THURSDAY, JULY 25, 1912.

RECENT WORKS ON NATURAL HISTORY.

(1) *A Naturalist on Desert Islands.* By Percy R. Lowe. Pp. xii+300. (London: Witherby and Co., 1911.) Price 7*s.* 6*d.* net.

(2) *The Gentle Art.* Some Sketches and Studies. By Henry Lamond. Pp. xi+303. (London: John Murray, 1911.) Price 6*s.* net.

(3) *The Age and Growth of Salmon and Trout in Norway as Shown by their Scales.* By Knut Dahl. Translated from the Norwegian by Ian Baillie. Edited by J. Arthur Hutton and H. T. Sheringham. Pp. ix+141+10 plates. (London: The Salmon and Trout Association, Fishmongers' Hall, E.C., n.d.) Price 5*s.*

(4) *Reptiles, Amphibia, Fishes and Lower Chordata.* By Richard Lydekker, J. T. Cunningham, G. A. Boulenger, F.R.S., and J. Arthur Thomson. Pp. xvi+510+plates. (London: Methuen and Co., Ltd., 1912.) Price 10*s.* 6*d.* net. (Animal Life: an Evolutionary Natural History. General Editor: W. P. Pycraft.)

(5) *The Ox and its Kindred.* By R. Lydekker. Pp. xi+271. (London: Methuen and Co., Ltd., 1912.) Price 6*s.*

(6) *Distribution and Origin of Life in America.* By Robert F. Scharff. Pp. xvi+497. (London: Constable and Co., Ltd., 1911.) Price 10*s.* 6*d.* net.

(7) *A History of the Birds of Colorado.* By W. L. Sclater. Pp. xxiv+576. (London: Witherby and Co., 1912.) Price 21*s.* net.

(8) *A Monograph of the British Desmidiaceae.* By W. West and Prof. G. S. West. Vol. iv. Pp. xiv+194+plates 96–128. (London: Printed for the Ray Society, 1912.) Price 25*s.* net.

(9) *The British Tunicata.* An Unfinished Monograph. By the late Joshua Alder and the late Albany Hancock. Edited by John Hopkinson. Vol. iii—*Aggregatae* (*Ascidiae Compositae*). Pp. xii+113+plates 51–66. (London: Printed for the Ray Society, 1912.) Price 12*s.* 6*d.* net.

IT is sometimes alleged, perhaps with reason, that books on natural history, travel, and sport are written with such a view to accuracy in the record of fact that they lose all charm of style and are unreadable to the ordinary layman. Certainly no such charge can be brought against Mr. Lowe's volume (1), wherein he discusses the physical features and natural history of Swan Island, Blanquilla and Orquilla, three islets in the Caribbean Sea which he visited in Sir Frederic Johnstone's yacht. Whether he is describing the origin of the islands, the life on their coral banks, the nesting of the birds, or the evolution of the hermit crabs, Mr. Lowe is never dull; and this he owes to the happy gift of imagination and feeling, coupled with a freedom from restraint in his style, which adds a charm to all he tells us.

Very pleasantly written, too, is Mr. Lamond's volume on the "Gentle Art" (2), and skilfully and alluringly do his pencil and pen express, in the series of chapters called "sketches," the attractions from which the passion for fly-fishing springs. Indispensable, moreover, to the angler, and especially to the novice, will be the more technical chapters, called "studies," wherein he attempts to explain to the practical lawyer, who frequently knows nothing of fishing, and to the practical angler, who as frequently knows nothing of law, the legal aspects of trout and salmon fishing in Scotland.

Those who wish, on the other hand, to dip more deeply into the difficulties involved in determining the age of salmon and trout and in understanding the factors which favour and control the growth of these fishes in different localities will find practically all that is known of the subject set forth in Mr. Ian Baillie's translation (3) of Knut Dahl's treatise on the scales of Norwegian examples of these two species.

Fishes again take up nearly half the volume written under the joint authorship of Mr. Lydekker, Dr. Boulenger, Mr. Cunningham, and Prof. Arthur Thomson, which constitutes the second instalment of Methuen's series on evolutionary natural history (4). The compression of the account of such large and important groups into a small compass disarms many criticisms that might be offered on the score of omissions and of the arrangement of the subject matter, especially in connection with the reptiles. The chief claim to merit the book possesses is the treatment of the natural history of these vertebrates, not from the point of view of species but from that of habits. The result of this new departure is, despite some mistakes, a useful and instructive treatise, the chapters on fishes by Mr. Cunningham and on the breeding habits of batrachians by Dr. Boulenger being particularly good. But it would be ungenerous not to mention the section of the volume on the lower chordates, written by Prof. Thomson, whose account of these obscure forms will be especially welcome to beginners in zoology. Perhaps the unfortunate illness of the editor, Mr.

Pycraft, may account for several regrettable misprints in the titles of the plates.

There is no more interesting and, at the same time, more difficult question to unravel than the origin of many of our domesticated animals; and the cattle come into the category of those about the ancestry of which the last word has not yet been said. The subject is discussed at some length in his little volume (5) on cattle by Mr. Lydekker, who appears to think it fairly well established that European cattle are descended from the extinct aurochs (*Bos primigenius*) and the zebus, or humped cattle, from the living banting (*Bos sondaicus*); and that the zebu-like characters observable in some European cattle are due to the introduction of zebus into south Europe. It may be so, but the evidence adduced in support of this is susceptible of other interpretations. There are also very strong reasons for doubting the banting descent of zebus, especially as some of the latter exhibit a character, namely the light spinal stripe, which is regarded by Mr. Lydekker as certain evidence of aurochs descent when it is present in European breeds. The volume, nevertheless, is a useful compilation, since it brings together in a small compass much of what is known about the aurochs, British park cattle, and other European and exotic breeds, about existing species of the genus *Bos*, and the hybrids that have been produced by crossing them.

Within the limits of a short notice it is impossible to do justice to Dr. Scharff's volume on the "Distribution and Origin of Life in America" (6). All zoologists who have worked at the geographical distribution of recent animals have been met with the difficulty of squaring the regions and minor areas into which the earth seems divisible when one group is considered with those that are indicated by another group. Probably no agreement on this point well ever be reached, because animals which are later in origin have as a rule a different distribution from those of earlier date. Even when, as in the case of the mammals, a mass of evidence has been accumulated to reveal the faunas of past epochs, there is commonly a wide divergence of opinion as to the position of the evolutionary centre and the lines of migration of any given group. One of the facts which makes decision on this point uncertain is the difficulty of being sure that strata assigned to a particular system in one continent coincide in time with strata assigned to the same system in another continent.

Again, the author of a volume like the one under notice, which deals not only with all groups of terrestrial animals but with plants as well, is of necessity dependent upon the expert for the determination and affiliation of species; and this is often a fruitful source of error and perplexity. For instance, Dr. Scharff is, naturally enough, utterly nonplussed by the intimate relationship alleged to exist between the prairie wolf of North America and the antarctic dog of the Falkland Islands. He will be comforted, therefore, to know that this is a complete fallacy. He is also puzzled, quite needlessly we think, by the belief held by some that that pariah, the dingo, is indigenous to Australia. If palæontology teaches that, then so much the worse for palæontology.

These, however, are points of subordinate interest which Dr. Scharff cites to prove the difficulties to be contended with. The really serious undertaking he has attempted is the record and reconciliation of the varied and often opposing views touching the subject-matter expressed by the title of his volume; and since there is ample evidence for the former union of North America with Asia by way of Behring Sea and with Europe by way of Greenland and Iceland, and of South America with Africa or Europe on one side and Australia on the other, the difficulties the question presents and the wide field for speculation it opens up need no demonstration.

Mr. W. L. Sclater's volume (7) on the birds of Colorado is a model of what a book of this kind should be. The characters, distribution and habits of each species are concisely recorded and analytical keys to the orders, families, genera and species have been carefully compiled. It is this last feature which gives to the book its stamp of merit, because it is the best available testimony that the author has taken the trouble to master his subject and present it in a form intelligible to others. Would that the same could be said for all ornithological works!

The two volumes on British desmids (8) and tunicates (9), published by the Ray Society, call for little comment, since they fully reach the standard of excellence that institution aims at achieving. Great credit is due to Mr. Hopkinson for his able editorship of the last instalment of the MS. of the late Messrs. Alder and Hancock's monograph of the British tunicates, which, as we are told in the preface, was accepted by the Ray Society somewhere about half a century ago. The work, although admittedly incomplete, will be most valuable to students of the group; and the insertion of Canon Norman's portrait at the beginning of this volume, with which the monograph closes, is an appropriate tribute to his share in the editing and publication of the two preceding parts.

R. I. P.

MICROSCOPY.

(1) *Modern Microscopy.* A Handbook for Beginners and Students. By M. I. Cross and M. J. Cole. 4th edition. Revised and enlarged. Pp. xvii + 325. (London: Baillière, Tindall and Cox, 1912.) Price 6*s.* net.

(2) *Wirkungsweise und Gebrauch des Mikroskops und seiner Hilfsapparate.* By Prof. W. Scheffer. Pp. vii + 116. (Leipzig and Berlin: B. G. Teubner, 1911.) 2.40 marks.

(3) *How to Use the Microscope.* A Guide for the Novice. By the Rev. C. A. Hall. Pp. viii + 88 + plates. (London: A. and C. Black, 1912.) Price 1*s.* 6*d.* net.

(1) THAT a book on microscopy should reach a fourth edition, although the first was written some eighteen years ago, says much for the information it contains, and is sufficient indication that it has taken its place among the literature of the subject. It is intended, at least primarily, for the amateur worker, and for such the description of apparatus and methods of using it are lucidly set out.

Important as the amateur may still be, he is in point of numbers far outstripped by the professional, to whom the microscope is a necessary tool in constant use from day to day, but who none the less needs a knowledge of the principles governing the use of the instrument to enable him to get the best results. This knowledge is in too many cases sadly wanting, but a careful perusal of this book and application of the information given will remedy the deficiency. No space is wasted on mere catalogue eulogy, the main points of the instrument, both from a mechanical and optical point of view, being indicated. It is interesting to note that the student is advised to give preference to a microscope of English manufacture where work of a critical nature is contemplated, as in the best of these is to be found that combination of adjustments that the critical worker needs. This advice is in agreement with the opinion of the majority of leading microscopists in this country.

