Nature

A WEEKLY

ILLUSTRATED JOURNAL OF SCIENCE


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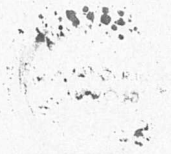

"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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R. CLAY AND SONS, LTD., BRUNSWICK ST., STAMFORD ST., S.E., AND BUNGAY, SUFFOLK.

NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE.

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

THURSDAY, MARCH 6, 1913.

SCIENTIFIC WORTHIES.

XL.—SIR J. J. THOMSON, O.M., F.R.S.

It is impossible to think of the rapid and profound evolution which occurred in the fundamental conceptions of natural philosophy during the final years of the past century without one figure looming large in the mental picture—that of the celebrated physicist of the University of Cambridge. In effect, the new and fruitful trend assumed by the science of physics in recent years has been in great part due to the happy intuition of Sir J. J. Thomson and to the experimental researches unwearyingly pursued by him and his students in the celebrated Cavendish Laboratory.

One circumstance is particularly striking in that movement—the unforeseen opening out of new and vast horizons to the physicist precisely at the moment when the electromagnetic theory of light had been victoriously acclaimed—a theory which not only gathered into one marvellously harmonious synthesis all the phenomena of the physical world, but at the same time satisfied that natural scientific instinct, which seeks for the greatest simplicity in its explanation of natural phenomena, by attributing to a single medium, the æther, the double office of transmitting electrical and magnetic forces as well as the waves of light.

In spite of this, physicists were not able long to rest upon their laurels; for certain classes of phenomena, which, perhaps, it was hoped would find an easy explanation, proved quite resistant to elucidation unless accessory hypotheses were devised.

If we go back in thought fifteen or twenty years, it is plainly visible that, after the definitive triumph of Maxwell's theory in the experimental field with the work of Hertz and his successors, the great unknown which we call electricity was still considered by all, in its real nature, more or less as an incompressible fluid which could displace itself in dielectrics, overcoming a certain elasticity, or flow in a conductor; whilst the principal electrostatic facts, metallic conduction and some other phenomena could be considered as intimately known. But the propagation of electricity in electrolytes, and more especially in gases, remained in part problematical.

To these two classes of phenomena was not attributed the importance they should have merited. But even then was perceived one most important specific character of electricity in the case of its propagation in electrolytes, namely, its apportionment into small parts, identical among themselves, and representing the charges corresponding with each valence of the electrolytic ions. The significance of this fact could not escape the mind of Maxwell; and it led him to consider those charges as *atoms* of electricity. Nor could it escape Helmholtz, who acutely pointed out that the existence of such charges must be considered possible, even apart from the ponderable matter with which they are ordinarily accompanied, even if it were only during the short time in which, having left the ion, they are about to enter the electrode to feed the current in the metallic portion of the circuit.

The existence of atoms of electricity, or of "electrons," according to the felicitous expression proposed by Stoney, was accepted without hesitation as a fundamental hypothesis in the theories constructed by Larmor, Lorentz and other mathematical physicists; and the former of these so

far back as 1894 succeeded in outlining an electrical theory of matter. But, however seductive these theoretical investigations appeared, and in their comprehensiveness they represented a considerable advance on earlier theories, the real existence of electrons could not be accepted by physicists until a satisfactory experimental demonstration of their existence was forthcoming.

To succeed in such a demonstration undoubtedly appeared to everyone a sufficiently difficult matter; yet such has actually been achieved, thanks to the study of the kathode rays, that is, of certain peculiarities presented by electrical discharge and already known for some considerable time.

The phenomena of discharge have always attracted the attention of physicists, and innumerable studies have been made in this field. The peculiarities which they present, varied as they are almost indefinitely, and certain brilliant aspects which they possess, even though not always of the highest scientific interest, have rendered these studies so attractive, that it is difficult for anyone who has once pursued them to free himself from their seductiveness and pursue other researches. A rich material of facts thus went on accumulating, between which, however, in the majority of cases there was no intimate connecting link; this material was later to be coordinated by the electronic theory, which in turn gained many indirect confirmations from it. Finally, when, with the perfecting of technique, it became an easy matter to p.oduce the greatest rarefaction of gases, the phenomena of the kathode rays assumed their due importance in the eyes of physicists; and all those who, by natural disposition or as a result of long experience in physical researches, possessed that fine intuition which in certain cases appears almost as a true divination, presaged that from the study of the kathode rays would accrue results of capital importance, capable of throwing light on the nature of electricity.

The very brilliant and ingenious experiments described by Crookes, and the theory of "radiant matter" proposed by him to explain them, gave a great impulse in the direction which has led to the actual views of to-day. It is true that that theory was combated, unfortunately, even by physicists of such high reputation as Hertz; but there were some, at least, who at once welcomed it with enthusiasm.

The present writer can boast that he was one of this small band, and that he drew from the theory the inspiration of numerous experiments, demonstrating the existence of electrified particles (ions) in gases under atmospheric pressure transmitting the discharge, and capable of producing with their movements regulated by electrical forces phenomena of "electrical shadows" similar to those produced by the kathode rays.

Meanwhile, shortly afterwards and independently of the explanation given of the kathode rays, various physicists sought to explain by the presence of mobile charges the conducting properties possessed by gases in certain circumstances, and it then appeared that they could not do better than apply to gases the mechanism imagined in the case of electrolytes. Schuster, Arrhenius, Elster, Geitel and others obtained noteworthy results in this field, bringing forward numerous proofs of the existence of ions in gases, and basing on the facts observed the explanation of divers phenomena.

It was not easy, however, to apply directly to gases the electrolytic theory. In the first place, an enormous difference exists between the two orders of phenomena as regards the difference of potential required to bring about a transmission of electricity, this difference being exceedingly small in the case of liquids and relatively great in the case of gases. Another formidable difficulty also presented itself in the fact that, whilst it is a most natural thing for atoms of different chemical nature to carry charges of different sign, so that, for example, there are negative ions of oxygen and positive ions of hydrogen, it was not easy to conceive that, in a given simple gas, there could exist ions of the same chemical nature but some charged positively and some negatively.

But this difficulty disappeared when, by the classical experiments of J. J. Thomson, it was rendered probable, and demonstrated, so far as this is humanly possible, that negative electrons or "corpuscles" exist and form an integral part of the structure of the atoms.

The suggestive fact having been observed by Perrin, and then by Thomson, of the effective transport of negative charges by the kathode rays, a fact which suggested the hypothesis that such rays consisted of the movement of particles expelled from the kathode, Thomson commenced in 1897 those famous experimental researches in which he succeeded in measuring, at the same time, the ratio e/m between charge and mass of the said particles and their velocity v. Having obtained for v a value clearly inferior to the velocity of light, and, above all, a value for e/m nearly two thousand times that corresponding

with the ion of hydrogen, and, moreover, as it could be shown that the same identical particles always resulted on changing the substances dealt with in the experiments (electrodes, gases, &c.), it was revealed that those particles were neither atoms nor molecules, but the electrons themselves, contained in and expelled from the atoms. Others had previously employed the action of a magnetic field on the kathode rays to obtain the foregoing determinations, and Thomson himself had made a similar attempt, but without attaining immediately the results indicated.

It is here clearly seen how a theoretical concept or a happy hypothesis devised to guide the experimenter can be of the greatest assistance in obtaining far-reaching results. In fact, it is difficult to decide which most to admire in Thomson—the ability of the proved experimenter or the felicitous intuition of the keen thinker which leads him to foresee and anticipate the final interpretation of the facts observed. Even to-day it would require most prolonged and difficult experimental work to show in a rigorous manner that the ratio e/m is really (save the influence of v on the value of m) constant on all occasions, whatever be the circumstances in which the kathode rays originate (the nature of the electrodes, of the rarefied gas, the pressure of the latter, &c.). But with inspired generalisation, Thomson, conscious of the accuracy of his own measurements, and with great faith in the conceptions that were becoming matured in his mind, did not hesitate to proclaim that his experiments furnished the proof of the existence of particles negatively electrified and having a mass not greater than one two-thousandth part of the mass of the atom of hydrogen.

With this was assumed that the charge of each was equal to that corresponding with one atomic valence; but in strictness the results obtained could have been interpreted alternatively by attributing to the said particles somewhat large charges and a mass of atomic magnitude. However probable the first interpretation seemed, there still remained a gap to fill in. Thomson succeeded in this by utilising the studies carried out in his laboratory by C. T. R. Wilson, who had recognised that electrified particles, and more particularly the negative ones, acted as nuclei of condensation for water vapour. The experimental method adopted by Thomson, which enabled him to evaluate the charge of each single corpuscle, is a true model of ingenuity. The numerical result obtained was perfectly favourable to the interpretation adopted in the earlier experiments; and if not at first very exact, was soon corrected by the later experiments of H. A. Wilson and of Thomson himself.

When the results were first communicated to the British Association in 1899, they were so favourably received that it may be said that from that date the new ideas on the nature of the kathode rays were accepted by the majority of physicists.

Meanwhile other discoveries of considerable importance were made, which brought unexpected confirmation to these hypotheses. The phenomenon discovered by Zeeman, which was at once explained by the electronic theory of Lorentz, and the discovery of radio-activity by Becquerel, came at the most opportune moment in support of the electrical theory of matter, which now became almost irresistible and had its basis in the experiments of Thomson which have been recorded.

It was not, in fact, possible to conceive how the kathode rays could be composed of corpuscles always identical whatever the nature of the bodies present, or taking part in their formation, without supposing that such corpuscles pre-existed in the atoms of every substance, and were thus identical with the electrons already assumed to be constituent parts of the atoms. From this to the hypothesis that the atoms consist only of electrons is a short step. And, in truth, the mass of the corpuscles may be entirely electromagnetic, that is, due solely to the motion with which the electrical charges are possessed. The well-known experiments of Kaufmann also came at an opportune moment in support of this opinion, demonstrating as they did that the mass of the electrons emitted by radio-active bodies appears so much the greater the greater their velocity. Thus, from experiments on the kathode rays a theory was evolved the philosophical import of which is evidently of the highest, inasmuch as it enables one to eliminate one of the fundamental or primitive entities (matter) which have been invoked to give an explanation of the phenomena of the physical world.

One can conceive, in fact, the possibility of building up a system of philosophy with only æther and electrons as a basis; a system all the more seductive on account of the simplification that it carries with it.

The known dualism of electricity of two signs, which causes differences more or less considerable in every fact, becomes accentuated when the single electrons are considered. In fact, in spite of the numerous and varied attempts that have been made to demonstrate the existence of positive electrons,

that is, of positive charges endowed with a mass (electromagnetic) of the same order of magnitude as that of the negative electrons, all such efforts have ended in failure. It is, therefore, natural to consider only the negative electrons, from which one may eliminate the adjective, and admit that in the positive ions each valence is due, not to the addition of a positive electron, but to the subtraction of a negative electron or electron strictly so called. This naturally led Thomson to attribute to positive electricity certain special characters within the atoms, and to assume for these a special structure in which the negative electrons have a preponderating influence; which view is in conformity with known facts, and, in particular, with the Zeeman effect, from which is deduced, as is well known, that the emission of light has its origin in the vibration of negative electrons.

Taking, as point of departure, an idea suggested by Lord Kelvin's "Aepinus Atomised" (according to the picturesque expression employed by him), Thomson assumed that a neutral atom is composed of a sphere of positive electricity in which are immersed negative electrons, the total charge of which is equal in absolute value to that of the sphere. The electrical force which acts on each of these throughout the positive sphere is proportional to the distance from the centre, and maintains them in closed orbits, the stability of which needs a special distribution of the electrons themselves.

Some concrete idea of such a species of solar systems was opportunely found in the old experiment of floating magnets, due to the physicist Mayer, which was thus rescued from the unmerited oblivion in which it had been left.

This hypothesis of the structure of the atoms, although most daring, seems to respond to all exigencies. It may be modified with the progress of time, and certainly needs completion; but it is probable that its essential features will be retained by the science of the future.

A necessary complement of the present-day theory of the kathode rays is found in the theory elaborated in much detail by J. J. Thomson to explain the production and nature of the rays discovered by Röntgen. It presents such a character of evidence, and, in short, is so intuitive, that everyone feels that he could have conceived it himself, which idea, however, is only one of many similar illusions of *amour propre*. Indeed, how can one avoid admitting the production of sudden electromagnetic perturbations in the æther, at the spot where the electrons are entirely arrested or retarded, as occurs when the kathode rays encounter an obstacle? It will naturally follow, I believe, that the X-rays will be considered as the manifestation of those perturbations, in spite of there having been proposed recently a new hypothesis, according to which these rays are of a corpuscular nature and composed of the motion of neutral couples (one negative electron and one positive). It will be necessary at least to bring proof on proof for this new hypothesis before Thomson's theory is abandoned. And in such a case it will be necessary to establish what happens to the perturbations due to the variations of velocity of the electrons constituting the kathode rays, which undoubtedly are produced.

In creating the actual current of ideas relative to the nature of matter and the common prime cause of phenomena of light and electromagnetism, in addition to the experimental work of Thomson other discoveries of recent years have contributed, above all, that of Zeeman (1897), to which I have already alluded, and that of radio-activity—the latter thanks to the very simple and ingenious explanation given by Rutherford and Soddy. If from the measurements carried out on the kathode rays was demonstrated the existence of the electrons as integral parts of the atoms, the facts of radio-activity lead us further—to the view that the atom is a complex structure of negative electrons and positive ions, or at least that at a given moment, perhaps in consequence of the continuous irradiation of part of its energy, there can separate electrons and positive ions, the latter being, at any rate in the cases studied as yet, not other than bivalent ions of helium. This interpretation of radio-active phenomena seems so natural as to give rise easily to the illusion that the phenomena themselves could have been foreseen. On the other hand, they may make the importance of Thomson's work appear to some less than it undoubtedly is; but it is necessary to go back in mind to the period at which it was carried out and take account of the mode of thought prevailing at the time, to appreciate the acuteness and originality of mind which were necessary in order to dare to snatch from the atom its dogmatic prerogatives of indivisibility and invariability.

There are other examples in the history of physical science of discoveries made at short intervals of time converging to a truth which the discovery of a final fact put into a clear light. It is usual then to say that that truth was "in the air," as if any person in favourable circumstances would have been able to discover it. I do not believe, in any case, that the same can be

said of the discoveries of which we are speaking; moreover, such an opinion, too frequently repeated, should be rejected. If one looks closely, it is possible to recognise that, in the majority of cases, not blind fortune is the aid of the happy discoverer, but the special attitude of mind and the scientific preparation he possesses. In the concrete case it is evident that Thomson, from the commencement of his researches, was unconsciously preparing himself for the grand discovery of the true nature of the kathode rays. It is sufficient in proof of this to cite his noteworthy memoir of 1881, relative to the electrical and magnetic effects produced by the motion of electrified bodies, for which Crookes's theory of radiant matter had furnished the inspiration.

The work published by Sir J. J. Thomson during recent years constitutes the complement and crown of his principal achievement. Thus, in a short time he was able to collect into a body of doctrine everything which relates to the propagation of electricity in gases, and of which his well-known treatise on the subject is the embodiment of the faith—a work that is consulted by all who conduct experimental researches in this field, which is very far from having yielded all its fruits. In this volume are treated with much detail the production of ions in gases, their disappearance, their velocities under certain contingencies, &c. Frequently the original experiments of the author and his students have rendered possible the completion of the explanation of a particular phenomenon, or put in evidence some new detail or the laws which it obeys. Moreover, making use of the facts thus accumulated and the relationship existing between them, Thomson had at his disposal the elements necessary to found a theory of electrical discharge more comprehensive than any previously proposed, which, although not yet complete and definitive, has enabled him to point out the relations between facts apparently disparate which previously could only be described separately and disconnectedly.

