De Koninck, appears to have continued for the greatest length of time. Additional observations are also made on *Aclisoides striatula,* De Koninck.—T. H. **Burton**: The microscopic material of the Bunter pebble-beds of Nottinghamshire and its probable source of origin. As shown by the distribution of the heavy minerals, combined with (*a*) the direction of the dip in the cross-bedding, (*b*) the evidence adduced by boreholes and shaft-sinkings, a main current from the west is indicated. A large quantity of the material is derived from metamorphic areas. The source of the bulk of the material is probably Scotland, and the westward

adjoining vanished land, from rocks similar in the main to those of the metamorphic and Torridonian areas known in that country. The material was transmitted by means of a north-western river and its tributaries, flowing into the Northern Bunter basin. During certain flood-periods this river overflowed across Derbyshire, carrying its load of sediment, much of which was deposited in the pebble-beds of Nottinghamshire.

Linnean Society, May 3.—Sir David Prain, president, in the chair.—H. W. **Pugsley**: An enumeration of the species of Fumaria, section Sphærocapnos. The author alluded to Shakespeare's mention of "rank fumiter" in "King Lear." The earliest known references date back to Dioscorides in the first century, under the name of καπνὸς, smoke; the elder Pliny spoke of two species, one apparently our *Fumaria officinalis*. The modern generic name first appears in Bock (Tragus), Fuchs and Mattioli. Gerard, in his "Herball," includes the common fumitory as "*Fumaria purpurea*," but Gerard's description was altered and not improved by his later editor, Dr. Thomas Johnson. The enumeration in Ray's "Historia" was confined to the three species given by Gerard, but all the specimens in the Sloane Herbarium, and the Dubois herbarium at Oxford, prove to be a rampant form of *F. officinalis*. The true *F. capreolata*, an uncommon British plant, was added to our flora in 1859, when Prof. C. C. Babington read his paper on the genus before the Linnean Society. The *F. capreolata* of "English Botany" and Curtis's "Flora Londinensis" is Jordan's *F. Boraei*. With Vaillant's species, *F. Vaillantii*, there were six species distinguished before the time of Linnæus. In his "Species Plantarum" of 1753 the latter author has but two species of Fumaria; the remainder are now reckoned in Corydalis and other genera. The author then referred to works on the genus by Handschuch (1832) and Parlatore (1844), and especially the masterly monograph by Olof Hammar in 1857, the basis of recent work; a later monographer, Haussknecht, in "Flora," 1873, relied upon leaf-characters rather than the sounder characters afforded by the flower and fruit.—G. M. **Ryan**: The flowers of the Mahua, *Bassia latifolia*, Roxb. The tree and its products were described.—Dr. W. E. **Collinge**: (1) Paracubaris, a new genus and species of terrestrial Isopoda from British Guiana. (2) The oral appendages of certain species of marine Isopoda.—C. C. **Lacaita**: Two critical plants of the Greek flora.

EDINBURGH.

Royal Society, March 19.—Dr. John Horne, president, in the chair.—Dr. J. **Aitken**: Some nuclei of cloudy condensation. By means of an improved apparatus for producing a series of definite expansions of a given volume of saturated air, the author studied the cloud-producing qualities of dust particles of different sizes obtained in various ways. After the air was cleared of the largest particles by one or more applications of a 2 per cent. expansion, cloud-producing particles of smaller sizes were removed in succession by expansions 4 per cent., 6 per cent., 8 per cent., and so on up to 20 per cent. if necessary. The particles were produced by such means as flames, electric sparks, chemical action, and heating of solid substances; and the general conclusion was that in no expansion lower than 25 per cent. was there any evidence of electric ions being by themselves efficient nuclei for cloudy condensation. The view that the nuclei of cloudy condensation produced by heat are ions discharged at high temperatures is not supported, since such nuclei are produced at much lower temperatures than that at which ionic discharge from heated bodies occurs; and even at this higher temperature spectroscopic examination shows that some chemical or disintegrating action takes place along with the discharge of the ions.—W. L. **Calderwood**: Note on the salmon of the River Lochy as shown by a collection of scales made in 1916. The purpose of the paper was to compare the scales and weights of two groups of fish, distinguished as groups A and B. The members of group A had spent two years in the sea and one in the river, while the members of group B had spent two years in the river and two in the sea. The average weight of the former was the greater. Thus the actual number of lines of growth as determined by the examination of the scales cannot be taken as a true index of the weight of the salmon. The condition in which the smolt leaves the river after only one year and commences a period of rich feeding in the sea may lead to a greater increment of weight than in the case of fish which are a year older but have spent the more normal period of two years' early life in the river.