Perhaps the most important part of the book is that devoted to the preparation of microscopic objects, and to ensure that the information is thoroughly trustworthy, the cooperation of a recognised expert has in each case been secured. The result is that a clear, short, and lucid description of the chief processes involved in each branch of microscopic science is provided.

The book may be cordially recommended to the student who desires to acquire a good general knowledge of microscopic technique.

(2) The book by Prof. W. Scheffer is intended as a guide to those who are unacquainted with the use of the microscope. Perhaps for its size it covers too much ground to fulfil its purpose efficiently, and the subject is not so simply dealt with as the author apparently intends. It is a book of considerable interest to those who already have a good knowledge of the subject, but, at least for English readers of the class for which it is written, it would not prove to be a simple handbook and guide.

The opening portions are devoted to an exposition of the optical theory of the instrument, which is dealt with in a thorough and interesting manner without the use of higher mathematics. A slight technical error occurs on page 15, Fig. 10–3. The figure is intended to show the utmost resolution that can be obtained with oblique light. In such a case the chief and the first maximum in correspondence with one another, which are necessary for resolution, would be contained in similar halves of the circle.

On pages 54 and 55 are to be found an exposition of the usual views held in Germany, as well as the misunderstandings, as to the function and use of sub-stage condensers. It is implied that aplanatism and achromatism are only necessary in general if the source of light is small, and that the use of a large light source makes up for this; a conclusion that is, to say the least, misleading. It is interesting to note that the use of wide illuminating cones is distinctly favoured, and that the advisability of having a centring arrangement to the sub-stage is admitted, both points indicating that the usual German disregard of such arrangements is perhaps weakening.

The description of the Abbe diffraction apparatus is most interesting, and the methods of carrying out the experiments are concisely stated. The use of dark ground illuminators is described, together with the effect of over and under correction, when using such appliances. The book is, in general, most interesting, and is written on scientific lines. It fills a place in the literature of the subject that no English work can claim to have done exactly in the same way.

(3) There are several books available to those who have practically no knowledge of the microscope and its use, but the one now under notice may reasonably claim to be the simplest of them all.

The expressed intention is to indicate the general ideas governing the use of the instrument; and with a view to simplicity, the instructions given are only in reference to low and medium power work. It is to be regretted that in some cases there is a want of accuracy of expression which might easily have been avoided, and that even the plea of simplicity cannot justify. For instance, we read, when speaking of the effect of alteration

of tube-length, that "greater extension of the tube will give higher magnifications, but not better definition." It cannot be too strongly insisted on, particularly to a novice, that microscope objectives are designed to work at a particular tube-length, and that the possibility of obtaining greater or less magnification by alteration of this is not to be contemplated. Again, the quality of penetration in an objective is referred to as if it were a point to be considered, whereas it might have been pointed out that penetration is dependent on numerical aperture and on focal length. One-half of the book is devoted to a description of common objects and methods of observing them. The descriptions given are clear and suitable for those to whom they are addressed. J. E. B.

OUTLINES AND PRINCIPLES OF CHEMISTRY.

(1) *Outlines of General Chemistry.* By Prof. Wilhelm Ostwald. Translated with the author's sanction by Dr. W. W. Taylor. Third edition. Pp. xvii + 596. (London: Macmillan and Co., Ltd., 1912.) Price 17*s.* net.

(2) *Grundlinien der anorganischen Chemie.* By Wilhelm Ostwald. Dritte Auflage. Pp. xxii + 860. (Leipzig: Wilhelm Engelmann, 1912.) Price 18 marks.

(1) THE new English edition (a translation of the fourth German edition) of Ostwald's "Outlines," the pioneer elementary text-book on general chemistry, is sure to receive a warm welcome on the part of English-reading students of chemistry. During the seventeen years which have elapsed since the preceding edition (in Prof. James Walker's translation) was published, Ostwald's "Outlines" had practically ceased to be known to the ordinary English student of chemistry; and the reason for this is, of course, to be found in the fact that during this interval other text-books, due in most cases to pupils of Prof. Ostwald himself, appeared both in this country and in America, which were written in a manner more suited, perhaps, to the mental aptitudes and to the manner of thought and training of British and American students. The treatment of the subject by Prof. Ostwald was, as it seems to the reviewer, somewhat too abstract and too philosophic for the average young student of chemistry in this country, who, partly through lack of taste for or training in philosophy, partly perhaps owing to our examination system, desires to have the facts and laws and theories of physical chemistry placed before him as clearly, as succinctly, and as concretely as possible. This "defect" of the older editions the author has recognised, and has to a great extent remedied; and even if it do not displace the indigenous text-books, the "Outlines" will be valued, in any case by more advanced students and by teachers, on account of its breadth and originality of treatment and the suggestiveness of its ideas.

Not only have the earlier portions of the book been subjected to considerable rearrangement and the method of treatment been revised, but extensive alterations and additions have been made in harmony with the changes and progress which have taken place in this branch of science. Thus new chapters on gas ions and radio-activity and on micro-chemistry (colloid chemistry) have been inserted; and the chapters on chemical kinetics and equilibrium and on electro-chemistry have been nearly quadrupled in extension. These additions and extensions constitute probably the most interesting and readable portions of the book.

To many chemists, perhaps, the most interesting and most welcome change which has occurred since the appearance of the previous edition is the change of mental attitude of Prof. Ostwald himself, to which he bears testimony in the following words:—

"I am now convinced that we have recently become possessed of experimental evidence of the discrete or grained nature of matter, which the atomic hypothesis sought in vain for hundreds and thousands of years. The isolation and counting of gas ions, on the one hand . . . and, on the other, the agreement of the Brownian movements with the requirements of the kinetic hypothesis . . . justify the most cautious scientist in now speaking of the experimental proof of the atomic nature of matter. The atomic hypothesis is thus raised to the position of a scientifically well-founded theory. . . ."

The author, however, makes little use of the atomic theory in his treatment of the stoichiometric relationships; and the discussion of the kinetic theory is now removed from its former position in the section dealing with the gas laws, and is relegated to a position near the end of the book, where it is treated in connection with the experimental evidence for it yielded by disperse systems. As the German edition on which the present English translation is based was published more than three years ago, it is conceivable that when another edition appears the author will take a step farther and will adopt the atomic and kinetic theories as the bases of treatment of the whole of stoichiometry.

With regard to the section on the transformation products of the radio-active elements, it is to be regretted that in this English edition of 1912 the author should have remained content with the summary given by Rutherford in 1905. Perhaps he finds his justification for this in the statement:—

"One result of the present-day rapid development of science is that work is published more hastily, and many unstable intermediate steps which, under the old system of slower production, disappeared after they had served their turn, now enjoy their brief existence in the literature under all eyes. The unfortunate thing is that no formal notice is given of their decease."

It only remains to be said that the translator has performed his part of the work very well.

(2) Of the many services for which the science of chemistry is indebted to Prof. Ostwald, not the least is the writing of the "Grundlinien der anorganischen Chemie," the third German edition of which (completing an issue of ten thousand copies) has recently appeared. To English-reading students of chemistry the book is already well known under the title "Principles of Inorganic Chemistry," which is also in its third edition, so that it is unnecessary to say anything with regard to the general purpose and scope of the work. The continued demand for the "Grundlinien," however, and the publication of a number of other text-books modelled largely on that of Ostwald, afford a clear indication of the nature of the revolution which has taken place during the present century in the methods of teaching inorganic chemistry.

While the general character of the book remains unchanged, the author has not wearied in effecting a revision and rearrangement of the text and in making such additions as were necessary to make the method of treatment more logical in its development and to bring the subject-matter into line with the present-day position of knowledge. Having become convinced that a description of the properties and formation of the three states of matter, independently of the chemical differences in the narrower sense, should precede the usual description of the preparation and properties of the individual substances, the author has inserted into the earlier portion of the book two chapters on the transformation of physical states and on solutions, in which the fundamental characteristics of equilibria between phases and of solutions are treated. Through this rearrangement of the matter, the book has been considerably improved.

Of the additions which have been made, the most notable is the chapter on the radio-active elements. In this chapter an excellent account of the phenomena of radio-activity and the radio-active characters of radium, uranium, thorium, and actinium is given. One can only regret that this chapter was not worked into the section on the same subject in the English edition of the author's "Outlines of General Chemistry."

A. F.

HEALTH HANDBOOKS.

(1) *Rural Hygiene.* By Prof. H. N. Ogden. Pp. xvii+434. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1911.) Price 6*s.* 6*d.* net.

(2) *The Fasting Cure.* By Upton Sinclair. Pp. 261. (London: W. Heinemann, 1911.) Price 2*s.* 6*d.* net.

(3) *Exercising in Bed: the Story of an Old Body and Face made Young. The Simplest and most Effective System of Exercise ever Devised.* By Sanford Bennett. Second edition. Pp. xi+262+xii–lxiii+263–268. (New York: The Physical Culture Publishing Co., n.d.)

(1) THIS book, though written by an engineer and therefore dealing more particularly with the constructional side of hygiene, contains a considerable amount of epidemiological data, and forms a complete simple treatise on the subject of which it treats. Rural hygiene is of much importance, and many problems present themselves for solution which do not arise in towns and cities. Although dealing with American practice, it is quite applicable in this country, and includes details somewhat novel to us. Thus for waterproofing cellars, it is suggested that the wall may be built in two layers with a half-inch interspace which is filled with asphalt, or that the outside of the wall may be painted with hot tar into which several layers of tar-paper are pressed, the several sheets overlapping in a special coating of tar. A simple test is given for ascertaining the amount of sand in gravel used for making concrete, by which the proper proportion of sand may be arrived at. While giving current views on a subject, the author does not hesitate to state facts which are not altogether in agreement with them, *e.g.* as regard the unhealthiness of made soil (p. 37). Altogether the book is one which may be read with pleasure and profit.