Quite recently the activity of the Cambridge physicist seems to have been concentrated on the study of the properties of the positive rays, and especially of the so-called canal rays. This is a field of studies in which several most daring workers (Wien, Stark, &c.) have amassed a rich harvest of most important results; none the less, J. J. Thomson, by the adoption of ingenious experimental arrangements, in part new, and especially by virtue of happily inspired and most original interpretations, has drawn, and continues to draw, from his researches consequences the import of which far surpasses the limits in which they might have been expected to be confined.

Of these researches physicists await with some impatience the publication of a treatise which shall present them not merely in order of date, but with that arrangement, clearness and concision which are precious characteristics of Thomson's writings.

However insufficient and incomplete, the foregoing considerations will help to make clear the signal value of Thomson's work. Such, at least, has been my intention. Although compelled to abandon an analysis of the extensive scientific productions of the great physicist, I trust that all will be, like myself, convinced that his work belongs to the category of those investigations which leave an indelible impress on the progress of science. AUGUSTO RIGHI.

AN ENGLISH TEXT-BOOK OF PROTOZOOLOGY.

An Introduction to the Study of the Protozoa: with Special Reference to the Parasitic Forms. By Prof. E. A. Minchin, F.R.S. Pp. xi+520. (London: Edward Arnold, 1912.) Price 21*s.* net.

THIS work on the Protozoa by Prof. Minchin may be considered as an attempt to confine a knowledge of the philosophical and the practical side of the modern science of protozoology within the limits of one volume.

After discussing the one-celled organisms grouped for convenience under the term Protista, their modes of life are considered. Various types of nutrition—purely animal, plant-like, feeders on decaying matter, and finally parasitic methods—are described and illustrated. The "mutual aid" associations of the animal world known as symbiotic unions are charmingly portrayed, and in contrast the interrelations of hosts and parasites are set forth. A most interesting study in animal mechanics is presented, together with a broad account of the organisation of the Protozoa. To the cytologist there is much of interest in the chapter dealing with the nucleus and nuclear structure. The author draws a distinction "between organisms of the 'cellular' grade, with distinct nucleus and cytoplasm, and those of the 'bacterial' grade, in which the chromatin does not form a distinct nucleus." He considers that a "bacterial type of organism" is "not to be regarded as a cell, but as representing a condition antecedent to the evolution of the true cellular type of structure." Such a distinction seems somewhat arbitrary and unnatural, and tends to overlook the importance of intermediate forms.

The problems of the propagation and perpetuation of races of organisms and the modes of transference of the parasitic forms are both of great interest and of economic importance. The parasites have multiplicative methods of reproduction which are necessary for the increase of their numbers within one host, while propagative forms are produced for their transference to other hosts. The function of syngamy (fusion of gametes) as a factor in keeping the tendency to variation within the specific limits is a view worthy of more attention. The many forms assumed by one organism (polymorphism) are traced as arising from adaptation to environment, to growth and development, and to sexual differentiation. The general part of the book closes with an interesting chapter dealing with the vital physiological phenomena shown by Protozoa.

Following the general consideration of the Protozoa, eight chapters are devoted to an account of their systematic grouping, and the enormous extent of the group can be realised by scanning the sequence of genera or by referring to the copious index. Prof. Minchin considers that two types of organisation prevail among the Protozoa. The simpler or Sarcodine type possesses no permanent locomotor organs when mature, although such may be present in its youth form. The second or Mastigophoran type, comprising organisms often of small size, has permanent locomotor organs, flagella, which are lost in the resting phases. Subdivisions of each group are numerous. The very diverse organisms among the Rhizopoda, such as the Amœbæ, the sun-animalcules (Helizoa), the chalk and ooze-formers known as Foraminifera and Radiolaria, and the Mycetozoa (claimed also by the botanist as the slime fungi or Myxomycetes), are all considered. Perhaps some newer illustrations would be an improvement here.

The bionomics of the flagellates are of much interest, whether the parasitic forms or the tiny inhabitants of ponds (also claimed by the botanist as Algæ) are under discussion. The interest of the medical man will be claimed by the accounts of the sleeping-sickness parasites, and the causes of such diseases as kala-azar, oriental sore, and malaria. The agriculturist should be interested in the parasites of red-water and East Coast fever, so fatal to cattle, as well as in the accounts of Coccidia, fish tumours, and silkworm disease. Incidentally, it may be mentioned that Prof. Minchin does not now accept the results of Schaudinn's researches on the parasites of the little owl.

Certain organisms, considered by some as doubtfully Protozoa, such as the Spirochætes, causing African tick fever and relapsing fever, and the bodies responsible for small-pox, are briefly considered in the concluding chapter. Those who care for possible genealogies and speculations will also find here an account of the possible evolution and ancestry of the Protozoa.

In conclusion, it is a pity that certain blemishes in the form of loose statements, some inconsistencies of nomenclature (for example, the use of Coccidium, Piroplasma), and slightly partisan views on some contentious subjects have been allowed to creep in and mar the book, but doubtless these will disappear in the second edition. We would also suggest that an increase in the number of illustrations would be a very great advantage, and this should not be incommensurate with the cost of the book (21*s*. net). Some rather old figures could be replaced by others embodying the results of more recent and accepted research. Criticisms of technique employed some years ago are obviously futile, inasmuch as the said technique was the best available at the time. Also we are distinctly of opinion that the systematic part of the book should be enlarged. But it must be recognised that the task before Prof. Minchin was an enormous one, and he is to be congratulated on the successful issue of the work.

CHEMISTRY AND ITS APPLICATIONS.

A Dictionary of Applied Chemistry. Revised and enlarged edition. By Sir Edward Thorpe, C.B., F.R.S., assisted by eminent contributors. Vol. ii. Pp. viii+786. Vol. iii. Pp. viii+789. (London: Longmans, Green and Co., 1912.) Price 45*s*. net per volume.

AS a notice of the first volume of the new edition of Thorpe's Dictionary appeared in the columns of NATURE for April 18, 1912, it is not necessary on the present occasion to do more than express cordial concurrence in the reviewer's high estimate of the character of the work and of the services rendered to the chemical world by the editor and his staff of contributors. In the two volumes before us the reader rather naturally turns first to those articles which specially illustrate the applications of science to industry, namely, those of which the subjects had not even come into practical existence at the date of the former edition. Metallography, for example, is one of these subjects, and is treated in a thoroughly masterly manner by Dr. Walter Rosenhain, of the National Physical Laboratory. Here is a subject which, originating fifty years ago in the microscopic study of rocks by Sorby, has been largely dependent for the advances

already made on the provision of instruments for measuring and recording temperatures above the range of the mercurial thermometer. Without the electrical pyrometer comparatively little would have been accomplished.

Another subject of the greatest chemical and commercial importance is the utilisation of atmospheric nitrogen, which has been treated in a complete and interesting article by Prof. Crossley. Up to the present the fixation of nitrogen in the form of nitrate has perhaps attracted most attention, and has been practised on the largest scale, but the recent announcement that the Badische Anilin- u. Soda-Fabrik has actually started the manufacture of ammonia from the combination of gaseous nitrogen and hydrogen by Haber's process is a further step of great significance.

Among other new subjects unrepresented in the former edition are "Colloids," by Dr. J. C. Philip, and "Corrosion and Fouling of Steel and Iron Ships," by Prof. Vivian B. Lewes; while several others, such as "Explosives," by Mr. G. H. Perry, and "Matches," by Mr. E. G. Clayton, have been largely added to and brought up to date. There is also a judicious unsigned historical article on the liquefaction of gases.

There are few deficiencies apparent on first acquaintance with the dictionary, and in the presence of so much that is admirable, hypercriticism may be deprecated. The inequality in length of the various articles is probably one of the most difficult questions which come before the editor in relation to such a work as this. The most glaring case noticeable in the two volumes before us is the assignment of 100 pages to naphthalene, while fuel receives only twenty-four pages and flame eight pages. In neither of these articles is there any reference to the important question of smoke production and prevention, which is surely a question of chemical as well as practical interest.

The attention of the editor may also be directed to the fact, though too late for remedy, that the article on essential oils, though containing much useful information, is distinguished from every other important article in the book by the absence of references or bibliography. It would probably provide a slight shock for Prof. Wallach to find that an article on this subject could be written without mention of his name. The writer of the article similarly ignores Schimmel's half-yearly reports, which furnish a large body of valuable information extending over many years, and cannot yet be considered to be replaced in this country by *The Perfumery and Essential Oil Record*.

All British chemists will certainly make frequent use of the new edition of the dictionary, and in doing so the majority will be glad of the adoption of a system of abbreviations of the titles of journals and books which is practically identical with the system with which all are familiar in the publications of the Chemical Society, and is much to be preferred to the contractions, often rather tiresome, used in the previous edition. W. A. T.

PRACTICAL MATHEMATICS.

(1) *Practical Geometry and Graphics.* By E. L. Bates and F. Charlesworth. Pp. ix+621. (London: B. T. Batsford, 1912.) Price 4*s.* net.

(2) *Practical Mathematics.* By E. L. Bates and F. Charlesworth. Pp. ix+513. (London: B. T. Batsford, 1912.) Price 3*s.* net.

(3) *Analytical Geometry. A First Course.* By C. O. Tuckey and W. A. Nayler. Pp. xiv+367. (Cambridge: University Press, 1912.) Price 5*s.* net.

(4) *A Preparatory Arithmetic.* By C. Pendlebury. Pp. xiv+185+xxx. (London: George Bell and Sons, Ltd., 1912.) Price 1*s.* 6*d.*

(5) *Les Anaglyphes Géométriques.* By H. Vuibert. Pp. 32. (Paris: Librairie Vuibert, n.d.)

(1) THE contents of this volume fall into three sections: (*a*) plane geometry; (*b*) graphics; (*c*) descriptive geometry. The first deals with the calculation of areas and volumes, the fundamental geometrical constructions and the chief properties of the circle and conic. In the second the student is shown how to apply graphical methods to the solution of practical problems in mechanics, considerable space is devoted to the consideration of harmonic motion and systems of frameworks, and allusion is made to the use of vector products. The last section, which occupies nearly 200 pages, contains as full an account of the methods of practical solid geometry as any ordinary technical student is likely to require. The diagrams are clear and the quality of the examples is distinctly good.

(2) The authors have attempted to collect in as concise a form as possible all those portions of mathematics which are likely to be of use to practical students. The volume is self-contained in the sense that no previous knowledge is assumed, and its contents are designed to supply material for a course lasting between two and three years. About two-thirds of the book is devoted to arithmetic, algebra and geometry; due prominence is given to graphical methods; the treatment of mensuration is excellent, and the selection of those geometrical properties and ideas with which it is considered students should be familiar has been made with great care. The concluding part of the

book develops the fundamental ideas of trigonometry, vector geometry, mechanics, and the calculus. Considerations of space have made this section somewhat brief, but it should prove useful to those who regard it as an introduction to more advanced text-books.

(3) The distinguishing feature of this work is the early introduction of the equations of curves of the second and higher degrees. It is an undoubted fact that if a student is compelled to make himself thoroughly familiar with the analytical geometry of the straight line and circle before proceeding to other loci, he finds it hard to appreciate the purpose and the value of the work in which he is engaged. The boy who intends to specialise in mathematics will not derive any harm from pursuing this course; in fact, there is much to be said for giving him a sound grounding in the elementary principles at the outset; but those who are taking scientific or engineering courses, and therefore require less manipulative skill, secure what they need from a course which is less detailed and more general in character. Their requirements are met admirably by such a treatment as is given in the work before us. This will be made clear by a brief enumeration of the subjects and the order in which they are taken: (1) standard equations of the straight line, circle, ellipse, parabola, hyperbola; (2) gradient of curves; (3) locus problems; (4) polar coordinates with applications to the limaçon, cardioid, cycloid, etc.; (5) the conic based on the focus-directrix definition; (6) the solid geometry of the plane, straight line, and simple curved surfaces.

There is an excellent collection of examples, answers to which are given at the end of the book. We would suggest that an index should be added in future editions.

(4) During the last ten years a number of valuable reports on the teaching of elementary mathematics have been issued by the Mathematical Association, and they have exercised a very considerable influence on the curriculum and the methods employed. As evidence of this it is necessary only to refer to the changes which examining bodies have made in their regulations and to the alteration in character of modern text-books. The present work is based on the report dealing with the teaching of arithmetic in preparatory schools. Concrete and abstract questions are taken side by side, those parts of the subject which are of small intrinsic importance are omitted, and the artificial divisions of the subject-matter into a number of standardised types of problems are avoided. We have no hesitation in recommending this book for use with junior students.

(5) This pamphlet describes a means of exhibiting three-dimensional figures, examples of which were shown at the International Congress at Cambridge last August. Two perspective figures are drawn close together on the paper in the complementary colours green and red, and they are viewed through red and green transparent screens. A highly striking effect is obtained. It is clear that the simplicity of the method will contribute largely to its practical utility. For purposes of demonstration, in the teaching of solid geometry, it should be invaluable. About thirty examples are given; the diagram which represents a cube with one diagonal vertical with its plan and elevation is particularly good. The figures of the cylinder seen from one end and the section of a tetrahedron by parallel planes appear to be a trifle out of drawing.

OUR BOOKSHELF.

Télégraphie sans Fil: Reception des Signaux horaires et des Télégrammes météorologiques. By Dr. Pierre Corret. Pp. 93. (Paris: Maison de la Bonne Presse, n.d.) Price 1 franc.

THIS little volume gives simply-worded directions for the construction of apparatus that will enable persons interested to make use of the time signals dispatched regularly from the wireless telegraph station at the Eiffel Tower. The author begins with a description of the very simple apparatus required by a Parisian amateur, and gives a clear account, with fully detailed examples, of the time signals and the meteorological messages from the tower. From his story of a day's programme of the tower, including as it does telegraphic exercises with other French stations as well as regular service messages, it would appear that the amateur in the French capital has excellent opportunities of learning Morse with a very small outlay on apparatus.

The next two sections of the book give instructions for erecting a receiving station of sufficient sensitiveness to pick up the messages at distances of two or three hundred miles from the tower. These directions are plain and sufficient. With the apparatus described, a French amateur may listen to a great variety of Spanish, Italian, German, and English messages; and an entertaining programme is made out for him in the book. Here the information conveyed is just such as will help those amateurs who are in a state of mental fog as regards the origin of the signals they listen to, and the information will be almost as useful to English as to French amateurs. The book closes with an account of the system of signalling time adopted by the international conference of October last.

It is intended that different stations shall transmit certain signs at different hours. Those normally audible in England are Paris at midnight and 10 a.m., Norddeich at midday and 10 p.m. At present, it may be remarked, the Paris signals indicate 10.45 a.m. and 11.45 p.m.

The receipt of these time signals is so easy a matter that every observatory, and every other institution or person needing accurate time, ought to take advantage of them.

(1) *School Gardening, with a Guide to Horticulture.* By A. Hosking. Pp. xi+326. (London: W. B. Clive, 1912.) Price 3*s.* 6*d.*

(2) *Plant Geography.* By Prof. G. S. Boulger. Pp. viii+136. (London: J. M. Dent and Sons, Ltd., 1912.) Price 1*s.* net. (The Temple Primers.)

(1) MR. HOSKING has produced a useful book, or rather three small books, under the title of "School Gardens." The second part deals with soils, manures, and the cultivation of garden crops; while part iii. is devoted to garden pests and miscellaneous information.

Part i., which gives the title to the book, is to us the section of most interest and value, and we would gladly have seen it expanded at the expense of the other portions of the book which require treatment on a more generous scale. On the subject of school gardens the author can speak with a full experience, and his practical details throughout are concise and thoroughly to the point.

The school garden must not be considered in the light of a paying venture. Its value will only appear when the pupils have become settled in life; then the stimulus to observation and method and the interest in outdoor pursuits they received will be fully appreciated, and the experiment will reap sufficient reward.