PARIS.

Academy of Sciences, April 30.—M. A. d'Arsonval in the chair.—J. **Boussinesq**: Fundamental hypotheses of the mechanics of pulverent masses.—General **Sebert**: Can violent cannonades produce rain? Comments on a recent note by M. Deslandres on this subject. There is some evidence that the rainfall produced may not be all local, but that effects may be observed at considerable distances from the front. Sudden changes of weather have occurred without previous barometric changes, heavy rainfall suddenly following on fine weather without any previous indication of the change.—C. **Richet**, H. **Cardot**, and P. Le **Rolland**: Regular and irregular antiseptics. Studies in lactic fermentation in presence of various antiseptics show that when large numbers of trials are made under conditions apparently identical, the resulting acidities are not constant, but deviate considerably from the mean. This deviation varies with the nature of the antiseptic present. Thus sodium fluoride is very regular in its action, and the average deviation is smaller than that given by the control tubes. Mercuric chloride, on the other hand, added in equal quantities to each tube, gave surprisingly variable results, the average deviation being ten times that of the controls.—Ch. **Depéret** and L. **Joleaud**: The marine Quaternary deposits of the region of Bône and of La Calle (Algeria).—C. **Guichard**: The O networks of Monge in space of any order.—M. de **Sparre**: Hammering in a conduit formed of three sections of different diameters, for which the duration of propagation is the same.—R. **Ledoux-Lebard** and A. **Dauvillier**: Contribution to the study of the L series of elements of high atomic weight.—M. **Ménard**: The treatment of hæmorrhoids by high-frequency currents. High-frequency currents (d'Arsonvalisation) are of high value in the treatment of hæmorrhoids, and in many cases have avoided a surgical operation which would otherwise have been necessary. The results of the application of the method in six cases are given in detail; the cure was complete and permanent.—M. **Marage**: The duration of cases of deafness due to shell-shock.

CALCUTTA.

Asiatic Society of Bengal, March 7.—Dr. G. A. **Boulenger**: A revision of the lizards of the genus Tachydromus. Tachydromus is a genus of Lacertidæ characteristic of the Far East, and the only one of the family that extends eastward of the Bay of Bengal. Owing to insufficient material, the relations of the various species have hitherto been very imperfectly understood, and the revision which Dr. Boulenger has now prepared was in consequence badly needed. Eleven species are recognised in the genus

and a key provided for their ready determination. Two forms hitherto placed in Tachydromus have been transferred to the new genera Platyplacopus and Apeltonotus.—Dr. J. **Stephenson**: Zoological results of a tour in the Far East: Aquatic Oligochæta from Japan and China. In this paper Dr. Stephenson gives an account of certain Oligochæte worms obtained by Dr. Annandale in Japan and China. The specimens were all found in fresh water and comprise five species, three species and one genus being described as new. *Criodrilus bathybates* was found in Lake Biwa at the remarkable depth of 180 ft.—Dr. N. **Annandale**: Zoological results of a tour in the Far East: Hydrozoa and Ctenophora. The Hydrozoa dealt with in this paper are mostly from the Tale Sap, in Lower Siam, where they were found living in brackish water. A single fresh-water form, *Cordylophora lacustris*, was obtained in the Tai Hu Lake in China. The paper includes an account of the habitat, adaptations, and distribution of all the Hydrozoa inhabiting brackish water connected with the Indian Ocean. *Asenathia piscatoris*, a new genus and species of Medusa from the Matla River, is also described, and it is suggested that the form may possibly represent the medusoid generation of a peculiar little hydroid recently described by Ritchie from Port Canning under the name *Annulella gemmata*.

BOOKS RECEIVED.