(2) Mr. Sinclair's book is somewhat diffuse, but apparently the underlying idea is that a *régime* consisting of alternate periods of fasting and of special diet is the secret of ideal health. Inasmuch as those of us who can afford to do so probably habitually overfeed rather than underfeed, and that Chittenden and his co-workers have shown that perfect health may be sustained on half the protein usually considered necessary, there may be a good deal in the author's views. Ordinarily the fasts may be of four to six days' duration, abundance of water being taken during this period; the fast is cautiously broken, and then the diet consists of abundance of milk, or of lean beef-steak with water (*i.e.* the Salisbury treatment). It is well known, of course, that milk, owing to the peculiar chemical composition of its

proteins, does not give rise to putrefactive products which are the basis of auto-intoxication, so that the diet in this sense is an ideal one. It is interesting to note that the author has tried again and again a strictly vegetarian diet, but does not find it so satisfactory as those mentioned. Making allowance for the author's enthusiasm and special pleading, we may conclude that there is "something in it."

(3) The first edition of this book was noticed in NATURE of January 21, 1909. The author, by adopting a series of exercises carried out in bed, claims that he became a rejuvenated individual. As we said regarding the first edition, we think that the author has devised a system of physical exercises which, if carried out, would be of considerable benefit to those who, either from necessity or inclination, lead a sedentary life.

R. T. HEWLETT.

OUR BOOKSHELF.

Lectures delivered at the Celebration of the Twentieth Anniversary of the Foundation of Clark University, under the auspices of the Department of Physics. By Vito Volterra, Ernest Rutherford, Robert Wm. Wood, and Carl Barus. Worcester, Mass., September 7–11, 1909. Pp. vii+161. (Published by Clark University; New York and London: G. E. Stechert and Co., 1912.) Price 10*s.* net.

THE system of holding conferences at which a number of lectures are given by eminent specialists is a noticeable feature of American universities, and is being adopted with success in other countries. Clark University was founded in 1889, and under the invitaton of its Department of Physics courses of lectures were given to celebrate its twentieth anniversary. Those published in this volume are by Prof. Vito Volterra on recent progress in mathematical physics (in French), by Prof. Rutherford on the history of the alpha rays, by Prof. R. W. Wood on optical properties of metallic vapours, and by Prof. C. Barus on physical properties of iron carbides. Other lectures by Profs. Michelson and E. F. Nichols are not published. The volume will be of interest to those who attended the conferences or who desire a not too extensive summary of our knowledge in the branches of study covered by the lectures.

Magnetochemie. Beziehungen zwischen magnetischen Eigenschaften und chemischer Natur. By Prof. E. Wedekind. Pp. viii+114. (Berlin: Gebrüder Borntraeger, 1911.) Price 3 marks.

THE subject of this monograph is one which has attracted considerable attention within recent years. It is, as the title implies, the study of the relation between magnetic quality and chemical composition. The author begins with a short sketch of the methods of magnetic measurement, which is useful and no doubt sufficient for his purpose, although it is not free from blemishes which one might desire to see removed. For instance, the diagrams on pp. 7 and 10 are extremely rough, and even misleading. Then follows an account of the ferromagnetic substances, and after this the magnetism of dissolved salts is described. Paramagnetism and diamagnetism are then dealt with, and the book concludes with a sketch of the "magneton" theory.

The descriptive parts are good and extremely useful as a record of modern work and progress; but the book is essentially qualitative in character and contains little in the way of exact analysis of the results which have been obtained. The work will be valued by those engaged in research upon the subject, and also by those wishing to obtain some general acquaintance with it. We have, unfortunately, too few books of this character in our own language.

The Teachers' Book of Constructive Work for Elementary Schools. By Ed. J. S. Lay. Pp. xii+142. (London: Macmillan and Co., Ltd., 1912.) Price 3*s.* 6*d.* net.

EACH year now sees more attention given to school exercises in the various subjects of the curriculum which demand the employment of the hands as well as the brains of the children. Teachers of experience understand that young pupils learn best by doing, and this view gains ground everywhere. Mr. Lay in this book describes for the benefit of other teachers how he has succeeded in giving reality to lessons in arithmetic, history, geography, and so on, by constructive work of an interesting kind, so graduated that the method may be employed with children from five to fourteen years of age. The book may be commended to the notice of schoolmasters and schoolmistresses as an example of what can be done with very little expenditure to make elementary education less bookish and unreal.

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.*]

Forced Vibrations.

IN his letter on the above subject in NATURE of June 27, Prof. Perry examines some typical dynamical and electrical solutions of the equation

$$(D^2+2kD+n^2)x=A\cos pt \quad . \quad . \quad . \quad (1)$$

with special reference to the critical case of maximum amplitude of the forced vibration; he shows that in all the cases examined the critical value of p which excites maximum response is either n or $\sqrt{n^2-2k^2}$, while the frequency of the free damped vibration is given by $\sqrt{n^2-k^2}$, and concludes that the usual statement is not correct that for maximum response "the forcing influence ought to be in tune with the natural frequency of the system." But is it usual to define the natural frequency of the system as $\sqrt{n^2-k^2}$? The term is ordinarily employed, like the

German *Eigenfrequenz*, to designate the natural *undamped* frequency of the system, and, interpreted in this sense, the statement to which Prof. Perry objects is, with certain limitations, quite correct.

Apart altogether from the question of nomenclature, the student finds the usual text-book treatment of forced vibrations somewhat unsatisfactory. From his dynamics he learns that the amplitude of the forced vibration is a maximum when $p=\sqrt{n^2-2k^2}$, while the dynamical theory of audition tells him that maximum response is excited when $p=n$. The apparent confusion seems to arise from the incomplete differentiation between the two separate variations involved—in the limit we may either submit a fixed resonator of invariable frequency $n/2\pi$ to the influence of radiation of variable wave-length, or we may excite a whole range of resonators of different frequencies by radiation of invariable frequency $p/2\pi$. In the first case, maximum amplitude is conditioned by $p=\sqrt{n^2-2k^2}$, and in the second by $p=n$. These results, of course, follow directly from partial differentiation of the amplitude of the forced vibration given by integrating equation (1), but a student is more apt to appreciate the distinction between the two cases from a geometrical treatment. Write the integral of equation (1) in the form

$$x=\frac{A}{2kp}\sin\phi\cos(pt-\phi) \quad . \quad . \quad . \quad (2)$$

where ϕ is the phase angle $\tan^{-1}\frac{2kp}{n^2-p^2}$. For a maximum value of the amplitude of x, $\frac{\sin\phi}{2kp}$ must be a maximum. Draw a line AB to represent n^2; from it cut off BO equal to p^2, and at O erect OP perpendicular to AB and equal to $2kp$. When p is constant x is obviously a maximum for AO=o, that is, $n=p$. If, on the other hand, n is constant, the locus of P is a parabola of semiparameter $2k^2$ described with B as vertex symmetrically about AB; for a maximum value of x in this case the reciprocal of AP must be a maximum, hence AP must stand normal to the curve, and therefore the subnormal AO must equal the semiparameter. Hence $n^2-p^2=2k^2$.

Frequently we have to deal with the energy absorbed by the resonator, and not at all with the amplitude of its forced vibration. The mean rate at which energy is absorbed is $\frac{A^2}{2k}\sin^2\phi$, so that, for maximum absorption $\sin^2\phi=1$, or $\phi=90^\circ$ and $n=p$ as before.

In cases, therefore, where the resonator frequency is variable (acoustics, electromagnetic radiation, resonance frequency meter, &c.), the condition for maximum response is $n=p$, while in cases where the frequency of the incident radiation is variable (elementary optical theory), the condition for maximum absorption is still $n=p$. Where the critical case is $p=\sqrt{n^2-2k^2}$, we are obviously dealing with a maximum opposing force (vibrating spring, "voltage resonance," &c.) which is quite different from the case of maximum response.

A very interesting method of examining these results is to obtain a series of "surfaces of amplitude" for various values of the damping factor by plotting the two frequencies along perpendicular axes, and the amplitude x of the forced vibration along an axis perpendicular to the other two. With zero damping the surface is symmetrical about the plane $n=p$, and exhibits a ridge rising to infinity in this plane. By ascribing any finite value to the damping factor k, we occasion a threefold change in the character of the surface:—

1.—The ridge no longer rises to infinity; it asymptotically approaches the plane $x=o$ the more rapidly the greater the value ascribed to k.

2.—The symmetrical aspect of the surface is destroyed; towards the p, x side of the central plane the surface falls lower than towards the other, and at the same time the ridge moves towards the n, x side of the central plane, the deviation being but slight at high frequencies.

3.—The larger the value ascribed to k, the flatter becomes the ridge. The physical interpretation of these characteristics is obvious.

The foregoing results are all well known, but it seems advisable to direct attention to conditions which are usually ignored.

JOHN P. DALTON.

University College, Dundee.

Lobsters in the Ægean.

WITH reference to Prof. D'Arcy W. Thompson's letter on this subject in NATURE of May 30 (p. 321), it may be worth while to record that the British Museum (Natural History) has just received fine specimens of the common lobster (*Homarus gammarus*) and the spiny lobster or crawfish (*Palinurus vulgaris*) from Smyrna, through the kindness of Capt. J. R. Westcott, of the Westcott and Laurance (Ellerman's) Line, Ltd. The existence of both species in the eastern Mediterranean is thus confirmed, but it would be of great interest, as Prof. Thompson points out, to determine the limits of their range and their relative abundance in various localities. W. T. CALMAN.

British Museum (Natural History), Cromwell Road, London, S.W., July 18.

Wanted—a Flower Sanctuary.

ON revisiting Cheddar last month, after eight years, I was horrified to find that plants of Cheddar Pink and Thalictrum were being offered for sale to visitors. Everyone knows that, when once this sort of thing is begun, extermination is only a question of time; and in the case of the Cheddar Pink I am afraid that it will be a question of a short time only; and then this beautiful plant will be lost to the English flora. The case is not nearly so serious as regards the Thalictrum; but all lovers of Cheddar would grieve to see this plant becoming rarer. It is important to add, also, that there is just one patch of the Welsh Poppy in Cheddar Gorge, and that this is so situated that an enterprising dealer could exterminate it entirely in a couple of hours or so. I am not aware that this plant has yet been taken for sale; and it is not a very hopeful subject for transplantation, perhaps: but, when once the dealer has begun his nefarious work, one never knows to what lengths he may proceed. I should like, therefore, to urge very strongly that any naturalists and nature-lovers, who may have any means of bringing influence to bear upon the Somersetshire County Council, should lose no time in petitioning that body to "proclaim" these plants and prohibit their removal, especially for sale. There would be no need to interfere with botanists who gather specimens, or with residents and visitors who may wish to take bunches of flowers: but what is essential is that the rooting-up of the plants should be stopped, and that without loss of time. F. H. PERRYCOSTE.