(2) In the small compass of 136 pages Mr. Boulger has succeeded in compiling a very readable account of plant geography. The four divisions of the book deal with the evolution of the plant world, the factors of distribution, floristic regions, and botanical ecology or topography. He has wisely devoted the larger part of the book to the consideration of factors of distribution rather than to detailed accounts of the floras of different regions, since the science of plant geography is so fundamentally bound up with the proper understanding of the ways and means of plant dispersal.

Mendel's Principles of Heredity. By W. Bateson, F.R.S. Pp. xiv+413. (Cambridge University Press, 1913.) Price 12*s.* net.

A REVIEW of the first edition of Dr. Bateson's valuable conspectus of discoveries in regard to heredity made by the application of Mendel's methods of research, appeared in NATURE of May 25, 1911 (vol. lxxxvi., p. 407). Since then a vast amount of work has been done upon various subjects of Mendelian analysis; and Dr. Bateson has endeavoured to take account of this by a series of appendices giving descriptive references to papers representing advances upon the state of knowledge when the original volume was published. Short of rewriting the book, this was probably the best means of giving a new lease of life to a standard work upon Mendelism by a leading exponent of its principles.

LETTERS TO THE EDITOR.

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

The Spectra of Neon, Hydrogen, and Helium.

IN the issue of NATURE for February 27 (p. 699), Prof. Collie and Mr. Patterson have directed attention to numerous approximate coincidences between lines of neon and hydrogen, from which it is presumably intended to be inferred that certain lines of neon are ordinarily present in the vacuum tube spectrum of hydrogen. A further examination of the observational data, however, seems to be desirable.

Messrs. Collie and Patterson have omitted to state that in the region considered, λ6507 to λ3472, Watson's list of the secondary spectrum of hydrogen contains more than 700 lines, while that of neon contains 260 lines, of which nearly 100 are of intensity 4 or greater. With spectra of this complexity there is nothing at all remarkable in the occurrence of a considerable number of approximate coincidences between lines belonging to the two spectra. As stated by Messrs. Collie and Patterson, there are, in fact, twenty neon lines of intensity 4 and upwards which fall within a quarter of an Angström unit of lines of hydrogen; while, if all the neon lines are included in the comparison, and differences of wave-length amounting to a whole Angström unit be allowed, the number is brought up to 110.

Messrs. Collie and Patterson, however, do not seem to have realised the accuracy of modern spectroscopic tables, such as they have utilised in the present comparison. A difference of more than a few hundredths of an Angström unit in the tabulated wave-lengths of two lines should now suffice to prove that they have different origins, unless other evidence of probable identity is forthcoming. If the permissible discrepancy be reduced to one-twentieth of an Angström unit, there remain only six lines which might be regarded as possibly common to the two spectra, namely:—

Neon			Hydrogen		
Intensity		Wave-length	Intensity		Wave-length
5	...	6175·09	0	...	6175·14
7	...	6143·31	0	...	6143·30
7	...	5343·40	0	...	5343·43
4	...	4537·93	0	...	4537·91
9	...	3520·61	1	...	3520·60
6	...	3472·68	0	...	3472·65

Thus, of the hundred brightest lines of neon, only six are found in hydrogen within the probable limits of error, and only one of the six brightest is among them. There is no evidence that the six "coincident" neon lines have special properties which would favour their survival, and the coincidences cannot, therefore, be properly regarded as significant. Even twenty such coincidences would not prove a relation between the two spectra, unless it could be shown that the lines in question were the most persistent of the neon spectrum.

A very similar result is indeed obtained when a comparison is made between neon and iron. Over the same range of spectrum there are thirteen of the hundred brighter neon lines which differ by no more than one-twentieth of an Angström unit from iron lines, but this would scarcely be accepted as evidence of any relation between the two spectra.

As regards the comparison of neon with helium, the mean deviation of the three lines noted is 0·16, which

is probably considerably greater than can be attributed to errors of measurement. Moreover, helium lines occur in connected series, and there is no justification for supposing that one of them would be represented in the absence of other members of the same series. The oxygen line 5330·84, which, it was pointed out, is nearly coincident with neon 5330·90, is one component of a triplet forming part of a series, and would not appear in the absence of the associated lines.

To my mind the proper conclusion to be drawn from the comparisons is that the respective spectra are quite distinct, and that the approximate coincidences are entirely accidental. A. FOWLER.

South Kensington, March 3.

The Influence of Icebergs on the Temperature of the Sea.

PROF. BARNES, in NATURE of February 20, gives an important piece of information which seems to me to enable us to clear up the confusion at present surrounding this subject, as it explains the reason for the different results obtained by Prof. Barnes in his earlier and later observations, and why his results differ from those of previous observers; and it also helps us to an explanation of the puzzle of the rising temperature of the sea on approaching icebergs, found by Prof. Barnes. The earlier observers made their tests in the cold but weak sea-water floating on the surface. Prof. Barnes's first tests were made at a depth of 5 ft. The first part of his curve, Fig. 1 (NATURE, June 20, 1912), gives the temperatures of the sea as the thermometer passed under the outer edge of the cold surface water, and was thus made in the ordinary sea-water, and gave the temperatures below the cold surface water, until the ship arrived within a mile of the iceberg, where the increasing depth of the cold surface water began to affect the thermometer, and from that distance, the thermometer being now in the cold surface water, the temperature fell rapidly as the ice was approached. The thermometer in Prof. Barnes's second ship, he tells us in his last letter, was placed at a depth of 18 ft. below the surface, and seems to have been always too deep to get into the cold surface water.

We now come to the question as to why these last observations of Prof. Barnes show a constant rise in the temperature of the water as icebergs were approached. We can scarcely imagine ice to have any heating effect, and solar radiation does not seem to meet the case. It would, however, appear that we do not require to call in the aid of sunshine, or other outside source of heat, to explain this rise in temperature, as it can be more simply accounted for by the indraught current near the surface having to dip below the cold surface water, its upper warmer water being thus carried downwards towards the thermometer. By this explanation there is no heating of the water as it approaches the iceberg, but the warmer surface water coming from outside the cold surface area is carried underneath the cold water to lower levels, so giving a rise of temperature at these levels.

If the above explanation be correct it would appear that the surface cold current is the one to be mainly depended on for indicating the presence of ice, because, unless there is some depth of cold surface water, there will be no depression of the inflowing current, and therefore no rise of temperature on approaching the iceberg. Perhaps the best method of observing would be to have two thermometers, one near the surface and the other at a depth of, say, 18 ft., writing on the same paper. Under ordinary conditions these two would show nearly a constant difference, but would tend to diverge on the approach of ice, so checking each other, and magnifying the indications.

JOHN AITKEN.

Ardenlea, Falkirk, February 22.

Systems of Lines obtained by Reflection of X-Rays.

IN continuation of the experiments of Mr. W. L. Bragg (NATURE, December 12, 1912, p. 410), we have investigated the reflection of X-rays by mica and rock salt. In these experiments we found that in general two dark spots are obtained in consequence of the reflection, one of which is crossed by equally-spaced lines, which run at right angles to the plane of reflection. The distance between the different lines increased with increasing distance of the photographic plate from the crystal, and appeared greater with rock-salt than with mica. In some photographs the second spot was also striated.

The plates cut from the crystals were fastened down to aluminium foil 0·2 mm. thick. Successful photographs were only obtained with rays of grazing incidence, an angle of about 80° being used in most cases.

The regularity in which the fringes were distributed suggests that the phenomenon is due to interference. Further experiments are, however, required before this question can be definitely settled. Since Prof. Barkla and Mr. Martyn (NATURE, February 13, 1913, p. 647) have recently described similar results, it may be desirable to publish our preliminary results, of which a more complete description will soon be communicated to the German Physical Society.

E. HUPKA.
W. STEINHAUS.

Physikalisch-technische Reichsanstalt,
Charlottenburg, February 23.

Four-horned Sheep in Scotland.

SO little seems to be known regarding the early occurrence of Scottish four-horned sheep that the following record will bear repetition. It occurs, almost as an aside, in the account of the parish of Moffat, in the lowland counties of Dumfries and Lanark, published in Sir John Sinclair's "Statistical Account of Scotland," vol. ii., p. 292, 1792. The writer of the account, Rev. Mr. Alex. Brown, says:—"It is not long since the sheep in this part of the country, were of the four-horned kind; a few of which, it is said, remain still in some parts of Nithsdale. Their body is smaller, but their wool finer than those of the present breed. Their want of weight for the butcher, and greater difficulty and danger in lambing have banished them from this place."

This lowland four-horned race agrees with the Hebridean in the characters of fineness of wool and smallness of body. It also appears to agree in the less tangible character of maternal inefficiency, for of an experiment carried out in a small Western Islands' flock in the Isle of Man a few years ago Prof. Wallace says ("Farm Live Stock," p. 521, 1907):—"The animals weighed only 5 lb. to 6 lb. per quarter, and they proved to be such indifferent nurses that they were eventually put away"—causes remarkably similar to those which "banished them" from south Scotland. At any rate, it would seem clear that the four-horned breed of sheep, the last remnants of which in Scotland were isolated on the Hebridean and Western Islands, had at a comparatively recent date considerable outposts on the mainland. JAMES RITCHIE.

The Royal Scottish Museum, Edinburgh,
February 26.

J. Palmer Clarke, Cambridge, photographer. Emery Walker Ph. sc.

J. J. Thomson.

THE TRIBES OF NORTHERN AND CENTRAL KORDOFAN.[1]

IN many ways this is a most interesting and suggestive volume, nor can its significance be measured entirely by the number of new and important facts recorded in it. If we except Mr. J. W. Crowfoot's archæological studies, not only is this the first piece of precise work of any magnitude dealing with an ethnological subject produced by an officer in the service of the Anglo-Egyptian Sudan, but since the Government has borne the expense of its publication it furnishes a further example of that enlightened spirit which has already led the Government to find the funds necessary to start an ethnographical survey on a small scale. Considering that the part played by the Sudan Government in the production of this volume is perfectly well known, it is perhaps a pity that the book contains no definite statement on the subject, since its appearance may be looked upon as the first fruits of the sensible forward scientific policy in favour in the Sudan. This, indeed, is the aspect of general public importance with which ethnologists and historians are most concerned.

There is, of course, another point of view, which no doubt specially appealed to the representatives of the Intelligence Department. During the years of residence and travel in Kordofan Mr. MacMichael accumulated a fund of knowledge concerning the quarrels, wanderings, and relationships of both the sedentary and nomad Arab tribes of the province. Part of this had perforce to be acquired as the country was opened up by the new administration, but the remainder of the really vast stores of hitherto unpublished and recondite historical information brought together in this volume was collected as a labour of love, and constitutes a corpus of information concerning the history, sociology, or ethnology of Kordofan. While all interested in these subjects should be grateful, Mr. MacMichael's successors responsible for the present and future administration of the province will most profit by his labours, for it is not too much to say that a collection of facts such as this, put in the hands of an intelligent newcomer and properly used, must reduce the doubts and difficulties of administration by 50 per cent.

Southern Kordofan, Dar Nuba, does not come within Mr. MacMichael's purview; in this he follows the native idea, for neither Arabs nor blacks include Dar Nuba in Kordofan. In spite of this, Mr. MacMichael has rightly included the Baqqara, and he has added to the interest and scientific value of the book by chapters on Jebel Midob and the little-known Zaghawa. The former is a hill *massif* some forty miles long on about the same latitude as Omdurman, but so far west as to be in Darfur territory. From the details concerning its inhabitants, now for the first time available, there can be little doubt that these non-Mohammedan "black black slaves" (as the

A Kabábish camel with "utfa" ready to transport the daughter of the wife of a sheikh from one camping ground to another. (Note the leather work and cowrie shells). From "The Tribes of Northern and Central Kordofán."

[1] "The Tribes of Northern and Central Kordofán." By H. A. MacMichael. Pp. xv+259. (Cambridge University Press, 1912.) Price 10s. 6d. net.

Kababish called them to the writer) are the surviving representatives of the old Nuba population of the hills of northern Kordofan, the remains of whose houses can be seen on so many hills. In spite of the contemptuous tone taken by the nomad Arabs when speaking of these folk, they are bold raiders, and do not hesitate to cross the border to lift the cattle and camels of even the strongest tribes, the herdsmen of which they kill or enslave as opportunity offers.

The Zaghawa are Hamiticised negroids who about the end of the eighteenth century emerged as a vassal State in northern Darfur under practically independent rulers. It was probably about this time, or a little earlier, that a party of Zaghawa migrated eastwards and seized the hills in the neighbourhood of Jebel Kagmar in northern Kordofan, where they settled and which their descendants still occupy, though none of these can speak a word of any language but Arabic, and have adopted a pedigree dating back nineteen generations to Khalid el Guhani, the brother of Abdulla el Guhani, to whom the usual faked *nisba* of the tribes of the northern Sudan goes back.

The mere mention of these two matters will serve to give some idea of the value and scope of the book.

A MEMORIAL TO SIR JOSEPH HOOKER.

A MEMORIAL to the late Sir J. D. Hooker, which has been placed in the Parish Church at Kew, near the similar memorial to his father, Sir W. J. Hooker, was unveiled by Lady Hooker in the presence of members of the Hooker family on Saturday, February 22. The memorial consists of a mural tablet of coloured marble bearing the following inscription:—

1817–1911 JOSEPH DALTON HOOKER, O.M. G.C.S.I. C.B. M.D. D.C.L. LL.D., ASSOCIÉ ÉTRANGER OF THE INSTITUTE OF FRANCE, KNIGHT OF THE PRUSSIAN ORDER "POUR LE MÉRITE," SOMETIME PRESIDENT OF THE ROYAL SOCIETY, FOR XX YEARS DIRECTOR OF THE ROYAL BOTANIC GARDENS KEW. BORN AT HALESWORTH 30TH JUNE 1817, DIED AT WINDLESHAM 10TH DEC. 1911. THE WORKS OF THE LORD ARE GREAT SOUGHT OUT OF ALL THEM THAT HAVE PLEASURE THEREIN.

Below this inscription is a Wedgwood medallion portrait of Sir Joseph, flanked and supported by five panels containing Wedgwood figures of plants with which, in the course of his long career, there had grown up some especial association. In the upper and corner panels, left and right, these plants are an Aristolochia, commemorating his connection with African floristic work and travel, and a Nepenthes, recalling a notable contribution to our knowledge of vegetable morphology and physiology. The left lower corner panel contains a Cinchona, commemorating Hooker's connection with one of the most humane episodes in economic botany during his lifetime—the introduction to south-eastern Asia of the medicinal Cinchonas of South America. The panel which balances this on the right contains a Rhododendron, commemorative of Hooker's great Himalayan journey.

In a smaller central panel between the lower corner ones is a Celmisia, recalling the southern voyage with Ross and the labour bestowed on the flora of New Zealand. At foot are the family arms with the family motto and the motto of the Most Exalted Order of the Indian Empire, of which Hooker was a member in the highest grade. The portrait, a head profile to left, is the work of Mr. Frank Bowcher, and is an excellent likeness, recalling the same artist's treatment of his subject in the medallion executed in 1898 at the instance of the President and Council of the Linnean Society to record the completion of Hooker's "Flora of British India" and his sixty years' services to science.

SIR WILLIAM HENRY WHITE, K.C.B., F.R.S.

BY the sudden death of Sir William White on February 27, at sixty-eight years of age, the country has lost one of her best sons and engineering science one of its leading authorities. Sir William White was born at Devonport in 1845, and started his professional life by leaving a private school in the town, in which he was at the time "head boy," and becoming a shipwright's apprentice in Devonport Dockyard.

In the fullest sense of the term the boy was "father to the man," as on entering the dockyard he occupied the highest position among those entering with him, a position which he not only maintained but improved upon by rapidly becoming higher than apprentices who had been entered before him and had had longer practical training and longer education in the dockyard school.