Steel and its Heat Treatment. By D. K. Bullens. Second impression. Pp. vii+441. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 17*s*. 6*d*. net.

Seeding and Planting. By Prof. J. W. Toumey. Pp. xxxvi+455. (New York: John Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 16*s*. 6*d*. net.

The Elementary Principles of Wireless Telegraphy. By R. D. Bangay. Part ii. Second edition. Pp. 241. (London: The Wireless Press, Ltd.) 2*s*.

Some Compounds of Boron, Oxygen, and Hydrogen. By M. W. Travers, N. M. Gupta, and R. C. Ray. (London: H. K. Lewis and Co., Ltd.) 1*s*. net.

The Glastonbury Lake Village. By A. Bulleid and H. St. G. Gray, and others. Vol. ii. Pp. xxxiii–xl+353–724. (Glastonbury: Antiquarian Society.) Two vols., 3 guineas net.

Optical Theories. By Prof. D. N. Mallik. Pp. 181. (Cambridge: At the University Press.) 7*s*. 6*d*. net.

The Cancer Problem: A Statistical Study. By C. E. Green. New edition. Pp. ix+140. (Edinburgh and London: W. Green and Son, Ltd.)

Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information, 1916. (London: H.M.S.O.)

Microscopical Determination of the Opaque Minerals. By Dr. J. Murdoch. Pp. vii+165. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 9*s*. 6*d*. net.

Handbook for Rangers and Woodmen. By J. L. B. Taylor. Pp. ix+420. (New York: J. Wiley and Sons, Inc.; London: Chapman and Hall, Ltd.) 11*s*. 6*d*. net.

DIARY OF SOCIETIES.

THURSDAY, MAY 17.

ROYAL SOCIETY, at 4.30.—Bakerian Lecture: The Configuration of Astronomical Masses and the Figure of the Earth.—J. H. Jeans.

ROYAL INSTITUTION, at 3.—The Chromosome Theory of Heredity and the Alternatives: Prof. W. Bateson.

ROYAL SOCIETY OF ARTS, at 4.30.—The Future of Indian Trade with Russia: D. T. Chadwick.

INSTITUTION OF ELECTRICAL ENGINEERS, at 6.—Annual general meeting.

FRIDAY, MAY 18.

ROYAL INSTITUTION, at 5.30.—The Complexity of the Chemical Elements: Prof. F. Soddy.

INSTITUTION OF MECHANICAL ENGINEERS, at 6.—The Construction of Turbine-Pumps: A. E. L. Chorlton.

SATURDAY, MAY 19.

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

MONDAY, MAY 21.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—Anniversary Meeting, President's Address.

ARISTOTELIAN SOCIETY, at 8.—Some Aspects of the Philosophy of Plotinus: Dean W. R. Inge.

TUESDAY, MAY 22.

ROYAL INSTITUTION, at 3.—Architectural Design in Organisms: Prof. D'Arcy Thompson.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 5.—Tattooing in South-Eastern New Guinea: Capt. F. R. Barton.

THURSDAY, MAY 24.

ROYAL INSTITUTION, at 3.—The Chromosome Theory of Heredity and the Alternatives: Prof. W. Bateson.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30.—The Resources and Future of British Columbia: Dr. J. F. Unstead.

LINNEAN SOCIETY, at 3.—Anniversary Meeting.

AERONAUTICAL INSTITUTE, at 8.—The Testing of Materials for Aeronautical Construction: Edgar A. Allcut.

INSTITUTION OF MINING AND METALLURGY, at 5.30.—Shall Great Britain and America Adopt the Metric System?: W. R. Ingalls.

FRIDAY, MAY 25.

ROYAL INSTITUTION, at 5.30.—Breathlessness: J. Barcroft.

PHYSICAL SOCIETY, at 5.—An Investigation of Radium Luminous Compound: C. C. Paterson, J. W. T. Walsh, and W. F. Higgins.—The Resistance to the Motion of a Lamina, Cylinder, or Sphere in a Rarefied Gas: F. J. W. Whipple.—The Effect of Stretching on the Thermal and Electrical Conductivities of Wires: Dr. C. H. Lees.

SATURDAY, MAY 26.

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

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