Higher Shute Cottage, Polperro, Cornwall July 15.

ANTHROPOLOGY IN SOUTHERN INDIA.[1]

SOUTHERN India offers a most attractive field for the exploration of the religion and folklore of the native population. In this region the Dravidian tribes, isolated by the physical obstacles which checked Aryan migration, were permitted for ages to establish powerful kingdoms and to develop their national polity, while in the north successive inroads of foreign tribes, ending in the Scythian, Hun, and Muhammadan invasions, introduced new racial strains, and the establishment of the reformed Brahmanism overwhelmed the indigenous culture and reduced the popular religion to its present dead level of uniformity, in which the primitive elements can now only with much difficulty be identified.

The present book is the result of the author's prolonged investigations among these interesting races. Its object is to bring together a mass of information much of which is to be found in his two earlier works—"Ethnographic Notes in Southern India" and "The Castes and Tribes of Southern India"—published respectively in 1906 and 1909. He admits that in his first book the chapter on omens, animal superstitions, the evil eye, sorcery, and so on, was merely a confused outline of material which, if worked up, would furnish the subject of a volume. This project has been only imperfectly realised. In one particular the present volume is an improvement on its predecessors, in that it, as a rule, gives references to the authorities on which it is based. But it loses much of its value to the student ignorant of India from at least two defects which further study of his material might have enabled the author to avoid.

In the first place, we find the same lack of precise and logical arrangement which characterised his earlier works. For example, the first and longest chapter, occupying sixty pages, on omens, is a mass of ill-digested facts, because he has failed to realise to himself what the word "omen" means. Thus with omens in their most familiar form, those of meeting, he groups practices like the pouring of water on a victim to test its suitability for sacrifice, without any hint of an explanation; bathing at an eclipse; appealing to the hero Arjuna when a child is waked from its sleep by a thunderclap; pouring oil into or bathing in a holy well to secure offspring; the planting of Gardens of Adonis; worshipping a ball of hair disgorged by a cow; the prohibition of looking at the moon on the feast day of Ganesa, and so on—practices having little or no relation to each other and based on quite divergent lines of thought. He was obviously more interested in the physical than the psychical side of anthropology, and his position as Superintendent of the Madras Museum permitted only occasional visits to the interior, when his time was chiefly spent in measuring skulls. Hence there is little indication of that profound knowledge of rural beliefs which can be gained only by prolonged residence among the people.

FIG. 1.—Malayan exorcist with fowl in his mouth. From "Omens and Superstitions of Southern India."

[1] "Omens and Superstitions of Southern India." By Edgar Thurston, C.I.E. Pp. 320. (London: T. Fisher Unwin, 1912.) Price 12s. 6d. net.

Secondly, if he had studied with attention works of authority, such as the writings of Sir E. Tylor, Professor Frazer, Messrs. Hartland and Lang, he would have understood much which in its presentment is obscure; and the absence of reference to the work of other writers on the popular beliefs in other provinces diminishes the value of this contribution to the subject. On the vital subject of agricultural feasts and rites the information is scrappy and inadequate.

Even with these reservations, the book contains much valuable material. One moral to be drawn from it is that beneath a specious uniformity of culture there is a vast substratum of savagery which is now repressed by the steady pressure of a strong administration. The accounts of some forms of animal sacrifice and the abominable Odi system of magic are extremely repulsive, and instances are given of quite modern recrudescence of human sacrifice when official control was temporarily relaxed.

FIG 2.—Vettuvans wearing leafy garments. From "Omens and Superstitions of Southern India."

While the presentment of this collection of useful material leaves something to be desired, the book will probably for some time remain the standard authority on the beliefs and superstitions of the South Indian races.

IMPERIAL CANCER RESEARCH FUND.

THE 11th annual meeting of the Imperial Cancer Research Fund was held on Wednesday, the 17th inst., at the Royal College of Surgeons, under the presidency of the Duke of Bedford.

From the report of Dr. Bashford it appears that the investigations of the year had suffered partial interruption by the transference to new and more commodious laboratories. The Fourth Scientific Report was published in November, 1911, and the Fifth Report was now ready to be issued, both having absorbed much of the time and energies of the scientific staff. The contents of the scientific reports are highly technical and have necessitated numerous elaborate and careful illustrations. The statistical investigation of the incidence of cancer in various human races was being continued with the collaboration of Government departments and private individuals; of 2014 fresh cases reported from India, for 477 specific reference to diet was not made, 1074 were stated to live on mixed diet, and 463 occurred in vegetarian Indian castes.

The breeding experiments on the influence of heredity on the development of cancer of the mamma in mice continued to be an important part of the investigations, having taken on a permanent form necessitating a statistical survey of the material once a year. This survey last year confirmed in every respect the conclusions drawn from the analysis undertaken in October, 1910, published in the Fourth Scientific Report. There were 706 female mice available for study as compared with 562 in 1910. In those of remote cancerous ancestry, *i.e.*, where the mother or grandmothers had not developed cancer of the mamma, 25 carcinomata of the mamma developed in 283 mice, a proportion of 8·8 per cent. In those of recent cancerous ancestry 71 carcinomata occurred in 423 mice, or 16·8 per cent. The results at the end of this year will have so increased in volume as to permit of a further scrutiny elucidating features of the transmission of hereditary predisposition which still require investigation. The breeding experiments were also a valuable source of other interesting tumours, as well as of mice of known age and of differing susceptibility suitable for other investigations.

While the Fourth Scientific Report dealt mainly with the nature of cancer and an explanation of

the association of chronic irritation with its origin, and based upon a study of the variability of tumour cells, the Fifth Report deals mainly with the nature of the resistance which may be obtained against the growth of inoculated cancer. The evidence adduced tends to prove that the resistant condition can only be induced by treatment with living normal or cancerous tissue of the same species as that furnishing the tumour tested against, and that the resistance is always an active immunity. The facts which have been held to establish the existence of another kind of immunity in cancer—a starvation immunity, Ehrlich's atreptic immunity—have been shown not to require this assumption but to be naturally explained by the mode of operation of the active immunity referred to. Natural healing occurs very much less frequently in spontaneous tumours than in transplanted. Only one per cent. of spontaneous malignant new growths recede naturally. In the natural healing of transplanted tumours two factors appear to operate: the first is the power of the transplanted cancer cells to induce active resistance in fresh animals; the second is the susceptibility of the tumour cells to this resistant condition. Great variations in both respects are met with in the different strains of transplanted tumours, so that some grow progressively, as do the majority of spontaneous tumours, while others, being susceptible to the resistance they themselves induce, regress spontaneously in practically every case.

The details of the process of natural healing seem to be very closely alike in spontaneous and transplanted tumours, but while in transplanted tumours it is pretty certain that the damage to the cancer cells is due to the resistant condition, the causes of the cell damage which leads to natural cure in spontaneous growths are still quite obscure. Attempts to achieve this action by means of drugs are being widely made, but as yet with little success.

Appreciative reference was made to the loss the Fund had sustained through the deaths of Sir Julius Wernher, Lord Lister, Mr. Archibald Coats, and Sir Henry Butlin. Sir William Watson Cheyne was elected Honorary Treasurer in succession to Sir Henry Morris, who was elected a Vice-President on the suggestion of the Duke of Bedford. Professor Woodhead was re-elected a member of the Executive Committee and Dr. William Bulloch was elected to the Executive Committee.

MR. JAMES DUNN.

MR. JAMES DUNN, who died suddenly at York on the 17th inst., was a well-known naval architect, whose professional career had been long and honourable in the service of the Admiralty until he attained (fifteen years ago) the age-limit of sixty years, which permitted him to retire on pension. Since 1897 Mr. Dunn has been connected with the great firm of Vickers and Company, serving as director and chief naval constructor, and he was actively engaged on these responsible duties until a few months ago, when he retired from active service in these offices, although his interest in the shipbuilding department continued. During this latter period of his professional career Mr. Dunn was most successful; the ships for foreign fleets designed and built under his supervision have added greatly to his reputation, and to the success of the company. It is interesting, therefore, to summarise the principal facts of his training and employment; more especially as Mr. Dunn never had the opportunity of studying at any school of naval architecture wherein the science of shipbuilding was systematically taught, because no such school existed at that time in Great Britain.

His training began by apprenticeship in Chatham Dockyard as a shipwright, at the age of fourteen years, and included attendance at the dockyard school, where the apprentices were instructed in mathematics and the elements of physical science. On the completion of his apprenticeship he became a draughtsman, and in that capacity was transferred to the constructive department at the Admiralty about 1860, when the ironclad reconstruction of the Navy was begun. This employment lasted about seven years, and was followed by a period of service as resident overseer of ships building for the Navy; after which Mr. Dunn returned to the Admiralty and resumed work in the constructive department, rising in rank gradually, until (in 1894) he became principal assistant to the Director of Naval Construction (Sir William White), and for three years did excellent work in that capacity. Certain special duties were from time to time entrusted to Mr. Dunn, and were well performed. In 1875 he undertook the survey of mercantile steamships and framed a list of vessels the subdivision and other features of which made them suitable for naval service in case of war. In 1884 he had much to do with the construction of the flotilla of boats built for the advance up the Nile of the Gordon relief expedition. He was the Admiralty representative on many important committees, including that which led to legislation for fixing the load-lines of merchant ships. His tact and temper were admirable, and his wide and varied experience made him a valued colleague wherever he was employed. His contributions to technical literature were not numerous, but were always practical in character and full of suggestive statement. His connection with the Institution of Naval Architects was formed very soon after it was established, and he was elected a Vice-President many years ago. His loss will be greatly felt in that Institution and by the members of his profession. W. H. W.

ANDREW LANG.

SCIENCE and letters are the poorer by the death of Andrew Lang. For in him we lose in criticism, anthropology, history, and psychic research, not to mention many other subjects digested by his versatile mind, a brilliant amateur. We should rather say a knight errant, for "amateur" still has a tinge of reproach, and Lang

touched nothing that he did not master. He possessed critical genius, the native acumen that penetrated to the heart of a subject, be it crystal-gazing, exogamy, or the Casket Letters.