In 1864 a Royal School of Naval Architecture and Marine Engineering was founded at South Kensington, and to this eight shipwright apprentices were appointed, of whom Sir William was the first in order of merit. Of these only one, viz. Mr. H. E. Deadman, C.B., who was principal assistant to Sir William on his retirement from Admiralty service, now survives.

During his study at South Kensington Sir William uniformly kept highest in order of merit, and although some of his college mates, notably the late Dr. F. Elgar, formerly Director of dockyard work at the Admiralty, Mr. W. John, of Lloyd's Register, Mr. W. J. Bone, of Newcastle, and Mr. H. E. Deadman, mentioned above, achieved great distinction, it fell to the lot of Sir William to be called upon to undertake still higher work, and this work he carried out most successfully under trying conditions, often involving shortness of Admiralty staff and inadequacy of office accommodation.

On completing, in 1867, his training at South Kensington, Sir William joined the Admiralty Constructive Staff, under the headship of Sir Edward Reed, K.C.B., and at once threw himself with his characteristic zeal into all of the many difficult matters existing at that time of changing

from wood shipbuilding to iron and steel shipbuilding and from unarmoured to armoured ships.

At this time the principal problems before the Admiralty naval architects were:—(1) What was the best method of constructing the armoured side of ships of the line; (2) what was the best method of disposing the armament; and (3) whether on the whole it was more advantageous to build a comparative short vessel like Sir Edward Reed's *Bellerophon,* notwithstanding the cost in machinery and coal involved in propelling each ton of her displacement, or to build such long fine-lined vessels as the *Warrior* and *Minotaur?*

Even at this early stage of his career Sir William threw much light on these questions, and, in addition, was of the utmost assistance to Sir Edward Reed in the preparation of his famous book, "Shipbuilding in Iron and Steel," published in 1869.

In 1870 Sir Edward Reed retired from his position of Chief Constructor of the Navy, and a Council of Construction, with Sir N. Barnaby (then Mr. Barnaby) at its head, was appointed to carry on the work of Admiralty naval construction. So valuable had been the work of Sir William White in the short time he had been at the Admiralty that he was retained in the position he had served in under Sir Edward Reed, and was gradually entrusted with more and more important work involving a continually increasing amount of responsibility on his part, and from then to the time of his leaving the Admiralty service in 1883 to become the head of the war shipbuilding department of Sir W. G. Armstrong and Co., at Elswick-on-Tyne, there was no work done by the Admiralty designing staff in which he did not play a very large part, which in many cases was a leading part.

In 1871 he read his first paper before the Institution of Naval Architects, which had been prepared by him with the assistance of Mr. W. John named above, and was entitled, "On the Calculation of the Stability of Ships, and Some Matters of Interest Connected Therewith."

This reading of papers before the Institution of Naval Architects he kept up for many years. They were always of first-rate importance; many of them dealt with semi-naval matters as distinct from matters of naval architecture; and the views he put forward were always met with the greatest respect. In addition to beginning in this period the contribution of papers to the Institution of Naval Architects, he commenced taking part in the discussion of papers read by other persons at the same institution, his first effort in this direction being in 1875 with respect to a paper by Mr. William Froude on the graphic integration of a ship's rolling, including the effect of resistance.

During the period of 1869–83, now under consideration, Sir William much interested himself in the education of young naval architects, and almost immediately on his appointment to the Admiralty Office in 1869 he was appointed to succeed Mr. Crossland, a member of an earlier school of naval architecture, as lecturer on naval designing at the South Kensington school. This position he retained for some years after the transfer of the South Kensington School to Greenwich, where the school still exists.

While holding this position he, in conjunction with Dr. T. Archer Hirst, the Director of Studies at Greenwich, arranged a course of instruction in naval architecture for the benefit of executive naval officers, and the syllabus of instruction was so well chosen and so wisely given effect to under his guidance that large numbers of officers were attracted to the classes, and the classes continue in effective operation to this moment.

He also at this time put forward a well-considered scheme for the formation of a Royal Corps of Naval Constructors to replace the heterogeneous system then in force, and after some amount of consideration on the part of the then Controller of the Navy, Sir W. Houston Stewart, K.C.B., and of a committee appointed for the purpose and presided over by Sir T. Brassey (now Lord Brassey), the Crown in 1883, under an Order in Council, graciously created the corps on the footing it still holds.

The chief designing work on which Sir William was engaged in this earlier period of Admiralty work, viz. 1869–83, was that of the famous *Inflexible,* with two turrets in *échelon* each containing two 16 in. muzzle-loading guns. The design of this vessel excited very strong adverse criticism, led by Sir Edward Reed. A specially competent committee was appointed to report on the design, and after long and exhaustive investigation—much of it of a practical nature at sea on actual ships, and in the experimental works of Mr. Froude—the committee reported that the design fully satisfied the conditions it set out to meet.

This design was repeated on a smaller scale by two vessels, the *Ajax* and *Agamemnon,* and by two somewhat larger, viz. *Colossus* and *Edinburgh,* although these were still much smaller than *Inflexible.* On all these vessels Sir William took a very prominent part, introducing into *Colossus* and *Edinburgh* for the first time in our line of battleships the construction of the hull of the vessel of steel instead of as heretofore of iron.

From 1883 to 1885 Sir William was engaged on warship design and was head in all respects of the warship-building branch of Messrs. Sir W. G. Armstrong and Co. at Elswick-on-Tyne. He there designed and laid down several famous vessels for foreign Powers, and laid out the Elswick shipyard for warship-building in a manner securing the utmost efficiency for building purposes.

On the expiration of this period he was appointed by Lord George Hamilton, then First Lord of the Admiralty, as Director of Naval Construction in succession to Sir N. Barnaby, then retired on account of ill-health. It has long been recognised that no wiser choice could have been made; and then commenced that portion of the work of Sir William best known to the public, although it will be seen by what has been stated above that he had already a large and very varied amount of work to his credit.

To deal adequately with the work of Sir William

as Director of Naval Construction would be little short of writing a volume; and cannot be attempted here.

On rejoining the Admiralty in 1885, Sir William at once set about making improvements and developments in all classes of designs so as to embody in them all the improvements continually being made in guns, armour, and propelling machinery. Limitations of space will not permit us to describe the various type of vessels which received considerable development under his hands, and mention can be made of one or two points only.

As regards battleships, he made a special study of all the elements which go to make for fighting efficiency, having regard to the rapidly changing concurrent general features of the engineering world, and in 1889 wrote a famous paper for the Institution of Naval Architects, giving quite frankly all his views of the subject, and stating the points that had decided the Board in ordering the then new ships the *Empress of India* and her sisters. He was much criticised by many members, but it was generally felt that his views were sound. In principle and in main features they were adopted, with such extension as arose from the general increase in size and cost of ships up to the introduction of the *Dreadnought* type of ship.

Sir William received many distinctions. He was honorary vice-president of the Institution of Naval Architects, and past president of the chief engineering societies and honorary member of many others. He was elected a Fellow of the Royal Society in 1888, and was created K.C.B. in 1895. At the time of his regretted death on Thursday last he was the president-elect of the British Association for the meeting to be held at Birmingham next September, and his loss to the association will be severely felt. His name will ever be remembered in the annals of the British Navy and the records of engineering science.

PROF. ADAM SEDGWICK, F.R.S.

THE late Prof. Sedgwick was grand-nephew of Adam Sedgwick, Woodwardian professor in the University of Cambridge from 1818 until 1873, sometimes known as the "old Adam." Their ancestors had been "statesmen" in the Dale of Dent for several centuries. Adam Sedgwick, jun., was the son of Richard Sedgwick, vicar of Dent, and the affection he always bore towards his native valley was evidenced by the fact that he sent his second boy to the school at Sedbergh, at the mouth of the Dale.

Our Adam was born in 1854 at Norwich, where his great-uncle held a canonry. He was educated at Marlborough College, and after a short time at King's College, London, he entered in 1874 Trinity College, Cambridge. At that time the recently established professorship of zoology and comparative anatomy was held by Prof. Newton, and Mr. J. W. Clark was superintendent of the Museum of Zoology. Prof. (afterwards Sir George) Humphrey was professor of anatomy, and Michael Foster had recently come to Cambridge as prælector in physiology to Trinity College. A demonstrator in comparative anatomy had just been appointed by the University, and the late Prof. Bridge was the first to hold that office; a curatorship of the Strickland collection of birds was founded in the year that Adam Sedgwick came into residence, and Mr. O. Salvin was the first Strickland curator. It has not always been recognised that Cambridge led the way in the practical teaching of zoology and biology. Three years before Adam Sedgwick came into residence, J. W. Clark had, with the aid of his friend Mr. Bridge, started laboratory work in these subjects. This class-work was carried on with renewed activity by Milnes-Marshall and by Frank Balfour, and by the time that Adam Sedgwick began to be interested in zoology and to be influenced, as he was for life, by Balfour, practical classes were in full working order, although conducted in adverse circumstances of space and equipment.

Sedgwick was placed in the first class of the natural sciences tripos in the year 1877. In the same list were the names of Prof. Bower, of Glasgow, Dr. Fenton, of Christ's, and Dr. Alex. Hill, of Downing. Compared with the modern days, the tripos was insignificant in numbers, but modern days may not find it easy to equal the quality of this list. After taking his degree Sedgwick definitely cast in his lot with zoology. In 1880 the zoology class conducted by Balfour, with Sedgwick as assistant, was held in the room now occupied by physiological chemistry, at the top of Fawcett's building overlooking Corn Exchange Street.

The University was so conscious of Balfour's ability that, in 1882, he was appointed professor of animal morphology, it being understood that the professorship would lapse with his death, and that it carried but a small emolument with it. The tragedy in the Alps the same year brought this professorship to an end, and Sedgwick was left in a peculiarly difficult position. He had but recently taken his master's degree, he was but little older than some of the senior students, and the management of a comparatively large and rapidly growing department devolved on him.

Before the beginning of the October term of the same year Prof. Newton, Michael Foster, Prof. Humphrey, and J. W. Clark addressed a letter to the Vice-Chancellor, urging that the work which Balfour had so wonderfully begun should be carried on, and that the general supervision of the class should be entrusted to Sedgwick, who had been Balfour's demonstrator for some years, and had been in charge of the class during the Lent and May terms, when Balfour had been either ill or away. This was arranged, and Sedgwick was happy in securing the assistance of Mr. W. Heape, of Trinity College, and Mr. W. R. F. Welldon, of St. John's, as demonstrators, and a little later on of Mr. W. H. Caldwell, of Caius, who was then, with the aid of Mr. Threlfall, of the same college, at work on their automatic microtome.

The University was anxious to assist Sedgwick

in every way in carrying on his difficult task. At the time of Balfour's death it was already building a spacious laboratory and private rooms adjoining it to accommodate students of zoology. Owing to the rearrangement of the M.B. examination, further increase soon became necessary, and this the University provided in 1884 by bodily lifting the roof off the Mineralogical Museum and building up walls under it.

Whilst Prof. Newton kept alive in the University the study of zoology as a study of living animals, Sedgwick promoted the interest of those more interested in the architecture or morphology of the animal body. He had become in 1880 a Fellow, and soon after lecturer at Trinity College, and the college (as is the habit of Cambridge colleges) allowed his University lectures to count as though they were delivered to, as they were paid for by, the college.

Sedgwick's first researches, as was natural, were on embryology, and were mainly concerned with the origin of the vertebrate kidney. He also published a short paper on Chiton, with two useful diagrams, but the work by which he will be longest remembered was his investigation into the embryology and anatomy of the Cape species of Peripatus. His investigations did much to clear up the nature of the body-cavity of the Arthropods, and to explain what had become of the cœlom in the members of this group. What he found in the developing egg of Peripatus started him on more than one interesting speculation. His views on the cell-theory, at one time much criticised, have largely come into their own. Another of his ingenious hypotheses largely based on the same research related to the origin of segmentation in metameric animals. At one time he had contemplated a final volume to his "Zoology," which was to deal with the theory and philosophy of the science, and it is very greatly to be regretted that this has not appeared. His originality of outlook and power of expression would have made it a valuable contribution to the more speculative side of zoology.

As a result of his work on Peripatus, he was elected a Fellow of the Royal Society in 1886, and he twice served on the council of that body. In 1897 he became tutor at Trinity College, and for ten years held that position. Although he continued with his usual vigour the teaching and management of a great department, this appointment practically coincided with his ceasing research. It also coincided with the production of what is undoubtedly the most comprehensive text-book in English written, with the exception of one or two groups, by one man. Sedgwick's aim in his great text-book was to mention practically every genus. Of course, in some groups, such as the insects, this ambition could not be realised; but his broad outlook, his wide knowledge, and, on certain lines, his philosophical insight have made the book invaluable to all advanced students of the subject. It will be, with his work on Peripatus, a lasting memorial to his name.

In 1907 Prof. Newton died, and the chair of zoology then passed to Adam Sedgwick, who for so many years had been the head of the department of morphology. To the great regret of his Cambridge friends he only held it for two years. In 1909 he accepted the post of professor of zoology at the Imperial College of Science and Technology, and for the last three and a half years he spent his whole energies in the attempt to build up a school of zoology in South Kensington.

For some months his friends had marked with dismay a serious decline in his health, but his sudden death on February 27 came as a shock to many who read of it in their morning paper last Friday.

If one may say a few words about his personality, he was extraordinarily "alive," very trenchant in his criticisms, not a good lecturer, the reverse of fluent, yet by his earnestness and by the vigour of his language arresting attention. Still he was a successful teacher. The best course he gave was that on embryology; here he was giving his class the results of first-hand, personal knowledge, and his students felt they were listening to a master of the subject. His very entrance into the great laboratory where some hundred students were being taught by eight or ten demonstrators put a new spirit into the thing. The atmosphere, as it were, became electrified, and teachers and taught were "keyed up." As a conversationalist he was most interesting, holding often bizarre and impossible views, and maintaining them with extraordinary energy and humour. If one may judge by portraits and statues, he was in physique very like his great-uncle—small and frail in body, his face was quick and keen. Like his great-uncle again, he was an eager and rapid worker, one who never spared himself when working at the subject to which he devoted his life.

NOTES.

THE following fifteen candidates have been selected by the council of the Royal Society to be recommended for election into the society:—Prof. V. H. Blackman, professor of plant physiology and pathology at the Imperial College of Science and Technology; Dr. William Bulloch, professor of bacteriology in the University of London; Mr. D. L. Chapman, fellow and tutor of Jesus College, Oxford; Prof. W. E. Dalby, professor of civil and mechanical engineering at the Imperial College of Science and Technology; Dr. T. R. Elliott, lecturer in practical medicine at University College Hospital Medical School; Prof. J. C. Fields, professor of mathematics in Toronto University; Dr. J. S. Flett, assistant director of the Geological Survey of Scotland; Prof. J. P. Hill, Jodrell professor of zoology and comparative anatomy at University College, London; Mr. A. R. Hinks, chief assistant at the Cambridge University Observatory; Prof. F. Keeble, professor of botany in University College, Reading; Prof. A. Keith, Hunterian professor of the Royal College of Surgeons; Dr. K. Lucas, lecturer in natural sciences, Trinity College, Cambridge; Prof. O. W. Richardson, professor of physics in Princeton University; Dr. W. Rosenhain, superintendent of the metallurgical department of the

National Physical Laboratory; Mr. G. W. Walker, formerly superintendent of the Eskdalemuir Observatory.

THE Secretary of State for India in Council notifies that one appointment to the Indian Geological Survey Department will be made in July next. A further vacancy is expected to occur in the year 1914.

THE Rome correspondent of *The Times* states that the Italian Geographical Society proposes to give a gold medal to Capt. Scott's family and two silver medals respectively to the families of Dr. Wilson and Capt. Oates.

THE death is announced, in his eighty-fifth year, of Dr. S. A. Lattimore, professor of chemistry at the University of Rochester, N.Y., from 1867 to 1908. As a young man he spent ten years as a classical tutor and then professor of Greek at his *alma mater*, a university in Indiana. Having then decided to adopt a scientific career, he became professor of chemistry at Genesee College, where he served for seven years before his appointment at Rochester.

THE death is announced, at the age of ninety-one, of Major-General Henry Clerk, R.A., F.R.S. General Clerk was elected a fellow of the Royal Society so long ago as 1848, and he served on the council in the years 1878-80. He was the author of papers on meteorological and magnetic observations made in a voyage to the Antarctic circle, and also of papers on the strength of timber, friction, and the flow of liquids through small orifices.

FOR the meeting of the British Association which will take place in Birmingham on September 10-17 next, the following sectional presidents have been appointed:—A (Mathematics and Physics), Dr. H. F. Baker, F.R.S.; B (Chemistry), Prof. W. P. Wynne, F.R.S.; C (Geology), Prof. E. J. Garwood; D (Zoology), Dr. H. F. Gadow, F.R.S.; E (Geography), Prof. H. N. Dickson; F (Economics), Rev. P. H. Wicksteed; G (Engineering), Mr. J. A. F. Aspinall; H (Anthropology), Sir Richard Temple, Bart.; I (Physiology), Prof. F. Gowland Hopkins, F.R.S.; K (Botany), Miss Ethel Sargant; L (Education), Principal E. H. Griffiths, F.R.S.; M (Agriculture), Prof. T. B. Wood.

MR. R. J. BALSTON, of Maidstone, has presented to the British Museum (Natural History) his well-known collection of humming-birds. The birds are mounted and arranged in forty-nine cases, each of which contains a group of two or more species. The total number of specimens in the collection is stated in Mr. Balston's MS. to be 3315, representing 162 genera and 480 species. Of these, 2674 are skins, and 199 nests, some of the latter containing eggs. As soon as arrangements are made for its reception the series will be placed on exhibition in one of the corridors on the first floor of the zoological department. This collection and the Gould collection will render the exhibited series of humming-birds one of the finest, if not actually the finest, in the world.

THE thirty-fifth annual general meeting of the Institute of Chemistry was held on Monday, March 3. Prof. R. Meldola, F.R.S., occupied the chair, and in the course of his presidential address he remarked that the applications of chemistry in every field of human activity have been steadily increasing, and the importance of professional chemists to the public welfare is becoming more and more recognised. Professional chemists have not secured that full measure of public recognition to which they are entitled, but in this country all scientific affairs move but slowly. The consolidation and the elevation of the profession and the maintenance of the status of the chemical practitioner will become more and more determined in the future by the standard of efficiency and of conduct set up by the fellows and associates. Until the whole level of public appreciation of the value of this profession is raised, the country is destined to lose the services of that highest type of cultured and trained chemist of which other nations are more wisely availing themselves, to our detriment and their advantage.

THE following are among the lecture arrangements at the Royal Institution, after Easter:—Dr. A. S. Woodward, two lectures on recent discoveries of early man. Prof. W. Bateson, two lectures on the heredity of sex and some cognate problems. Prof. W. Stirling, three lectures on recent physiological inquiries. Prof. T. B. Wood, three lectures on recent advances in the production and utilisation of wheat in England. Dr. E. Frankland Armstrong, two lectures on (1) the bridge into life; (2) colour in flowers. Prof. J. Garstang, three lectures on the progress of Hittite studies. Prof. W. J. Pope, three lectures on recent chemical advances. Mr. H. A. Humphrey, two lectures on Humphrey internal-combustion pumps. Prof. E. Rutherford, three lectures on radio-activity. The Friday evening meetings will be resumed on April 4, when Mr. J. J. Dobbie will deliver a discourse on the spectroscope in organic chemistry. Succeeding discourses will probably be given by Mr. C. J. P. Cave, Dr. T. M. Lowry, Prof. J. Garstang, and Mr. H. G. Plimmer.

AS has been pointed out already in these columns, March 19 will be the centenary of the birth of David Livingstone. The event is being and will be commemorated in a variety of ways. On February 27 the University and town of Cambridge held a meeting at the Senate House, when speeches on Livingstone's work were delivered. Livingstone College, Leyton, E., has published, as a souvenir of the centenary, an illustrated brochure, entitled "Memorials of David Livingstone"; it contains two portraits of the explorer in colour and other pictures and extracts connected with his work. Livingstone College was founded in the year 1893, in order to give instruction to foreign missionaries in the elements of medicine and surgery, and constitutes a permanent memorial to Dr. Livingstone in the neighbourhood of London. It is now appealing for a sum of 10,000*l.* in order to meet various needs, one of which is to clear off a mortgage of 3500*l.*; 1500*l.* is needed for making certain improvements, whilst it is desired to raise 5000*l.* as the nucleus of an endowment.

AN eighteenth-century picture, which is said to be a portrait of Gilbert White of Selborne, has lately

come to light. Referring to this discovery, Mr. Wilfred Mark Webb remarked, at a meeting of the Selborne Society on March 3, that it was believed that no portrait of Gilbert White existed or had ever been painted. There was, he said, a reason for believing this, in view of the fact that Gilbert White was marked with smallpox, and would probably therefore not wish his appearance to be recorded. Still, the picture, which had been found in the Caledonian Market, and had come into the possession of a relative of one of the members of the society, showed internal evidence suggesting its possible authenticity. The stretcher, canvas, and frame indicated the date, about 1770, when Gilbert White was fifty years of age, and the portrait fitted that age. It also had a family likeness to the portraits of John White and Thomas White. There was a tablet on the picture stating it to be a portrait of Gilbert White, but this had been added when the painting was twenty years old. It was intended if possible to trace the history of the picture, but this would be difficult, though it had once come into a sale-room in London and had been withdrawn. Mr. Webb preferred to await investigation before expressing an opinion.

IN the course of a lecture on heredity in feeble-mindedness, delivered at the Galton Laboratory, University College, London, on March 4, Dr. David Heron showed a long series of pedigrees to illustrate various phases of mental defect, and said that there can be no doubt that it is a hereditary character. When, however, attempts are made to discover precise laws of inheritance, many difficulties are encountered, due to the fact that the term "mental defect" covers a multitude of conditions, each of which exists in an almost infinite number of grades of severity. Dr. Heron severely criticised some recent attempts to apply Mendelism to such cases, and showed that the evidence cited told strongly against the theory. What is specially required at the present time is more information. Special efforts ought to be made to follow up the children who are passing through the special schools for the mentally defective, and also to trace back the school histories of those who are now mentally defective criminals and paupers. Much yet remains to be discovered regarding the inheritance of mental defect, but on the basis of our present knowledge it may be asserted that a substantial reduction in the numbers of the mentally defective could be obtained by cutting off the supply at the source—by preventing the feeble-minded from reproducing their kind.

FEBRUARY was generally mild and dry, the rainfall in parts of England being less than one-half of the average. At Greenwich the mean temperature for the month was 41°, which is nearly 2° above the average, but is 2° colder than in February last year. There were during the month ten nights with frost in the shade, whilst on the grass open to the sky there were twenty-one frosts at Greenwich, and on the three consecutive nights from February 22 to 24, the exposed thermometer fell below 20°. The mean of the highest day readings was 47°, and the mean of the lowest night shade readings 35°. The duration of bright sunshine at Greenwich was fifty-eight hours, which is five hours more than the average for the last thirty years. The aggregate rainfall for the month was 0·80 in., which is 0·69 in. less than the average of the last sixty years, and at Kew Observatory the total rainfall was only 0·73 in., which is 0·86 in. less than the normal, and only 0·09 in. of rain fell in the last nineteen days of the month. At Greenwich the mean temperature for the three winter months was 42·5°, which is the same as the mean for the winter of 1911–12, but warmer than in any of the eight previous winters. The rainfall for the winter was about an inch in excess of the average, and February was the only dry month of the three.

THE alpine flora of Japan is to be made the object of special investigation by the Tokyo College of Science, which is establishing a large botanical garden for the purpose at Nikko, situated in a region of high mountains. The Tokyo *Asahi* of January 24 devotes considerable space to an account of the new enterprise, which is intended as a complement to the two gardens, representing the temperate zone and the tropics respectively, laid out by the college some years ago elsewhere in Japan. The site for the new garden was acquired some four or five years ago, and the necessary adaptations and arrangements are expected to be completed early in the summer of the present year. The buildings erected in the enclosure comprise a laboratory, a residential building for students, experimental greenhouses, &c. The garden is to be divided into eighteen sections for the separate cultivation of all varieties of mountainous flora, ranging from trees and shrubs to ground-plants and lichens, and including foreign as well as local growths. Dr. H. Komatsu has been placed in charge of the new station, to which the large collection of alpine species already acquired by the college, but hitherto restricted through lack of accommodation, will be transferred in due course.

BY the death of Mr. George Harold Drew at the age of thirty, which occurred suddenly at Plymouth on January 30, a worker of great promise has been lost to science. Intending in the first instance to qualify for the medical profession, Mr. Drew studied for this purpose at Cambridge, where he was a scholar of Christ's College, and subsequently at St. Mary's Hospital, London. He, however, never completed his medical course, and devoted himself to biological and pathological research, in which he displayed exceptional aptitude. After working for a short time at the Port Erin Laboratory, he settled at Plymouth, where, at the Marine Biological Laboratory, the greater part of his research work was done. For three years he held a Beit memorial fellowship, and he was last summer appointed John Lucas Walker research student in the University of Cambridge. He made two journeys to the United States and the West Indies for the purpose of carrying out researches in connection with the Carnegie Institution. On the purely scientific side, Mr. Drew's best work was on the development of Lamminaria and on the physiological action of marine bacteria, more particularly on denitrifying bacteria and their power of precipitat-

ing calcium carbonate. His pathological work was all undertaken with reference to the problem of cancer. He commenced by a study of the effect of transplanting tissues in invertebrates, and subsequently extended his researches to fishes, where he investigated the effect of repeated stimulation of the tissue by chemical reagents. During the short time he held the John Lucas Walker studentship he was engaged, with much success, in the culture of tissues from the frog and the dogfish in plasma outside the body of the animal.

A PAPER read recently before the Royal Statistical Society by Prof. E. C. K. Gonner, on the population of England in the eighteenth century, was of interest both historically and geographically. In the first part an analysis, in considerable detail, was furnished of the sources available for estimating the population before the "unfortunate superstition which delayed the taking of a census" was removed from the public mind, and of the controversy which occupied the pens of contemporary investigators. By means which he fully set forth, the author then arrived at conclusions which justified him in presenting comparative maps of the density of population in England in 1700, 1750, and 1801, which, while greatly generalised and based only on county areas, show several features of the highest interest. To take one case, the early establishment of a dense population in Lancashire, contrasted with its later establishment in the midland industrial area, and still later in the West Riding of Yorkshire, forms a series of facts which clearly emerges on the maps. Throughout the period there is visible the tendency of the present industrial areas to take their places above the purely agricultural areas in the list of relative density of population, although the population of the agricultural areas by no means declined. The results so accurately parallel the history of these areas at the period that the author's conclusions and his use of authorities are clearly justified.

No. 17 of the sixtieth volume of Smithsonian Miscellaneous Collections is devoted to notes by Mr. A. H. Clark on the American species of Peripatus, with a list of the known New World representatives of the group.

THE Agricultural Department of India has issued a further instalment, in its Memoirs, of the life-histories of Indian insects; this contribution, which is by Mr. G. R. Dutt, dealing with parasitic and other Hymenoptera. In the case of some of the Mutillids, or "velvet ants," it has not yet been ascertained how many species they may affect parasitically, and as this may have an important economic bearing inquiries are to be set on foot with the object of filling this gap in our knowledge.

IN an interesting and fully illustrated report of an expedition to Arctic America, published in the January issue of *The American Museum Journal*, Mr. R. M. Anderson states that the musk-ox was exterminated by Eskimo in the neighbourhood of Franklin Bay about fourteen years ago, and that the species is also practically killed off in the district around the east end of Great Bear Lake. The barren-ground caribou and the white sheep have likewise suffered severely at the hands of natives armed with modern weapons, although small numbers of the latter are still to be found near the sources of every river from the Colville to the Mackenzie, which probably formed the limit of its range.

MESSRS. J. G. O'Donoghue and P. R. H. St. John have published in *The Victorian Naturalist* (January, 1913) some notes on the vegetation and bird-life of the Brisbane Range, in continuation of their earlier work on the natural history of this little-known Australian locality. The prevalence of the gum-tree saw-fly in this area may be judged from their mention of a sapling of *Eucalyptus rostrata* which actually drooped with the burden of five large masses of the larvæ of this insect. Among other items of these interesting notes, mention may be made of the extraordinary activity of small red ants in the transport of the seeds of acacias, evidently for the sake of the oily appendage (caruncle), which the ants bite from the seed, leaving the latter in great masses outside the nest. Brief references are made to the various types of vegetation associated with different soils and physiographic aspects, but it is greatly to be hoped that Victorian botanists will make a detailed ecological investigation of what appears to be an area of unusual interest from this point of view.

PROF. F. W. OLIVER has contributed to *The Gardeners' Chronicle* (No. 1364, February 15) an extremely interesting account of the new nature reserve at Blakeney, Norfolk. The extensive area of waste maritime lands known as Blakeney Point, which has been presented to the National Trust, is to be preserved as a place for the study of wild nature, its acquisition having been made primarily on scientific grounds rather than on account of its scenic or historic interest, though it is fully entitled to rank as a place of great natural beauty. As Prof. Oliver has shown in his recent article in *The New Phytologist*, Blakeney Point shows to perfection the operation of the sorting mechanism by which new ground is built up from the spoils won by the sea from the land, and brought back by an orderly process in the form of shingle, sand, and mud, and also the colonisation of this new ground by plants appropriate to its kind. The distinctive features at Blakeney are the profusion in which developmental stages of all the maritime plant-communities abound, and the rapidity with which change in each sort of terrain is being accomplished. Apart from its ecological interest, the Point is famous as a breeding ground for wild seafowl, and as a place of call for winter migrants, while in many and various respects the fauna generally is full of interest, especially with reference to the important and sometimes surprising relation of the insects and the rabbits to the plant population.

THE liability to drought in India as compared with that in other countries is the subject of an interesting paper by Dr. G. T. Walker in the Memoirs of the Indian Meteorological Department (vol. xxi., part v.). The paper is a preliminary attempt to deal with the matter from an examination of the annual records,

owing to want of details for some countries. A tabular statement gives for a number of stations for which long series of observations were available the normal rainfall and the percentage of years with deficiency (1) between 30 and 45 per cent., (2) between 45 and 60 per cent., and (3) more than 60 per cent. In India places on the coast usually fare better than those in the interior; but burning sun and hot-dry winds during a long break in the rains do much more harm than in some other countries. In the United States, *e.g.* a deficiency of rain produces nothing like the damage that it does in India, while in Europe the liability to failure in the crops is not in the least comparable with that of India. In South America, Brazil and the Argentine Republic show nothing worse than a few cases of deficiency between 30 and 45 per cent., but in Chile, Santiago shows a considerable number of cases of deficiency in the three classes above mentioned; in some parts of Chile there may be a year without any rain whatever.

THE January number of the American journal *Good Lighting* contains an article by Prof. Gotch, of Oxford, which gives a valuable summary of our present knowledge of the properties of the eye when used for detecting and observing distant coloured lights, such as are seen at sea. The normal eye under such conditions recognises a red light as red over an area of the retina the radius of which is three or four times that over which a green light is recognised as green. Outside this area the red light is not seen at all, while the green light outside its area of recognition is seen as a bright white light. In view of these facts, Prof. Gotch suggests that in the absence of binoculars, on which in practice the recognition of the colour of a distant light depends, it should be noted whether the light, apart from its colour, is seen better by oblique than by direct vision; if so, it is a green or white light. If it is seen better by direct than by oblique vision it is red.