His delicate taste as a poet and critic attracted me long before I came face to face with him in the ruder matters of primitive sociology. But in both, as also in the history of cricket and of golf, he always hit the mark. His touch for crucial points was infallible. In one line he gives us the essence of Artemis the huntress—

"And through the dim wood Dian threads her way';

in one sentence he exposed the central problem of exogamy, the bisection of the tribe.

Unnoticed before, this last proposition served him as the basis of his most fruitful work as an anthropologist. His exposition of his cousin's "Primal Law" will always remain a classic.

His "Myth, Ritual and Religion" was the first book to oppose academic sociology with the facts of modern savage life. With its simple but irresistible logic, he was able to check for ever the extravagances of Max Müller's school. Ceaseless criticism, invaluable in its results, was carried on in this department of science. As a polemical writer he was urbane, though apt to be diffuse. As a historian, in spite of his hatred of modernism, he was modern in his logical fairness and his grip of essentials.

Few things are more charming than some of his poems and short stories. The latter are often, as witness "In the Wrong Paradise," both humorous and scholarly. His love of Greece and of the past was perhaps a defect of his quality. But Lang's mind was great, Homeric. It made him both critic and artist, and as either he is a loss.

A. E. CRAWLEY.

THE 250th ANNIVERSARY OF THE ROYAL SOCIETY.

AS the celebrations in connection with the anniversary of the Royal Society were in progress at the time of our going to press last week, we were unable on that occasion to do more than print the names of the foreign delegates and those of the British Dominions beyond the seas, and to give extracts from some of the speeches delivered at the reception and the City banquet. The programme arranged was carried through without alteration, and passed off satisfactorily. The garden party at Syon House was largely attended, and about 1000 persons were present at the conversazione, which was held in the rooms of the society on Wednesday night, when several interesting historical instruments were exhibited, among which mention may be made of the chronometer by Arnold used by Captain James Cook on his second and third voyages, an electrical machine constructed by Dr. Joseph Priestley, the original model of Sir Humphry Davy's miners' safety lamp, a pair of compasses which belonged to Sir Christopher Wren, and Newton's original account of his reflecting telescope.

At the garden party given by the King and Queen at Windsor on Thursday, the President, other officers of the Society, members of the Council, and the delegates were introduced to their Majesties.

We are glad to know that the delegates are returning home full of appreciation of the hospitalities which had been extended to them and their wives and daughters. The latter were the especial care of a ladies' committee: although the members of this committee are not named in the official programme, we are informed that Lady Bradford, Lady Crookes, Lady Lockyer, Lady Parsons, and Lady Ramsay were among the most active among them.

The proceedings were appropriately brought to a conclusion on Friday by the conferment of the honorary degree of Doctor of Science on eleven of the delegates from abroad by the Universities of Oxford and Cambridge, the recipients being—at Oxford—Prof. J. O. Backlund, director of the Imperial Observatory, Pulkowa; Dr. W. C. Brøgger, professor of mineralogy and geology in the University of Christiania and rector of the university; Dr. W. B. Scott, Blair professor of geology and palæontology in Princeton University; Dr. W. Waldeyer, professor of anatomy and director of the Anatomical Institute in the University of Berlin; Dr. P. Zeeman, professor of physics in the University of Amsterdam; and—at Cambridge—Prof. E. B. Frost, director of the Yerkes Observatory; the Marchese Emanuele Paternò di Sessa, professor of chemistry in the University of Rome; Prof. Pavlov, St. Petersburg University; Prof. Picard, University of Paris; Geheimer Regierungsrat Rubens, University of Berlin; and Dr. Warming, formerly professor of botany at Copenhagen.

Dr. G. Lippmann, president of the Academy of Sciences, Paris, would also have received the degree at Oxford but for his enforced return to Paris in consequence of the death of Prof. Poincaré.

After the degree ceremony, the company assembled at All Souls' College, where a large party were entertained at lunch by the Warden and Fellows. In the afternoon a garden party was given in the grounds of Wadham College. Wadham College being the scene, during the Commonwealth, of some of the meetings from which the Royal Society afterwards took origin, an exhibition of portraits, books, and other objects of interest illustrating the early history of the society and its connection with Oxford had been arranged in the hall, and was inspected by many of the visitors, each of whom was also presented with a short statement, drawn up by Dr. F. A. Dixey, F.R.S., containing notices of the distinguished members of Wadham College (Wilkins, Wren, Seth Ward, Rooke, Sprat, Sydenham, Mayow, &c.) who were instrumental in the foundation of the society and in the general scientific movement of the time.

The following is the text of the speeches delivered at Cambridge by the Public Orator, Sir

John Sandys, in presenting to the Chancellor the several recipients of the degree of Doctor of Science, *honoris causâ*, on July 19:—

(1) Edwin Brant Frost, professor of astrophysics, Chicago:—

Primum omnium respublica maxima trans oceanum Atlanticum nobis coniunctissima quasi nuntium quendam sidereum ad nos misit, qui lacus maximi in litore astrophysica (ut aiunt) praeclare profitetur, lacus minimi in margine speculae astronomicae celeberrimae praepositus. Ibi, astronomi praeclari, Societatis Regalis haud ita pridem Praesidis, vestigia secutus, stellas, quae inerrantes vocantur, diligenter observavit, et spectri (ut dicitur) auxilio, earum motus aut recedentes aut appropinquantes accurate computavit. Idem, cum collegis optimis consociatus, stellas duplices atque etiam multiplices plurimas detexit; siderum denique illorum praesertim, quorum in aëre helium inesse comprobatum est, primus tarditatem quandam motus demonstravit. Astronomo autem nostro, viro impigro, viro acerrimo, tarditatem mentis nemo exprobrabit. Etenim, talium virorum auxilio, "caelum ipsum petimus," non iam "stultitia,"[1] sed sapientia; atque, ut philosophi cuiusdam Romani verbis utar, "cogitatio nostra caeli munimenta perrumpit."[2]

(2) Marchese Emanuele Paternò di Sessa, professor of chemistry, Rome:—

Ex Italia ad nos advectus est regni Italici Britannis amicissimi senator, coronae Italicae eques clarissimus, qui, Palermi natus, Romae per annos quadraginta scientiam chemicam experimentis suis luculenter illustravit. Peritis notum est hunc virum olim benzenii potissimum progeniem explorasse,—benzenii, quod matris haud pulchrae filiam, filiarum autem suavium et pulchrarum matrem nominaverim. Notum est eundem postea corpora ex fluorino, elemento illo impigro, composita, penitus investigasse; in aliis denique elementis, bromio praesertim et phosphoro liquido, particularum pondera accuratius examinasse. Ceterum haec omnia scientiae ad mysteria intima pertinent, non a nobis vixdum initiatis divulganda. Etenim e scriptoribus Romanis unus ait, "omnium rerum sunt quaedam in alto secreta"[3]; alter autem, "facilius natura intelligitur quam enarratur."[4]

(3) Ivan Petrovitch Pavlov, professor of physiology, St. Petersburg:—

Russorum ex imperio maximo, a nobis remoto sed studiorum communium in vinculis vicino, ad nos venit physiologiae professor Petroburgensis, qui ciborum digerendorum rationem universam exploravit, his studiis officinam quandam dedicavit, physiologiae studiosorum scholam florentissimam fundavit. Ut alia omittam, quam pulchre ostendit sucos illos, qui cibo concoquendo inserviunt, non modo mentis motu vario etiam ipsos moveri et mutari, sed etiam unicuique ciborum generi esse accommodatos, atque omnibus elementis noxiis adversari et in contrariam partem fortiter contendere. Mentis quidem certamen Prudentii in carmine quodam heroico narratum vidimus; corporis autem certamen, mentisque et corporis societatem intimam ab hoc viro celebratam audivimus. Talium virorum ex studiis Cornelii Celsi praecepto illi melius obtemperare possumus: *ante omnia corporis sui naturam quisque norit.*[5]

(4) Charles Émile Picard, professor of higher analysis, Paris:—

Francogallorum respublica nobis vicina, et vinculis indies artioribus nobiscum coniuncta, hospitem ad nos misit mathematicum insignem, mathematici insignis (olim cum studii eiusdem antesignanis Cantabrigiensibus consociati) et generum et operum eius editorem praestantissimum. Reipublicae autem illi hodie propterea praesertim gratulamur, quod talium virorum consilium, populi totius cum fructu, totiens expetit. Primum, abhinc annos quattuor et viginti, praemium ex eadem studiorum provincia reportavit, quam in Scandinavia Abelius primus illustraverat. Idem, scientiarum Academiae Parisiensi nuper praepositus, quamquam argumentorum in genere quodam abstruso versatur, stili lucidi lumine libros suos omnes illustravit. Testis est opus praeclarum de scientiae statu hodierno ad sensum popularem accommodatum; testes sunt Analytica illa, etiam a iuventute Britannica libenter perlecta; testes etiam illae de methodi analyticae historia Angliae novae in Universitate quadam nova nuper habitae orationes. Ergo in uno eodemque viro et mathematici illustris et oratoris optimi habetis exemplar.

(5) Heinrich Rubens, professor of physics, Berlin:—

Germanorum ex imperio maximo, nobis utinam in perpetuum coniunctissimo, ad nos perlatus est scientiae physicae in Universitate Berolinensi professor, qui, luce cotidiana non contentus, etiam lucem illam, quae oculorum aciem fugit, assidue exploravit. Lucem quidem universam ex undis constare electricis, rationibus exquisitis ductus, Maxwellius noster olim praedixit; idque et sui ipsius et aliorum experimentis postea prorsus comprobatum est. Hic autem, rem ipsam denuo aggressus, placitis Maxwellianis maxime congruas, lucis undas longas est dimensus, illis quidem multo longiores quae erant antea cognitae, sed illis aliquanto breviores quas vis electrica per artem adhibita generare potuit. Sed, inter has duas undarum varietates penitus exploratas, iam restat intervallum perbreve, quo sine dubio (fortasse per hospitem nostrum) propediem expleto, Maxwellii nostri doctrina universa erit patefacta, et, inter tot rerum naturae miracula, etiam lucis leges melius cognoscentur. Dixit olim Miltonus noster, "Lux sacra, salve, prima progenies Dei"; et tu, salve, lucis legum explorator indefesse.