RED BOOK No. 176 of the British Fire Prevention Committee deals with tests made on a new celluloid substitute, intended to reduce the risks of fire from the use of kinematograph films. The material was "Cellit," which is an acetyl-cellulose, manufactured by the Bayer Company, Ltd., and resembles celluloid in all respects except that it is far less inflammable and appears to be practically free from the dangers which attend the use of celluloid. As the result of stringent tests to which it was subjected, the material was awarded the committee's certificate of "non-flaming." A copy of the report can be obtained from the secretary of the committee, 8 Waterloo Place, Pall Mall, S.W.

The Engineer for February 28 contains an account of an automatic electric light plant manufactured by Messrs. R. A. Lister and Co., Ltd., of Dursley, Gloucestershire. This plant is intended for private house installations, and consists of a petrol engine, dynamo, automatic starting switch, and water tank, the whole being mounted on two cross girders providing facility for setting down and removal. A small battery is supplied, of capacity very much below that of our ordinary private electric lighting plant. When the battery is charged and no lights on, the engine is at rest. If lights are switched on in number below that capable of being dealt with by the normal discharge of the battery, the engine remains at rest until the battery voltage drops to a certain value. On this voltage being reached, current is automatically sent through the dynamo, and runs it as a motor, thus starting the engine, an operation facilitated by the exhaust valve being automatically held open. When the battery is sufficiently charged, the engine stops again. The engine will also start and keep running if the demand is higher than that which can be dealt with by the battery alone. Exhaustage of the battery by reason of failure of the engine to start when required is prevented by a time-limit circuit-breaker, which allows starting current to pass through the dynamo for a limited period only. The whole arrangement seems likely to minimise the troubles which occur in small lighting sets owing to improper handling of the batteries.

THE issue for 1912 of the "Year-Book of the Scientific and Learned Societies of Great Britain and Ireland" has now been published by Messrs. Charles Griffin and Co., Ltd. It is described on the title-page as a record, compiled from official sources, of the work done in science, literature, and art during the session 1911–12, and in consequence its appearance is a little belated, and the information provided about some associations rather behind the times. But the present is the twenty-ninth issue of a work of reference which has proved its utility to workers in science and literature; its welcome would be even greater if it could be published in October, when the academic and scientific sessions begin.

OUR ASTRONOMICAL COLUMN.

DISCOVERY OF A COMET 1912*d*.—From *The Times* of February 26, we learn that a faint comet was discovered by Mr. B. Lowe, at Laura, South Australia, on December 31, 1912. According to the report by Mr. Dodwell, director of the Adelaide Observatory, the object was visible in a small telescope, and was seen to have a short tail; its position on December 30, at 5.30 p.m. (G.M.T.), was about 4° south of Spica, and it was travelling southwards so rapidly that the position on January 5 was about $\alpha = 14h.\ 30m.$, $\delta = 29°\ 50'$ S. An approximate orbit gives February 3 as the time of perihelion passage, when the comet was probably some sixty million miles from the sun, and indicates that the least distance from the earth occurred about the time the object was discovered, and was about twenty-five million miles. Mr. Dodwell also states that Mr. Lowe anticipated Mr. Gale in the discovery of comet 1910*a*, but did not notify the fact until later.

AN INTERESTING OCCULTATION.—On March 13 an interesting occultation will be provided by the moon passing in front of the Pleiades. As new moon occurs on March 8, our satellite will, at the time of the occultation, present a fairly thin crescent, and the several stars of the group will disappear at various points on the dark limb, to reappear at the bright limb. The first bright star to disappear will be Electra (mag. = 3·8), which will enter near the southern horn at 10h. 1m. p.m. Then will follow Merope

(mag.=4·3), hidden from 10h. 7m. to 11h. 2m.; Alcyone (η Tauri, mag.=3·1), from 10h. 47m. to 11h. 25m.; Atlas (mag.=3·8), from 11h. 20m. to 12h. 9m. (midnight); and Pleione (mag.=5·2), from 11h. 26m. to 12h. 7m. Asterope, Taygeta, and Maia will not be occulted, and it will probably surprise many people to observe how much larger the Pleiades group apparently is than the moon; about one degree, or two lunar diameters, separate Atlas from Taygeta or Electra. Occultations of the Pleiades will also occur, in daylight in Great Britain, on July 28 and October 18.

PUBLICATIONS OF THE VIENNA OBSERVATORY.—We have received vols. xxi. and xxii. of the *Annalen der K.K. Universitäts-Sternwarte in Wien,* edited by Prof. Hepperger. The former contains the results secured with the 27-in. Grubb refractor during the period 1903–06, and deals with a great number of observations of planets, comets, and nebulæ. The second volume is divided into two parts, the first dealing with planet and comet observations made with the 6-in. Fraunhofer refractor by Dr. J. Holetschek during 1903–10, and the second, by Dr. J. Rheden, giving an account of the observing station, and the observations made, at Sonnwendstein, from November, 1909, to 1910. The Sonnwendstein station is at an altitude of 1523 m., and the daily notes concerning the atmospheric conditions and their influence on the observations are of special interest.

ASTRONOMICAL YEAR-BOOKS.—"The Observer's Handbook for 1913," published by the Royal Astronomical Society of Canada, is a very useful, though small, volume, which contains a great deal of information set out in a form most useful to the amateur astronomer. In addition to various ephemerides it gives the astronomical phenomena for each month, and a detailed summary of special stellar objects which are available for observation month by month. It also contains four very useful and clear star charts, covering the whole sky, and a brief account of "Recent Progress in Astronomy," written by Mr. W. E. Harper.

The *Annuario* of the National Observatory of Brazil contains the usual full complement of ephemerides and astronomical and physical tables. An interesting map is also included, showing the central lines of all the total eclipses of the sun visible in Brazil between the years 1912 and 2162, as prepared by Prof. D. Todd.

THE EUGENICS EDUCATION CONFERENCE.

THIS conference was organised by the Eugenics Education Society for the purpose of opening up discussion on the possibility and advisability of infusing the eugenic ideal into the minds of school children and on the best methods for so doing. More than 400 headmasters and headmistresses or their representatives assembled in the large hall of London University on March 1 to take part in the debate, and it is in some ways to be regretted that with so large and expert an audience the subject discussed should have been rather sexual hygiene than eugenics. The relation between the two subjects was so clearly and admirably pointed out by Major Darwin in his presidential address on the eugenic ideal, that it is difficult to understand why so many subsequent speakers should have appeared to regard them as identical.

The discussion at any rate had the merit of showing how much the minds of the more earnest educationists are exercised in the question of instruction in sexual hygiene. The objections to its introduction into schools fall into three classes. In the first place it is maintained that the growing mind should be kept free from thoughts on sexual matters; to which it may be answered that practical experience shows this to be impossible. In private schools, attended by boys of nine to fourteen years of age, such subjects are certainly discussed, and it cannot be supposed that the pupils of corresponding ages in public elementary schools, with their ampler experience of the seamy side of life, are behindhand in this respect.

Secondly, there are many who say that it is practically impossible to introduce the subject in a fitting manner. These were answered by Mr. Badley, headmaster of Bedales, the well-known coeducational school, and by Miss Bonwick, headmistress of the Enfield Road Primary School, who each described their own methods. Miss Bonwick's speech is worthy of special mention, as her eloquence and enthusiasm made a marked impression on the audience. Prof. J. Arthur Thomson also dealt with this aspect of the subject clearly and wisely.

Thirdly, it is said that instruction as to sex should be given by the parents, to which it may be answered that in most cases the parents are quite unfit to give it.

Major Darwin, speaking in the name of the Eugenics Education Society, did not attempt to teach the teachers on these matters, but urged that in all institutions where sex hygiene is taught it should be taught in connection with the eugenic ideal. His address, together with those of the headmaster of Eton, the Principal of Bedford College, Prof. J. Arthur Thomson, and Mr. Badley, and the reports of other speeches, will be published in the April number of *The Eugenics Review,* and have therefore scarcely been touched on here. E. H. J. S.

NAPIER TERCENTENARY CELEBRATION.

IN the year 1614 John Napier, Baron of Merchiston, published his "Mirifici Logarithmorum Canonis Descriptio," a small quarto volume, the influence of which upon the development of mathematics, especially as an instrument of calculation, cannot be overestimated. The council of the Royal Society of Edinburgh, mindful of the greatness of the boon conferred on science by Napier's invention, convened a committee representative of some twenty societies, corporations, and institutions to discuss the proposal to hold a celebration in memory of the event. The universities and colleges of Scotland, the Faculty of Actuaries, the Edinburgh Mathematical Society, the Institute of Bankers, and other like bodies, also the Royal Society of London and the Royal Astronomical Society, were represented by delegates to the first meeting of the committee, which was held in the Royal Society Rooms, 22 George Street, Edinburgh, on Saturday, February 22. Mr. J. R. Findlay, one of the representatives of the Edinburgh Merchant Company, was voted to the chair.

Dr. Knott (general secretary, Royal Society of Edinburgh) and Dr. A. E. Sprague (Faculty of Actuaries) were appointed honorary secretaries in connection with the celebration, and Mr. Adam Tait, Royal Bank of Scotland, was appointed honorary treasurer. With these as officials, an executive committee was nominated to carry into effect the following resolutions:—

That a congress be held in the summer of 1914, to be opened by a public reception and an address by an

eminent man on some aspect of Napier's life and work; that, in response to an invitation from the directors of Merchiston Castle School, a garden-party be held in the grounds of Merchiston Castle; that papers be read on methods of calculation and of mathematical teaching; that exhibits be made of all kinds of calculating machines, of logarithmic and other mathematical books which are necessary for calculation, and of objects of historic interest associated with the name of Napier; that eminent mathematicians be invited from foreign countries to take part in the celebration; that a memorial volume be published containing the more important of the addresses and communications; that, to meet preliminary expenses, a donation list be opened, to which societies and individuals may contribute; that those interested in the proposal be asked to become founder members, the subscription being £2; and that the ordinary subscription be kept as low as possible.

The executive committee was given powers to add to its number and to appoint subcommittees to take charge of the special departments of work indicated above, and of any other lines of development which might occur to them.

THE METHOD OF "SHOCK-EXCITATION" IN WIRELESS TELEGRAPHY.

IN *Die Naturwissenschaften* of January 24 there appears an excellent short descriptive article on the principles and the advantages of the "shock-excitation" method of generating electrical oscillations, written by Dr. G. Eichhorn. The method of shock-excitation is used in wireless telegraphy on the large scale by the Gesellschaft für drahtlose Telegraphie ("Telefunken" system), and was first properly investigated and explained by Max Wien. Its essence consists in using a very short-lived oscillatory discharge in a primary circuit, to excite oscillations in an antenna arranged as a secondary circuit, the life of the primary oscillation being, in the ideal arrangement, just so long as to admit of the transference from primary to secondary of the maximum fraction of the initial energy—that is, the energy stored on the condenser in the primary circuit just before the beginning of its discharge. The points especially discussed are the conditions governing, and the means of realising, this ideal arrangement.

Dr. Eichhorn starts with the fact that in a pair of coupled circuits the phenomenon known as "beating" takes place, and that in the time of a beat the oscillatory energy passes from the primary to the secondary and back again. The time of a beat depends on the closeness of the coupling, being shorter with closer coupling. But in the quenched spark method of exciting oscillations the stoppage of the primary oscillation is effected by cooling the spark—that is to say, by de-ionisation of the spark-gap—and the critical moment for the stoppage is the first occasion on which the whole energy passes from the primary to the secondary, namely the moment of the middle of the first beat in the secondary circuit. Thus the better the quenching the closer can the coupling be made. The author shows that the primary must be tuned to the secondary the more exactly, the less effective the quenching is. Among the advantages claimed for the method that of economy is placed first, and a comparison of published researches shows that this method of shock-excitation may have an efficiency of 75 per cent. as against the 25 per cent. of the ordinary spark or the 10 per cent. of the Poulsen arc method.

A SUPERANNUATION SCHEME FOR ENGLISH UNIVERSITY TEACHERS.

THE advisory committee on the distribution of Exchequer grants to universities and university colleges in England has issued its second report (Cd. 6617). In the first report it was recommended that a certain proportion of the grant of 149,000*l.* available for distribution among the English colleges should be reserved pending consideration of a superannuation scheme, and should be regarded as applicable to the institution of such a scheme and to other purposes.

Several conferences have been held between a subcommittee of the advisory committee and representatives of the universities and colleges concerned, existing schemes have been examined, the possibility of a federated scheme has been considered, and the present report gives the governing principles which the committee suggests should underlie each scheme.

I. *Scope.*—(*a*) The new scheme should come into force on October 1, 1913, when—

(1) It should be compulsory on all new entrants in receipt of a salary of not less than 300*l.* a year.

(2) All new entrants in receipt of less than 300*l.*, but not less than 200*l.* a year, should be entitled to join the scheme.

(3) Any new entrant in receipt of less than 200*l.*, but not less than 160*l.* a year, should, with the consent of the governing body, be allowed to join the scheme.

(4) Any member of the existing staff who satisfies the salary conditions under (1)–(3) above should, with the consent of the governing body, be allowed to join the new scheme under such provisions as to his interest (if any) in any existing scheme of superannuation as may be approved by the governing body.

(*b*) Provided always that no member of the staff should have a claim for inclusion in the scheme who does not, in the opinion of the governing body, devote his main time to his duties as a member of the teaching or administrative staff.

II. *Contributions.*—(*a*) The total contributions in all cases should be 10 per cent. of the salary, except that in the case of salaries above 1000*l.* a year no contributions should be made in respect of the excess above 1000*l.*

(*b*) The normal contributions should be 5 per cent. of salary by the beneficiary and 5 per cent. by the institution, but if the governing body desire, it should be able to increase its proportion of the total 10 per cent. and diminish correspondingly the proportion payable by the beneficiary.

(*c*) If a person is a member of the staff of two or more institutions both within the federated system, the combined salary should be taken into account and the institutions should contribute *pro rata*.

III. *Benefits.*—(*a*) The benefit should include an annuity on reaching the age at which the benefit matures, or, so far as the governing body thinks desirable in each case, an equivalent cash payment. The beneficiary should, however, have the option of choosing a form of provision which secures in addition a benefit in the event of death.

(*b*) The age at which the policies mature should be fixed at sixty.

IV. *Means of Securing the Benefit.*—Every beneficiary should have the option of securing his benefit by means of an insurance policy. The governing body should have the power, however, if it thinks desirable, in individual cases, and if the beneficiary concurs, to accumulate the contributions by separate investment in trustee securities on behalf of the beneficiary. These separate investments may be in addition

to, or in substitution for, an insurance policy. Thus the various types of options would be as follows:—

(*a*) A deferred annuity or equivalent cash payment with a considerable benefit in the event of death while in service—to be obtained from insurance companies by means of "endowment assurance" policies of varied types.

(*b*) A deferred annuity or equivalent cash payment with return of accumulated contributions in the event of death while in service—to be obtained from insurance companies by means of a "sinking fund" policy (or, if necessary, in individual cases by separate investment as above).

(*c*) A deferred annuity without any return of premiums in the event of death while in service—to be obtained from insurance companies.

V. *Ownership of Benefit.*—(*a*) The governing body should hold the policy or other equivalent accrued benefit in trust for the beneficiary so long as he remains at the institution, and the beneficiary should execute some form of legal document which would enable the governing body so to do.

(*b*) On the transfer of a beneficiary from one institution to another within the federated system, the whole of the accrued benefit should be transferred to the second institution.

(*c*) In the event of a beneficiary leaving an institution before the retiring age, for any reason other than that indicated in (*b*) above, he should have the right to the whole of the accrued benefit, but the governing body should have the right to determine how the accrued benefit should be given.