(6) Eugenius Warming, late professor of botany, Copenhagen:—

Regnum Danicum, Scandinaviae pars eximia, cum Britannia vinculis teneris sed eisdem firmissimis coniuncta, misit scientiae botanicae professorem emeritum, qui inter suos horto praefuit admirabilem in modum disposito et ordinato. Idem non modo doctrinae botanicae orbem totum in libro quodam eximio perlustravit, sed etiam, in aliis litterarum monumentis, partes eius nonnullas aut ad Americam Australem aut ad zonae torridae miracula aut ad Floram Arctoam pertinentes subtilius perscrutatus est. In illa vero scientiae tam pulchrae provincia, quae oecologia nuncupatur, viarum novarum explorator exstitit. Unde factum est, ut haec studiorum provincia, non modo in regno Danico, sed etiam inter Francogallos, inter Germanos, in Helvetia, in Britannia, inter populos denique mari Atlantico a nobis divisos, cultoribus indies pluribus patet. Non minus autem quam haec potissimum pars scientiarum naturalium, talium rerum scientia tota munus sibi vindicavit locorum spatiis universum atque adeo orbi terrarum toti conterminum. Ergo hospitibus nostris omnibus, e tot orbis terrarum partibus ad nos hodie allatis, Historiae Naturalis auctoris eruditissimi verba licet sibi confidenter arrogare: "Non unius terrae sed totius Naturae interpretes sumus."[6]

[1] Hor. *Carm.* i 3, 38.
[2] Seneca, *De Otio*, v 6.
[3] Plin. *N. H.* xvii 29.
[4] Seneca, *Epp.* 121 § 1.
[5] Celsus, *De Medicina*, i 3, "ante omnia norit quisque naturam sui corporis."
[6] Plin. *N. H.* xviii 214.

M. HENRI POINCARÉ.

THE world has lost by the death of Henri Poincaré one of the greatest men who have lived in the present century, one who was equally at home in the domains of mathematics, mechanics, physics and astronomy, all of which have been enriched by his piercing and fertile genius. His comparatively early death in the full vigour of his activity, at the early age of fifty-eight—he was born at Nancy in 1854—has been a great shock to his admirers and friends in many lands, and his funeral, which took place last Friday, was a remarkable demonstration of the respect in which he was held by those who had been associated with him in his many-sided career. He entered the École Polytechnique in 1873; in 1875 he joined the Service of Mines as engineer; in the same year he gained the degree of Doctor of Mathematical Science; in 1881 he became professor in the Faculty of Science of Paris; and in 1887 he was elected a member of the Academy of Sciences. Even before this his fame was becoming world-wide.

We shall take a future opportunity of referring to the various advances with which his name will ever be associated. The following account of the funeral and the addresses delivered by his late colleagues are abridged from our Paris contemporary, *Excelsior*, of July 20, 1912.

The body was carried on the morning of the funeral from the nursing home in which he died to his house, 63 Rue Claude-Bernard, whence the procession passed to the Church of Saint-Jacques-du-Haut-Pas, for the religious ceremony.

The pall-bearers were MM. Guist'hau, Minister of Public Instruction, Jules Claretie, Lippmann, Appell, Bigourdan, General Cornille, Painlevé, and Zeiller, Vice-President of the Conseil-Général des Mines.

The hearse was covered with wreaths which had been sent by the staff and teachers of the École Polytechnique, the Faculty of Science, the French Physical Society, the Observatory of Meudon, the Association of Pupils and Past Pupils of the Faculty of Science, the General Association of Students, the French League of Moral Education, etc.

The chief mourners were MM. Léon Poincaré, son of the deceased; Émile Boutroux, his brother-in-law; Raymond Poincaré, President of the Ministerial Council; and Lucien Poincaré, Director of Secondary Education and Minister of Public Instruction, his cousins.

There were also present: Captain Grandclément, representing the President of the Republic; MM. Antonin Dubost, President of the Senate; Klotz, Minister of Finance; and Lebrun, Minister for the Colonies; the representatives of the President of the Chamber, MM. Steeg, Fernand David, Briand, Jean Dupay, Pams, René Besnard, and Léon Bérard, members of the Government; the delegacy of the French Academy, consisting of MM. Jules Claretie, director; Henri Roujon, treasurer; Thureau-Dangin, permanent secretary; Denys Cochin, the Marquis de Ségur, Masson, and Marcel Prévost; the delegacy of the Academy of Sciences, consisting of MM. Lippmann, president, Darboux and van Tieghem, permanent secretaries; Émile Picard, Painlevé, Humbert, members of the section of geometry; the members of the Higher Council of Public Instruction, the members of the Council of the University; the delegacy of the professors of the Faculty of Science, consisting of MM. Andoyer, Goursat, Kœnigs, Abraham, Cartan, Borel, Pinseux, Houssaye, and Perrin; a delegacy of members of the Corps des Mines, of the Bureau des Longitudes, of the Association Amicale of Pupils and Past Pupils of the Faculty of Science; Sir J. Larmor, senior secretary, and Mr. Dyson, representing the Royal Society of London; the Mayor and the Deputy-Mayors of the Fifth Arrondissement; the Prince of Monaco, Prince Roland Bonaparte; MM. Liard, vice-rector of the Paris Academy; Baillaud, director of the Paris Observatory; Deslandres, director of the Observatory of Meudon; Mgr. Duchesne, director of the École Française de Rome; Paul Hervieu, Henri de Régnier, Louis Passy, Joseph Reinach, Georges Perrot, René Doumic, Mmes. Milne-Edwards, Émile Ollivier, Prof. Hutinel, and others. The Bey of Tunis was represented by two sons and two members of his suite.

After the religious ceremony, the procession passed to the cemetery of Montparnasse, where the eulogies were delivered.

M. Guist'hau, Minister of Public Instruction, speaking in the name of the Government and of the University, said:

"The death of Henri Poincaré, if it unites in one common thought the intellectual aristocracy of all countries, is for us a public sorrow. By its presence, the Government expresses the sorrow of the whole nation. For, if the works of the mathematician are only accessible to a small number, everyone knew that Henri Poincaré represented all that was the purest, the best, and the most disinterested in the genius of France.

"His powerful spirit came into touch with every problem, and threw fresh light upon each. He was one of those rare figures in the history of mankind who, by bringing together fragmentary or isolated facts, ideas, or observations, can raise themselves to a conception of the universe, can study its constitution and evolution, and can fathom even its variations. With the help of this force of investigation, which extended to everything, he studied the laws of the intellectual, as well as of the physical world, and philosophers, as well as mathematicians and astronomers, recognised in him their master. All his work, all his life, was animated by a prepossession, which he expressed, as one of his most eminent colleagues has reminded us, in this thought: 'The search for truth must be the goal of our activity; it is the only end that would be worthy of it.' In seeking thus for truth, this noble and beautiful

soul tasted satisfying joys, but at the same time Henri Poincaré served his country faithfully and well."

M. Jules Claretie then saluted for the last time the mortal remains of his colleague of the French Academy :—

"In the name of the French Academy, I have the honour of saluting Henri Poincaré on behalf of a company of which he was justly one of the most illustrious members. When his colleagues called him, not yet thirty-two years of age, to take his place amongst us, it was a poet that this mathematician, this geometer, this philosopher, this poet of the universe succeeded. And, from the first day, we were conquered by the simple and limpid eloquence of this master writer, who, knowing everything, verifying everything, illuminated with his definitions, animated with his observations, and guided with his counsels our researches, the study of our language.

"It is not to-day, nor is it here, that one must study the work of this great man, who, scarcely full-grown, had already at one bound mounted to the summits. One might say, in many and eloquent tones, how much the country owes to this son of the borders of Lorraine, to this child of Nancy, who has shed lustre upon the whole of France. Before his grave the French Academy can only express its sorrow, and deplore the loss of a great seeker after truth, that stopped all too soon in the midst of his work. He would be a bold man who would assess the worth of a scholar. In celebrating his fame, we can only do homage to a philosopher whose thoughts will have so fertile, so profound an action on the new generations.

"Passion for scientific truth did not suffice for him, he loved literary beauty, and this incomparable mathematician was a strong supporter of good writing, of those humanities which for so long have guided the French genius along a right and a safe road. One might hear him, when the dictionary was under discussion, ask about the origin, and, as it were, the titles of nobility of words. This modern, who stimulated contemporary life by his discoveries and his calculations, defended with boldness the heritage of our ancestors. He knew that the French language is itself a country, and, against every perilous invasion, this soldier of sound speech stood firmly at the frontier."

MM. Appel and Bigourdan then spoke in the name of the Faculty of Science and of the Bureau of Longitudes. They recalled the excellent qualities of the professor, and the gap which would be left in the University by his premature death.

It fell to M. Paul Painlevé to display, in the name of the Academy of Sciences, the colossal work of the mathematician, who had acquired a universal fame, and whose life had been only "an intense and uninterrupted meditation." He concluded :—

"The Lacedemonian hero said, when dying after two victories, that he left behind 'two immortal daughters.' The hero of thought who has just passed away, he too has left in the world of ideas an immortal posterity, which will guide in the future the researches of mankind. His life will remain as an example equally harmonious in the faultlessness of its line with the orbits of those stars of which he sought to know the eternal future and the eternal past. But the blow which snatched him away is too cruel, the wound is too open for such thoughts yet to comfort us. In the name of the sorrow-stricken Academy of Sciences, in the name of his bereaved colleagues, I offer to the sublime thinker upon whose face we shall never gaze again a supreme homage and a supreme adieu."

Finally, after some words from General Cornille, Commandant of the École Polytechnique, who spoke a last farewell to the late professor of Astronomy, the interment was completed in the family vault.

NOTES.

THE presidents of the Royal Society and the Royal College of Surgeons recently took the necessary steps for the formation of a large and representative committee for the purpose of establishing a memorial to the late Lord Lister, and such a committee was appointed, and met on Monday afternoon last, at the rooms of the Royal Society under the chairmanship of Sir Archibald Geikie, P.R.S., when the following and others were appointed an executive committee to recommend to a future meeting of the general committee a scheme for the memorial to Lord Lister, and to organise an appeal for subscriptions :—The Archbishop of Canterbury, the Lord Chancellor, the Viscount Iveagh, K.P., the Lord Rayleigh, O.M., F.R.S., the Lord Rothschild, G.C.V.O., the Lord Alverstone, Lord Chief Justice, the Right Rev. Bishop Ryle, Dean of Westminster, the Right Hon. the Lord Mayor of London, the Right Hon. the Lord Provost of Edinburgh (Sir W. Brown), the Hon. the Lord Provost of Glasgow (Mr. D. M. Stevenson). Lord Rothschild and Sir W. Watson Cheyne were appointed treasurers, and Sir John Rose Bradford was appointed secretary of the committee. Proposals for a memorial of an international character were considered at a meeting of the executive committee, held also on Monday, and arrangements were made for a public meeting in furtherance of the objects of the memorial to be held at the Mansion House in October, at which details of the scheme will be announced. Communications for the treasurers or the secretary may be addressed to the Royal Society, Burlington House, London, W.

A DEPARTMENTAL committee, consisting of Sir H. Freer-Smith, C.S.I., R.N. (chairman), Prof. J. E. Petavel, F.R.S., Prof. J. Lorrain Smith, F.R.S., Mr. G. H. Ewart, and Mr. H. Cummins, with Mr. D. R. Wilson, H.M. Inspector of Factories, as secretary, has been appointed by the Home Secretary to inquire and report what amendment (if any) of the regulations for the spinning and weaving of flax or tow,

and the processes incidental thereto, is expedient in view of the report of the departmental committee on humidity and ventilation in cotton-weaving sheds or on other grounds.

THE honour of knighthood has been conferred on Mr. Francis Fox, the engineer, who has been closely associated with the work of securing the safety of Winchester Cathedral.

SIR TREVOR DAWSON, R.N., has accepted the presidency of the Junior Institution of Engineers, in succession to Mr. Marconi.

THE Lucy Wharton medal has been awarded by the Board of Managers of the Museum, University of Pennsylvania, to Sir M. Aurel Stein, for his explorations in Central Asia. The medal is conferred only upon English-speaking explorers.

THE Edward Longstreth medal of merit of the Franklin Institute, Philadelphia, has been awarded to Messrs. O. Schreiner and E. C. Lathrop for their paper on "The Distribution of Organic Constituents in Soils," which appeared in the issue of the Journal of the Franklin Institute for August, 1911.

THE medal of the Royal Bavarian Academy of Science has been awarded to Dr. C. C. Hosseus, of Berchtesgaden, for his journey in Siam.

THE erection of a tablet in the buildings of the University of Liverpool in memory of the late Sir Rubert Boyce is in contemplation, but the position for it has not yet been decided upon.

THE new dock at Immingham, Lincolnshire (the largest on the east coast), was opened by the King on Monday last. It will be known as the King's Dock. In connection with the ceremony, Mr. Sam Fay, the general manager of the Great Central Railway Co., received the honour of knighthood.

THE Middleton Goldsmith lectures will be given before the Pathological Society of New York by Dr. E. F. Bashford, director of the Imperial Cancer Research Fund, on October 2, 3, and 4 next. Dr. Bashford will deliver the Von Leyden memorial lecture in Berlin on October 21 next.

IT is announced that the following lectures are to be delivered at the forthcoming International Congress of Applied Chemistry which, as already stated in these columns, is to take place in September next:—"The Rôle of the Infinitely Small in Biological Chemistry," by Mr. G. Bertrand, of Paris; "Oxidation of Atmospheric Nitrogen in Norway," by Mr. S. Eyde, of Christiania; "The Most Recent Problems of Chemical Industry," by Mr. C. Duisberg, of Elberfeld; "Permanent Fireproofing of Cotton Goods," by Prof. W. H. Perkin, F.R.S., of Manchester; "Synthetic Ammonia," by Mr. H. A. Bernthsen, of Ludwigshafen; "The Photochemistry of the Future," by Mr. G. Ciamician, of Bologna; and "Priestley in America," by Prof. Ira Remsen.

THE Institution of Mechanical Engineers will meet in Belfast on July 30 and 31, when the following papers will be communicated:—new graving dock, Belfast: mechanical plant and general appliances, by Mr. W. R. Kelly; rolling stock in use on the principal Irish narrow-gauge railways, by Mr. R. M. Livesey; the evolution of the flax-spinning spindle, by Mr. J. Horner; wire ropes for lifting appliances, and the conditions that affect their durability, by Mr. D. Adamson; reciprocating straight-blade sawing machines, by Mr. C. Wicksteed; and commercial utilisation of peat for power purposes, by Mr. H. V. Pegg.

A CONFERENCE was held last week at the Mansion House to consider the desirability of forming a Central Health Committee for London which would promote joint action between metropolitan municipal authorities and voluntary health agencies in the prevention of disease and in the education of all classes in matters of health and domestic hygiene. It was resolved to form such a committee, and the motion that certain authorities and voluntary agencies be invited to appoint representatives upon the committee, with power to add to its number, was also carried. It was further resolved that the Social Welfare Association for London be requested to take steps to give effect to the resolutions, and that the Local Government Board be asked to allow the committee to meet at the offices of the Department.

THE first conference of the International Association of Poultry Instructors and Investigators took place last week in London, and was attended by representatives from twenty-seven countries. Lord Lucas, Parliamentary Secretary of the Board of Agriculture, welcomed the delegates on behalf of the Government, and stated in his remarks that an important project on foot is the establishment of a national poultry institute, where all practical questions regarding poultry can be scientifically studied, and where there can be trained the instructors who will be employed by the county councils to teach the farmers. As a result of the reorganisation now taking place, and thanks to the assistance of the Development Commission, it is hoped that in the course of the next few years poultry-keeping will be taught on the most approved lines all over the country. The association has been formed at a most auspicious moment. Mr. E. Brown was elected the first president of the association, and Dr. Raymond Pearl the hon. secretary.

SPEAKING at the meeting held last week at the Foreign Office in furtherance of the recently issued appeal for 100,000*l.* on behalf of the London School of Tropical Medicine, Sir Edward Grey, the Secretary for Foreign Affairs, said he would divide the work which appealed to them into two heads—the question of cure and the question of prevention. When they came to think that the men who went to tropical countries, either in the public service or in commercial fields, were some of the most courageous, enterprising, and self-sacrificing of our people, that they went willingly, fascinated by the work before them, that they braved all those risks and then often contracted one of those tropical diseases which left them no hope, but a few months' lingering suffering, followed by certain death, they could have nothing more tragic and

nothing to stir their sympathy more. Happily there were people now completely recovered whose cures were due solely to the research work of the School of Tropical Medicine. They could not create new countries, but they could make habitable countries which were previously uninhabitable, which was the next best thing. A work like the Panama Canal was an instance of human power which appealed to their imagination; but there was an even greater instance of human power in the fact that the district through which the Canal ran, by work closely akin to that of the School of Tropical Medicine, had been changed from a pestilential, blighted, and doomed district to one fit for habitation. That was a great conquest, and the triumphs which were being achieved by such institutions as the School of Tropical Medicine were the greatest instances of man's power over nature that they had had in the history of the world.

PROF. JOHANNIS CHATIN, of Paris, who has just died at Essarts-le-Roi, at the age of sixty-five years, was responsible for the inauguration of courses of instruction in comparative histology at the Sorbonne, while he occupied the position of *professeur adjoint* in zoology. So successful was this innovation that in 1899 a special chair of comparative histology was founded for M. Chatin. Most of his original work was done in the special field which he cultivated so assiduously as a teacher; and more than thirty years ago, while acting as a demonstrator under Milne-Edwards, he wrote a comprehensive memoir on the structure of sense organs in the animal series. Like Prof. Blanchard, to whose place in the section of anatomy and zoology at the Academy of Sciences he succeeded twelve years ago, he devoted considerable attention to the study of the parasites of animals. Like his father, the botanist, and former director of the Paris School of Pharmacy, Prof. Chatin was a member of both the Academies of Medicine and Sciences, and was also the president of the Army Medical Officers' Reserve.

THE proprietors of *The Bioscope*, the trade journal of the kinematograph industry, have been requested by members of the London County Council to arrange a demonstration of the possibilities of the kinematograph in education at the County Hall, and it will be held to-day. The films to be shown have been selected with the view of illustrating the subjects which could be assisted educationally by the kinematograph. The subjects to be dealt with will include, among others, zoology and botany. An attempt will be made to prove that the kinematograph would be useful in almost every grade of teaching.

WE learn from *Science* that in the autumn of last year funds were provided by the Department of Industrial Research of the University of Pittsburgh for a thorough investigation of the smoke problem. At the present time the study is being carried on by no fewer than twenty-five investigators, seven of whom are giving their whole time to the work. The inquiry ranges over the following branches of the subject:—The effect of smoke and soot on the atmosphere, on the weather, on plant life, on buildings, on the public health, the economic damage done by smoke and soot, the mechanical devices for preventing or abating smoke, the chemistry and physics of smoke and soot, and the laws concerning the smoke nuisance. Recognising the interest in the smoke problem manifested by a large number of American cities, and in response to inquiries that have been made, the department announces that members of its staff are prepared to lecture on the various phases of the problem.

THE curator of the museum at Nottingham Castle publishes a paper by Dr. F. Oswald on recent excavations at the Roman Camp of Margidunum, near Bingham, Notts. The place lies on the Fosse Way between Leicester and Lincoln, and was evidently occupied as an important strategical position from a very early period. A rough, unpolished bronze celt found here indicates a manufactory of such weapons, and patches of charcoal containing nodules of iron slag show that iron was smelted here in rude open-air forges such as are found at the present day in various parts of Africa. At a later time the fort was occupied and strengthened by the Romans. It has been as yet only imperfectly explored, but from a survey of the remains discovered it is clearly a promising site which deserves further examination.

IN the June issue of the Museum Journal of the University of Philadelphia, a curious Babylonian tablet of baked clay is described. It bears on one side a copy of an inscription of Sargon, dated about B.C. 2600, which was copied by a scribe in the days of Nabonidus (B.C. 555–538). The latter monarch, in his zeal for the restoration of ancient buildings, seems to have employed a college of antiquaries to direct the work, and one of these officers, finding the ancient tablet in the course of the excavation, copied it, as a record, before it was rebuilt into the new temple.