The advisory committee states that universities and colleges would be prepared to inaugurate a superannuation system on the basis of the foregoing principles, but, as in most cases increased outlay will thereby be involved ultimately, it is unreasonable to expect them to adopt the proposals until they know the amount of the assistance they may expect to receive by way of grant. The committee therefore makes recommendations for a further distribution of the money held in reserve.

Grants are made to thirteen universities and colleges varying from 1000*l.* each in the case of the Universities of Liverpool and Manchester, to 300*l.* each in the case of Bedford College, London, London School of Economics, East London College, and Reading University College. The colleges at Nottingham and Southampton do not receive additional grants.

The additional grants now recommended, together with those announced in March, 1912, dispose of a yearly sum of 148,000*l.* out of the 149,000*l.* available. The committee recommends that the annual balance of 1000*l.*, together with the balance of 2550*l.* from previous Exchequer grants, should be held over to meet contingencies.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—The Lord Mayor of Birmingham has opened a fund for the establishment of a memorial to the late Vice-Chancellor, Alderman C. G. Beale, whose services to the city were such as to demand a permanent monument to his name. It is proposed to devote the money subscribed to two objects, both of which would certainly have had the approval of the late Vice-Chancellor, viz. the endowment of a chair in the University (to be called the Beale chair), and the equipment of one of the rooms in the new Natural History Museum of the city with a collection of British birds and their nests in natural surroundings. Already promises to the amount of 9000*l.* have been received, including one donation of 5000*l.*, earmarked for the Beale chair, from that most generous friend of the University Sir Charles Holcroft.

CAMBRIDGE.—The General Board of Studies will proceed shortly to appoint a University lecturer in the philosophy of religion. The appointment is for three years from October 1, 1913. The annual stipend is 100*l.* Candidates are requested to send their applications to the Vice-Chancellor, with testimonials, if they think fit, on or before Friday, April 11.

Mr. A. Harker has been nominated to represent the University at the twelfth International Geological Congress to be held in Canada in August next.

OXFORD.—Sir William Mitchell Ramsay will deliver the Romanes lecture at the Sheldonian Theatre on Thursday, May 8, at 3 p.m. The subject of the lecture is "The Imperial Peace."

Mr. R. B. Bourdillon, lecturer in chemistry at Balliol College, has been elected to a fellowship in chemistry on the teaching staff of University College.

The degree of M.A. has been conferred by a decree of Convocation on Prof. W. H. Perkin, F.R.S., fellow of Magdalen College, the recently elected Waynflete professor of chemistry.

At the same Convocation, the statute altering the constitution of Congregation by abolishing the qualification of residence, and making other changes with the view of confining the membership to the "teaching and administrative elements in the University and the colleges," passed its final stage by 77 votes to 49.

In the Educational Supplement of *The Times* of March 4 an important letter appears from Prof. Poulton, F.R.S., pointing out that the extension of the scientific departments of the University was one of the principal objects had in view by the promoters of the original purchase for the University of the ground known as the Parks. The letter directs attention to a scheme which was devised some years ago, though not accepted by the University, in accordance with which a space of ten or eleven acres adjoining the museum at the south-west angle of the Parks would be definitely allocated to the purposes of the scientific departments at present existing or to be established in future. This would leave six-sevenths of the present open space untouched and unthreatened by building.

SHEFFIELD.—Dr. Sophia M. V. Witts has been appointed to the newly instituted post of lady tutor in anatomy.

MR. AUGUSTINE HENRY, reader in forestry, University of Cambridge, has been appointed to the professorship of forestry recently established in the Royal College of Science for Ireland.

DR. A. R. FORSYTH, F.R.S., formerly Sadlerian professor of pure mathematics in the University of Cambridge, has been appointed chief professor of mathematics at the Imperial College of Science and Technology, South Kensington.

As announced already, a course of four public lectures on the theory of the solid state, will be delivered at University College (University of London), by Prof. W. Nernst, director of the Institute of Physical Chemistry in the University of Berlin, at 6 p.m. to-day, March 6, and at 5 p.m. on March 7, 10, and 11. The chairman at the first lecture will be Sir William Ramsay, K.C.B.

AT the annual meeting of the court of governors of the Middlesex Hospital, on February 27, Prince Alexander of Teck, in moving the adoption of the report, announced an anonymous gift of about

10,000*l*. The object of the gift is to defray the cost of erecting a new pathological block and institute of hygiene. The scheme is one which the governors have been anxious to carry out for some time, as the present accommodation is wholly inadequate, but lack of funds has hitherto proved an insurmountable barrier to progress in this direction. The plans have been prepared, and it is hoped the work will be started almost immediately.

AT the meeting of the executive committee of the Carnegie Foundation for the Advancement of Teaching, held on February 11, it was announced that Mr. Andrew Carnegie had given an additional 250,000*l*. to the foundation. The gift is in the form of 4 per cent. bonds and the income is to be set aside for special investigation relative to the purposes of the original foundation of pensioning college professors. The money is to be devoted to the endowment of a division of educational inquiry and makes permanent provision for studies hitherto conducted by the foundation out of its general fund. It is the plan of the trustees to proceed with the new endowment to make other studies similar to those already published concerning medical education and in particular to study legal education in its relation to the supply of lawyers and the cost of legal process.

AN appeal on behalf of the British and Foreign Blind Association, 206 Great Portland Street, London, W., signed by four blind members of the executive council, including Mr. H. M. Taylor, F.R.S., is being circulated. One of the chief objects of the association is the maintenance of a printing press of works in embossed type; and properly to carry out this and other good works the council finds that extended premises are necessary. The sum of 10,000*l*. has been expended in carrying out part of the work entailed by the scheme for a new building, and the completion of the work, including adequate equipment, necessitates the raising of a further sum of 29,000*l*. The council is anxious that the invested funds of the association, producing an annual income of some 400*l*., should not be touched. To maintain the work on an enlarged scale an increase of 1000*l*. in annual subscriptions is needed. Donations or subscriptions should be sent to the honorary treasurer, Mr. Douglas A. Howden, or to the secretary-general.

THE report of the committee of University College, London, for the year ending last month is full of interesting particulars of the manifold activities of the institution. The total number of students during the session 1911–12 was 1679, being an increase of 79 over that of the preceding session. Of these students 403 were engaged in post-graduate study and research. In the faculty of science there were 392 students, and in engineering 174. Of the 403 post-graduate and research students, 117 were women. There were 710 registered internal students of the University of London, compared with 678 in the previous year. We notice that the sums promised and paid, together with interest on deposit and rents, for the new chemical laboratories, amounted in July last to upwards of 38,000*l*. A tender for the erection of the fabric at a cost of 39,000*l*. has been accepted, and the work is being pushed forward. A sum of about 28,000*l*. will be required to complete the laboratories, and it is earnestly hoped that the necessary amount will be speedily forthcoming, so that the completion of the scheme and the opening of the laboratories may not be delayed.

THE erection of new chemical laboratories is not the only important step in progress for the development of the buildings of University College, London. The recently published report of the committee of the college gives, in addition to an account of the formal opening last December of the new Pharmacology Institute, particulars of the plans being adopted to provide a great hall for examinations and ceremonial occasions. The site of All Saints' Church, Gordon Square, the west wall of which adjoins the Carey Foster Laboratory, has been acquired at a cost of 5900*l*., which, together with legal expenses, has been provided temporarily from current income, pending the provision of the necessary sum. The Ecclesiastical Commissioners have approved the scheme for the reconstruction of the existing church building. Under this scheme the old building will be so altered as to provide a hall capable of accommodating 1100 persons. The purchase of the site, together with the expenses of reconstruction and refitting, will involve an expenditure of 10,000*l*.; it is desirable to provide an organ, in addition to the ordinary fittings at a cost of 2000*l*., making the total cost 12,000*l*.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 27.—Sir Archibald Geikie, K.C.B., president, in the chair.—F. **Soddy**: The periodic law from the point of view of recent results in radio-activity.—C. F. **Jenkin** and D. R. **Pye**: The thermal properties of carbonic acid at low temperatures. The paper describes a series of experiments made in the engineering laboratory at Oxford, undertaken with the object of checking by direct measurements the accuracy of the accepted CO_2 entropy-temperature diagram, due to Mollier, and of extending the diagram to lower temperatures, *i.e.* from $-30°$ C. to $-50°$ C.—E. **Roberts**: Re-reductions of Dover tidal observations, 1883–4, &c.—Prof. F. **Keeble**, Dr. E. F. **Armstrong**, and W. N. **Jones**: The formation of anthocyan pigments in plants. Part iv., The chromogens. The results of the experiments described in this paper lend support to the hypothesis that the anthocyan pigments of plants are produced by the oxidation of colourless chromogens. Under certain conditions a coloured flower may be caused to reverse its pigment-forming process and to reduce the pigment which it contains to a colourless state. By again changing the conditions the pigment-forming mechanism may be made to resume activity and to give rise to pigments identical in colour with those of the normal intact flower. Whether the flower forms pigment or remains colourless depends on the degree of hydration of its tissues. If water be withdrawn from the tissues oxydase activity falls off, the activity of "reducing-bodies" becomes increased—actually or relatively—pigment formation is inhibited, and the pigment in existence already is reduced to chromogen. The flower becomes colourless. If water be supplied to the decolorised tissues, oxydase resumes its activity and chromogens are oxidised to pigments.—W. N. **Jones**: The formation of the anthocyan pigments of plants. Part v., The chromogens of white flowers. This paper, which deals with the biochemistry of the pigment-forming mechanism contained in white flowers, is a continuation of the work summarised in part. iv. of the present series of communications. As shown in the latter paper, the pigments of flowers may be reduced to the state of colourless chromogens and may be re-formed by artificial means from those chromogens. In the present paper it is shown that chromogens may be obtained from some white flowers and may be caused by similar treatment to give rise to pigments.—Mabel P. **FitzGerald**: The changes in the breathing and the blood at various high altitudes. The observations described in the paper were made during the summer of 1911 on persons residing in

towns, mining camps, &c., at various altitudes from 5000 to 14,000 ft. in the Colorado portion of the Rocky Mountains. The main conclusions reached are as follows:—(1) The volume of air breathed per unit mass of CO_2 produced by the body is always increased in persons acclimatised at high altitudes. The mean increase of breathing is such as to produce a fall of about 4·2 mm. (or roughly 10 per cent. of the normal for sea-level) in the partial pressure of CO_2 in the air normally present in the lung alveoli for every 100 mm. of fall in the barometric pressure. Both men and women show this fall, after allowance is made for the normal difference in the alveolar CO_2 pressure of men and women. (2) The percentage of hæmoglobin in the blood of acclimatised persons is likewise increased, the mean increase being about 10 per cent. of the normal at sea-level in men for every 100 mm. of diminution in the barometric pressure. Both men and women show this fall. (3) It may take some weeks for these changes to establish themselves fully in persons passing to a high altitude or to disappear in persons passing to sea-level.

Zoological Society, February 18.—Prof. E. A. Minchin, F.R.S., vice-president, in the chair.—H. B. **Preston**: Diagnoses of new species and varieties of agnathous mollusca from equatorial Africa. The author directed attention to the enormous field for conchological research awaiting the student of this very fruitful region, and stated that in many parts each range of hills appeared to have, to a certain extent, its own special molluscan fauna, often characterised by certain local and peculiar phases common not only to the species but also to the genera occurring in that particular locality.—W. A. **Lamborn**: Notes on the habits of certain reptiles in the Lagos district. An account was given of the habits of the lizard *Agama colonorum*, especially relating to courtship, polygamous practices, and combativeness, and of native superstitions in regard to chameleons. Observations were also recorded on a batch of eggs of a crocodile, probably *Crocodilus niloticus*, on their hatching, on the behaviour of the newly hatched young, and on the native beliefs as to the habits of the mother crocodile.—Dr. R. **Broom**: The Gorgonopsia, a suborder of the mammal-like reptiles. Descriptions of a new genus and two new species of Gorgonopsids, based on well-preserved skulls discovered by Mr. S. H. Haughton and the Rev. J. H. Whaits. The Gorgonopsia were re-established as a distinct suborder of the Therapsida, and a list of the characters distinguishing the Gorgonopsians from the Therocephalians was given.—Dr. R. **Broom**: The South African Rhynchocephaloid reptile, *Euparkeria capensis*. A detailed account of this species was given, and its affinities with allied forms discussed. The evidence at present seemed to show that Euparkeria was to be regarded as a member of an order of generalised Rhynchocephaloid reptiles, and might be taken as the type of a most important suborder of this group containing the ancestors of the Dinosaurs, the Pterodactyles, and the birds.—R. **Lydekker**: The heads of a male and female dwarf buffalo shot by Lieut. A. W. Hunt, R.N., in Southern Nigeria. The name *Bos caffer hunti* was suggested. This race agrees with the Gambian *B. c. planiceros* in that the adult bulls are darker than cows, but is of smaller size, with the orange band on the throat narrower. Mr. Lydekker also proposed the name *B. c. beddingtoni* for a mounted bull of a red dwarf buffalo from Ashanti, mainly on the ground that it is cut off from the red Congo *B. c. nanus* by the above-mentioned Nigerian race.—Dr. G. Stewardson **Brady**: Descriptions of two British Entomostraca apparently new to science. One was a Diaptomus, obtained abundantly in Loch Ness many years ago, but hitherto unnoticed; the other an Ostracod, of which one specimen only was found in brackish water in Sussex. The latter formed the type of a new genus, and possibly also a new family.

Institution of Mining and Metallurgy, February 20.—Mr. Edward Hooper, president, in the chair.—J. **Douglas**: Historical sketch of the Copper Queen Mines and Works, Arizona, U.S.A.—A. **Notman**: Geology of the Bisbee ore deposits.—C. **Legrand**: The power plant at Bisbee, Arizona; the power plant at Douglas, Arizona.—G. B. **Lee**: Reduction works at Douglas, Arizona. These five papers, dealing with different aspects of the famous Copper Queen property, are the amplification of a lecture delivered by Dr. Douglas before a special meeting of the institution in a previous session. The historical portion traces the development of the copper-producing industry in the Far West from its origin in about 1870 until the present date, incidentally showing the obligation under which mining is placed to the great railroad enterprises that have linked up the two sides of the continent. With regard to the geological surveys that have, more especially in recent years, supplemented the earlier empirical development work, Dr. Douglas points out that even in recent years the strictly exploratory work represents about one-fourth of the cost of the total mining operations, a proportion which it is hoped will be reduced in the future as the result of more accurate geological research. Mr. Notman's contribution to the quintet of papers shows that the system of geological survey has been conducted in a thorough manner, but that there are still unsolved problems with regard to many parts of the field, opening up possibilities of valuable discoveries in the sedimentary rocks of greater age and the intrusive igneous rock. The two papers dealing with the power installation at Bisbee and Douglas show that the consolidation of the various properties now comprised in the Copper Queen group has enabled a considerable improvement to be effected in this department. A feature of the reduction works is the attempt that has been made to deal with the problem of dust losses in the smoke from the converters and blast-furnaces.—R. **Davey**: Copper-smelting methods at Bogoslowsk, Perm, Russia. A special interest attaches to the works described in this paper, as they were among the earliest in the eastern hemisphere to adopt the Bessemerising of copper matte, the plant dating back to 1885. A modern plant is now in course of erection to supersede the somewhat out-of-date methods hitherto in vogue, which have accounted nevertheless for a considerable yearly production.

PARIS.

Academy of Sciences, February 24.—M. F. Guyon in the chair.—Paul **Appell**: Functional equation for the relative equilibrium of a homogeneous liquid in rotation under the Newtonian attraction of its parts.—H. Le **Chatelier** and Mlle. **Cavaignac**: The fusibility of the natural fatty bodies. From the study of the melting and solidifying points of two fats, vegetaline and stearin, it is shown that the phenomenon of change of state is strictly reversible. The exact temperature of transformation can be determined with an accuracy of 0·1° C., but the experiments require much time. There is no evidence of the existence of polymorphic bodies, the only peculiarity found being that the velocity of change of state is extremely slow.—Stuart **Menteath** and H. **Douvillé**: The Eocene deposits of Bos d'Arros.—Pierre **Duhem**: The stability of thermal equilibrium.—W. **Kilian** and Ch. **Pussenot**: A detailed analysis of the dislocations of the Eastern Briançonnais.—E. **Bompiani**: The configurations of Laplace.—Gustave **Sannia**: Some new properties of the char-

acteristics of partial linear equations of the first order in two variables.—T. de **Donder**: The theorem of independence of Hilbert.—L. **Crussard**: The propagation and alteration of waves of shock.—Alexandre **Sée**: A new principle of longitudinal stability of aëroplanes.—Albert **Turpain**: The recording of time signals and Hertzian telegrams with the aid of a Morse apparatus. A detailed description of two types of galvanometer used, in conjunction with a system of relays, in working recording apparatus.—V. **Crémieu**: The effects of flexion at the points of attachment of the wire of a torsion balance. A continuation of a previous paper on the same subject, with suggested applications to seismographs, dynamometers, and microbalances.—E. **Briner** and A. **Kuhne**: The transformation undergone by heated calcium carbide. When calcium carbide is heated in a closed vessel at 800° to 1000° C. the only transformation it undergoes is a decomposition into its elements. There is no evidence in support of the view that a subcarbide is formed.—E. **Fouard**: Differential tonometry of solutions and the theory of Arrhenius. The results with sugar are not in accord with the current theories of solution.—H. **Colin** and A. **Sénéchal**: The oxidation of complex cobalto-organic compounds. A study of the velocity of oxidation by air of an alkaline cobalto-glycerol solution.—Marc **Bridel**: The presence of gentiopicrin, gentianose, and saccharose in the fresh roots of *Gentiana punctata*.—R. **Dalimier**: The actions of the arseno-aromatic compounds (606 and neo-salvarsan) on the hæmoglobin of the blood. Dioxydiamido-arseno-benzene ("606") is without action of the hæmoglobin of the blood either *in vitro* or *in vivo*. Neo-salvarsan (sodium dioxydiamido-arseno-benzene sulphoxylate), on the contrary, has a marked action of the hæmoglobin. *In vitro* it causes hæmolysis and reduces oxyhæmoglobin; *in vivo* the reduction is not produced, and the hæmolysis rapidly vanishes. For these reasons there would appear to be reasons against the use of neo-salvarsan in certain cases.—V. **Grégoire**: The telophase and the prophase in somatic caryokinesis.—L. **Bounoure**: Observations on the post-embryonic evolution of *Dytiscus marginalis*.—A. Ch. **Hollande**: The figured bodies of the protoplasm of the cœnocytes of insects.—P. **Chaussé**: The suspension in air of the virulent particles obtained by liquid pulverisation. A solution of a dyestuff (methyl violet) was sprayed into a room and experiments made on the time of suspension and transportability of the particles. Similar experiments have been made with tuberculous virus.—Albert **Berthelot**: Researches on *Proteus vulgaris* considered as a producer of indol.—Em. **Bourquelot** and J. **Coirre**: Some new data on the reversibility of the ferment action of emulsion.—J. **Stoklasa**, J. **Sebor**, and V. **Zdobnicky**: The synthesis of sugars by radio-active emanations. By the interaction of carbon dioxide and nascent hydrogen in the presence of radium emanations and potassium bicarbonate reducing sugars were obtained.

BOOKS RECEIVED.

Illustrated Catalogue of Physical Apparatus. Pp. 1032+xix. (London: F. E. Becker and Co.)

Three Years in the Libyan Desert. Travels, Discoveries, and Excavations of the Menas Expedition (Kaufmann Expedition). By J. C. E. Falls. Translated by E. Lee. Pp. xii+356+plates. (London: T. F. Unwin.) 15*s*. net.

Die Synchytrien: Studien zu einer Monographie der Gattung. By Dr. G. Tobler. Pp. ii+98+4 plates. (Jena: G. Fischer.) 5 marks.

Die Ontogenie der Primatenzähne: Versuch einer Lösung der Gebissprobleme. By Prof. L. Bolk. Pp. vi+122+2 plates. (Jena: G. Fischer.) 5 marks.

Chemistry of the Oil Industries. By J. E. Southcombe. Pp. xi+204. (London: Constable and Co., Ltd.) 7*s*. 6*d*. net.

A Synopsis of the Elementary Theory of Heat and Heat Engines. By J. Case. Pp. iii+65. (Cambridge: W. Heffer and Sons, Ltd.) 2*s*. 6*d*. net.

An Introduction to the Physics and Chemistry of Colloids. By E. Hatschek. Pp. ix+94. (London: J. and A. Churchill.) 2*s*. 6*d*. net.

Vicious Circles in Disease. By Dr. J. B. Hurry. Second and enlarged edition. Pp. xiv+280. (London: J. and A. Churchill.) 7*s*. 6*d*. net.

On Aristotle as a Biologist, with a Prooemion on Herbert Spencer. By Prof. D'Arcy W. Thompson. Pp. 31. (Oxford: Clarendon Press.) 1*s*. net.

The Physical and Political School Atlas. By J. G. Bartholomew. Pp. xvi+32. (Oxford University Press.) 1*s*. net.

Man and His Future. By Lieut.-Col. W. Sedgwick. Part ii. Pp. 217. (London: F. Griffiths.) 6*s*. net.

The Year-Book of the Scientific and Learned Societies of Great Britain and Ireland. Twenty-ninth Annual Issue. Pp. vii+373. (London: C. Griffin and Co., Ltd.) 7*s*. 6*d*.

Union of South Africa. Mines Department. Annual Reports for 1911. Part iii., Geological Survey. Pp. 113+maps+plates. (Pretoria: Government Printing and Stationery Office.) 7*s*. 6*d*.

Life in Ancient India in the Age of the Mantras. By P. T. Srinivas Iyengar. Pp. x+140. (Madras: S. Varadachari and Co.)

Anales del Museo Nacional de Historia Natural de Buenos Aires. Tomo xxiii. Pp. 415+plates. (Buenos Aires.)

Records of the Survey of India. Vol ii., 1910–11. Pp. iii+157+xi maps. (Calcutta: Superintendent Government Printing, India.) 6*s*.

The Science of Human Behaviour. Biological and Psychological Foundations. By Dr. M. Parmelee. Pp. xvii+443. (London: Macmillan and Co., Ltd.) 8*s*. 6*d*. net.

Ausführung qualitativer Analysen. By W. Biltz. Pp. xi+139. (Leipzig: Akademische Verlagsgesellschaft m.b.H.)

Geological Survey of Alabama. Iron Making in Alabama. By W. B. Phillips. Third edition. Pp. 254+xxxi plates. (Alabama: University.)

Pharmakognostischer Atlas. By Dr. L. Koch. Zweiter Teil der mikroskopischen Analyse der Drogenpulver. Zweiter Band. 2 Lief. (Leipzig: Gebrüder Borntraeger.) 3.50 marks.

Taschenbuch für Mathematiker und Physiker, 3 Jahrgang, 1913. Edited by F. Auerbach and R. Rothe. Pp. x+463. (Leipzig and Berlin: B. G. Teubner.) 6 marks.

Exercises in Gas Analysis. By Dr. H. Franzen. Translated by Dr. T. Callan. Pp. vii+120. (London: Blackie and Son, Ltd.) 2*s*. 6*d*. net.

Vorlesungen über die Theorie der Wärmestrahlung. By Dr. M. Planck. Zweite Auflage. Pp. xii+206. (Leipzig: J. A. Barth.) 7 marks.

Lehrbuch der Thermodynamik. By Drs. J. D. v. d. Waals and P. Kohnstamm. Zweiter Teil. Pp. xvi+646. (Leipzig: J. A. Barth.) 12 marks.

Year-Book of the Royal Society, 1913. Pp. iii+258. (London: Harrison and Sons.) 5*s*.

Qualitative Determination of Organic Compounds. By J. W. Shepherd. Pp. xvi+348. (London: W. B. Clive.) 6*s*. 6*d*.

Wild Flowers as They Grow. By H. E. Corke and G. C. Nuttall. Fifth series. Pp. viii+200+plates. (London: Cassell and Co., Ltd.) 5*s*. net.

Trees and How They Grow. By G. C. Nuttall and

H. E. Corke. Pp. xi+184+plates. (London: Cassell and Co., Ltd.) 6s. net.

Percentage Compass for Navigators, &c. By J. C. Fergusson. (London: Longmans and Co.) Unmounted, 2s. 6d. net; mounted, 3s. 6d. net.

The Bandôt Printing Telegraph System. By H. W. Penday. Pp. iii+147. (London: Whittaker and Co.) 2s. 6d. net.

A First Book of Electricity and Magnetism. By W. P. Maycock. Fourth edition. Pp. xxii+351. (London: Whittaker and Co.) 2s. 6d. net.

The Design of Alternating Current Machinery. By J. R. Barr and R. D. Archibald. Pp. xvi+496+xvi plates. (London: Whittaker and Co.) 12s. 6d. net.

Dahlias. By G. Gordon. Pp. xi+115+viii coloured plates. (London and Edinburgh: T. C. and E. C. Jack.) 1s. 6d. net.

Practical Bird-keeping. Edited by J. L. Bonhote. Pp. xvi+142+plates. (London: West, Newman and Co.) 5s. net.

Das Relativitätsprinzip. By Dr. M. Laue. Zweite Auflage. Pp. xii+272. (Braunschweig: F. Vieweg und Sohn.) 8 marks.

Reports of the Committee on Electrical Standards appointed by the British Association for the Advancement of Science. Reprinted by Permission of the Council. A Record of the History of "Absolute Units" and of Lord Kelvin's Work in Connection with These. Pp. xxiv+783+10 plates. (Cambridge University Press.) 12s. 6d. net.

Psychology and Industrial Efficiency. By H. Münsterberg. Pp. viii+321. (London: Constable and Co., Ltd.) 6s. net.

DIARY OF SOCIETIES.

THURSDAY, MARCH 6.

ROYAL SOCIETY, at 4.30.—An Automatic Method for the Investigation of the Velocity of Transmission of Excitation in Mimosa: Prof. J. C. Bose.—The Evolution of the Cretaceous Asteroidea: W. K. Spencer.—A Preliminary Note on the Fossil Plants of the Mount Potts Beds, New Zealand, collected by Mr. D. G. Lillie, Biologist to Capt. Scott's Antarctic Expedition in the *Terra Nova* in 1911: Dr. E. A. Newell Arber.—(1) Trypanosomes found in the Blood of Wild Animals Living in the Sleeping Sickness Area, Nyasaland; (2) Trypanosome Diseases of Domestic Animals in Nyasaland—II. *Trypanosoma caprae* (Kleine); (3) Morphology of Various Strains of the Trypanosome causing Disease in Man in Nyasaland. I. The Human Strain: Surg.-Gen. Sir D. Bruce, F.R.S., Majors D. Harvey and A. E. Hamerton, and Lady Bruce.

ROYAL INSTITUTION, at 3.—Surface Energy: W. B. Hardy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Recent Developments in the Street Lighting of Manchester: S. L. Pearce and H. A. Ratcliff.

ROYAL SOCIETY OF ARTS, at 4.30.—Indian Section—The City of Karachi: J. F. Brunton.

LINNEAN SOCIETY, at 8.—*Discussion*: The Development and Inheritance of Sexual Characters—Opener: G. Smith.

FRIDAY, MARCH 7.

ROYAL INSTITUTION, at 9.—Photography of the Paths of Particles Ejected from Atoms: C. T. R. Wilson.

SATURDAY, MARCH 8.

ROYAL INSTITUTION, at 3.—The Properties and Constitution of the Atom: Sir J. J. Thomson, O.M.

MONDAY, MARCH 10.

ROYAL SOCIETY OF ARTS, at 8.—Coal Gas as a Fuel for Domestic Purposes: F. W. Goodenough.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.

TUESDAY, MARCH 11.

ROYAL INSTITUTION, at 3.—The Movements of the Stars: Our Greater System: Prof. H. H. Turner.

MINERALOGICAL SOCIETY, at 5.30.—The Mineral Collection of Thomas Pennant (1726–1798): W. Campbell Smith.—The Minerals and Mineral Localities of Montgomeryshire: Arthur Russell.—A New Stereographic Protractor: Dr. G. F. Herbert Smith.—A (sixth) List of New Mineral Names: L. J. Spencer.

ILLUMINATING ENGINEERING SOCIETY, at 8.—The History of Gas-lighting in this Country: W. J. Liberty.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Notes on City Passenger-Transportation in the United States: G. D. Snyder.

WEDNESDAY, MARCH 12.

ROYAL SOCIETY OF ARTS, at 8.—The Use of White Lead in Painting: Noel Heaton.

INSTITUTE OF CHEMISTRY, at 8.—The Function and Scope of "The Chemist" in a Pharmaceutical Works: C. A. Hill.

AËRONAUTICAL SOCIETY, at 8.30.—Some Research: A. P. Thurston.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—British Weather Forecasts: Past and Present: R. G. K. Lempfert.

THURSDAY, MARCH 13.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: A Simple Method of Finding the Approximate Period of Stable Systems: A. Mallock.—The Motion of Electrons in Gases: Prof. J. S. Townsend and H. T. Tizard.—The Self Inductance of Circular Coils of Rectangular Section: Prof. T. R. Lyle.—Ammonium Ferrous Sulphate and its Alkali-Metal Isomorphs: Dr. A. E. H. Tutton.—The Recombination of the Ions produced by Röntgen Rays in Gases and Vapours: H. Thirkill.—Optical Investigation of Solidified Gases. III. The Crystal-properties of Chlorine and Bromide: Dr. W. Wahl.

ROYAL INSTITUTION, at 3.—Surface Energy: W. B. Hardy.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Power Supply on the Rand: A. E. Hadley.

CONCRETE INSTITUTE, at 7.30.—Discussion on Reports of the Reinforced Concrete Practice Standing Committee on: (1) Cracks in Concrete; (2) Surface Treatment of Concrete.

INSTITUTION OF MINING AND METALLURGY, at 8.—Annual General Meeting.

MATHEMATICAL SOCIETY, at 8.—Some Cases of Tidal Motion of Rotating Sheets of Water: J. Proudman.—Indeterminate Equations of the Third and Fourth Degree: L. J. Mordell.

SOCIETY OF DYERS AND COLOURISTS, at 8.—Stripping Agents for Garment Dyers: F. G. Newbury.—A Few Notes on Fur Dyeing: M. C. Lamb.

FRIDAY, MARCH 14.

ROYAL INSTITUTION, at 9.—Great Advance in Crystallography: Dr. A. E. H. Tutton.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.

PHYSICAL SOCIETY (University College, Gower Street), at 5.—Demonstration of Spark Photographs: W. B. Haines.—(1) Some Oscillograms of Condenser Discharges and a Simple Theory of Coupled Circuits; (2) Exhibition of Braun Kathode-Ray Tubes and an Electrostatic Machine for Working them, used as a High-frequency Oscillograph: Prof. J. A. Fleming.—The Stretching and Breaking of Sodium and Potassium: B. B. Baker.—The Latent Heat of Evaporation of Aqueous Salt Solutions: R. G. Lunnor.—Some Flame Spectra: Dr. E. N. da C. Andrade.

ROYAL ASTRONOMICAL SOCIETY, at 5.

SATURDAY, MARCH 15.

ROYAL INSTITUTION, at 3.—The Properties and Constitution of the Atom: Sir J. J. Thomson, O.M.

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