UNDER the title of "Visvakarma," the name of the architect of the Hindu pantheon, Mr. A. K. Coomaraswamy has begun publishing a series of reproductions from photographs illustrating various forms of Indian art. The present instalment will supply one hundred examples of Indian sculpture—Buddhas, deities, saints, and animals. Each number contains a dozen photographs, issued at the price of 2*s.* 6*d.* The publication would be much more valuable if some descriptive letterpress were added to each illustration.

IN the July number of *The Child*, Gertrude Austin gives an account of heliotherapy as applied to tuberculous children at Leysin at an altitude of 5000 feet. The children are exposed nude to the sun's rays in galleries open to the south. It is claimed that under this treatment the patients rapidly improve, fever disappears, hæmoglobin increases, and open wounds soon heal.

A REPORT of the meeting of the Society of American Bacteriologists is given in *Science*, March 8, 1912. Abstracts of several of the papers appear, together with Dr. Gorham's presidential address on some biochemical problems in bacteriology, in which he pleads

for a more extensive use of synthetic culture media, and a summary of a report on the teaching of microbiology in colleges of the United States and Canada.

WE have received the Livingstone College Year Book for 1912, which contains particulars of the curriculum, notes from old students, &c. The college is doing excellent work in training missionaries in the elements of medicine.

IN an interesting and well-illustrated article by Mr. George Shiras in the May number of *The National Geographic Magazine* on the white sheep, giant moose, and the smaller game of the Kenai Peninsula, Alaska, the remarkable fact is recorded that the first-named animal invariably slakes its thirst by eating snow, and when feeding in a well-watered pasture, always resorts to a snow-patch for moisture.

IN a paper on crocodilian remains from the upper Tertiaries of Parana, published in vol. xxi. of *Anales del Museo Nacional de Buenos Aires*, Mr. C. Rovereto refers two out of three species to the genus Alligator, with the proviso that they may belong, as they almost certainly do, to Caiman. The third species, which was described by Burmeister as *Rhumphostoma neogaeum*, is referred to the existing Indian genus Garialis, a reference which is less remarkable than it might at first sight appear, when it is borne in mind that crocodilians of the same general type have left their remains in the European Cretaceous and Eocene.

IN the same issue (*An. Mus. Nac. Buenos Aires*, vol. xxi.) Mr. A. Cardoso adduces evidence to show that wild horses were in existence in La Plata in the sixteenth century, and that the modern Argentine horse is their direct descendant, the ancestral form being *Equus rectidens* of the Pampean formation, which exhibits certain osteological peculiarities common to the Argentine horse and the extinct Hippidium.

AN important contribution to our knowledge of the dentition of shrewmice is made by Dr. Augusta Ärnbäck-Christie-Linde in the June number (ser. 8, vol. ix.) of the *Annals and Magazine of Natural History*. The formula of the typical genus Sorex is considered to be $i.\frac{3}{1}$, $p.\frac{1}{2}$, $m.\frac{3}{3}$, and in none of the genera is there a canine, the tooth in Myosorex which has been classed as such being a premolar. The presence in the common shrewmouse (*S. araneus*), and probably in the water-shrew (*Neomys fodiens*), of the germs of more than three pairs of incisors has been demonstrated, this serving to link the Soricidæ with opossums and other polyprotodont marsupials, all of which probably had a common ancestry. Other rudiments indicate the former existence of a full series of premolars in shrews. In Sorex, Neomys, and Crocidura (musk-shrews) there is evidence of a rudimentary milk dentition, while there are likewise indications of the former occurrence in the family of a prelacteal dentition.

WE have received copies of several bulletins and leaflets issued by the Entomological Division of the Canadian Department of Agriculture relating to the economic aspect of insects in the Dominion. In one leaflet attention is directed to the damage inflicted on forests by insects, which is regarded as equally serious with that due to fires. The means of controlling insect pests generally forms the subject of Bulletin No. 4; cut-worms and army-worms are discussed in No. 3; while No. 2 is devoted to bee-culture in Canada.

THE remarkable fact that considerable quantities of free prussic acid are accumulated in the living tissues of certain plants was observed by the late Dr. M. Treub, and there appears to be little doubt that this poisonous acid is actually utilised as food material by these plants. Some interesting details concerning the occurrence and function of prussic acid in the cherry laurel are given by Peche (*Sitzungsber. kais. Akad.*, Vienna, 1912), who concludes from his observations that the prussic acid found in the leaves and other organs is produced as a direct result of carbon-assimilation in the green leaf-cells when exposed to light, and that it is not merely a product of the hydrolysis of glucosides. Peche found evidence that while part of the prussic acid enters into the building up of glucosides, some of it is transported in a labile form, probably in loose combination with a tannin, and is stored up in various tissues as a reserve food.

SOME notable contributions have recently been made to the knowledge of the lower fungi, including the Chytridiaceæ and allied forms. The relationships of these lowly groups are discussed in a paper by Nemec (*Bulletin Internat. Acad. Sci.*, Prague, 1911), in which a new genus of Chytridiaceæ, named *Sorolpidium betae*, is described. This parasite lives in the outer cortical cells of beetroot, but does not appear to cause any hypertrophy of the infected root. The organism consists of a naked multinucleate mass of protoplasm, which eventually acquires a wall and divides into a number of uninucleate portions which round off and become sporangia, each sporangium giving rise to a number of zoospores; in some cases the entire plasmodium becomes a sporangium, while in other cases still the plasmodium gives rise to a thick-walled resting cyst, which later produces zoospores. From his work on Sorolpidium, Nemec considers that there is a close affinity between the Chytridiaceæ and the Plasmodiophoraceæ, though the latter are usually regarded as being nearly allied to the Mycetozoa, and therefore to Protozoa, while the Chytridiaceæ have generally been placed at the base of the Phycomycetes or alga-like fungi. In the same journal, Nemec describes another new Chytridiaceous fungus, *Olpidium salicorniae*, with a fine series of figures illustrating the various stages in the life-history.

THE need of a handbook on the forest resources of India was pointed out in the report of the committee of the Franco-British Exhibition of 1908, with the result that the Indian Government decided upon having such a work prepared. This important work was entrusted to Mr. R. S. Pearson, of the Imperial Forest Service, and has just been published under the title "Commercial Guide to the Forest Economic Products of India" (Calcutta, 1912, price 1s. 6d.). This

handbook, which is accompanied by an excellent map showing the distribution of the Government forest areas in India and Burma, is divided into three parts. The first part deals with the distribution and classification of the many types of forest found in British India, with notes on the financial working of this enormous State property; the second with eighty of the commoner timber trees of India and Burma, explaining briefly the distribution, quality, and uses of the timber, its approximate value and yield in various localities, and so forth; the third with the minor products, such as gums, fibres, resins, tan and dye products, oil seeds, drugs, spices, bamboos, and a variety of others. The work is illustrated by several plates, and there is a comprehensive index of vernacular, English, and scientific names.

IN *The South African Journal of Science* for June, Prof. E. H. L. Schwarz continues his comparison of the Witwatersrand area and the Cape Province, and expounds the probable relations of the network of dolerite dykes in the Karroo area to an unseen laccolite below. He is a strong supporter of the assimilation theory to account for the bringing of igneous matter into place, and he holds that unsuitable substances become drained off to lower depths. New material, however, is added to the upper layers of the crust, and the resulting increase in bulk has set up thrusts which have influenced the slope of the folds in the coast-ranges of the Cape Province. The Bushveld granite, from the same point of view, has caused repeated folding in the bankets of the Rand.

DR. W. F. HUME has again earned the gratitude of geologists by publishing "Explanatory Notes to Accompany the Geological Map of Egypt" (Cairo: Survey Department, 1912, price 10 P.T.). A large amount of stratigraphical information is embodied in a series of tables, and the coloured longitudinal section across Egypt will be useful to many teachers. The relations of the Cenomanian limestones north of latitude 27° 50′ to the Nubian sandstone are interestingly stated.

AN interesting article on "Wind and Weather in the Adriatic," by Prof. E. Mazelle, director of the Marine Observatory at Trieste, is printed in the *Osterreichische Rundschau* (vol. xxxi., part iii.). After giving a popular explanation of conditions obtaining in barometric maxima and minima, in connection with gradients, rotation of the earth, and centrifugal force, the author gives a very instructive account of the prevalent winds in the above sea, viz. the cold and dry north-east wind (bora) and the warm and moist south-east wind (sirocco). The bora occurs both in cyclonic and anticyclonic conditions; in the first case the depression lies in the Mediterranean or in the Adriatic, and the weather is usually rainy. In the second case the bora is mostly restricted to the coastal districts, and is very violent and gusty. The greatest velocity observed at Trieste was 84 miles an hour (? factor 3); during gusts the velocity exceeds 100 miles per hour. The sirocco also occurs both in cyclonic and anticyclonic conditions. In the former case the rainfall in the southern Adriatic reaches abnormal amounts, and near the Gulf of Cattaro one of the wettest spots of Europe is to be found. The anticyclonic sirocco, caused by high pressure east and south-east of the Adriatic, is the more violent of the two, and is only occasionally accompanied by rain.

WITH reference to the meteorological charts of the great oceans and lakes published by the U.S. Weather Bureau for August, we wish to direct attention to a very useful set of charts showing monthly wind directions over the monsoon area of the North Indian Ocean, prepared by Mr. W. E. Hurd. The charts are accompanied by an interesting discussion of the usual behaviour of the winds over the seas on both sides of the great Indian Peninsula which "causes the most important phenomenon of the monsoon, the summer rains, or the south-west monsoon, by its influence in changing the winds." The gradual overpowering of the north-east trade-winds by the south-west monsoon as the warm season draws on is clearly shown by the monthly wind-stars.

ACCORDING to the kinetic theory in its simplest form the viscosity of a gas should vary as the square root of the absolute temperature of the gas. The considerable deviations from this law found experimentally were first explained by Sutherland in 1893. He showed that the molecules exert an appreciable attraction on each other before an encounter actually takes place, and that if this attraction is taken into account the viscosity should vary as the square root of the absolute temperature t, divided by $1+c/t$, when c is a constant for each gas. This expression has been verified by experiments on many gases at temperatures above 0° C. According to the *Verhandlungen* of the German Physical Society for May 15, Dr. O. Zimmern has determined the viscosity of ethylene and carbonic oxide at temperatures down to −150° C., and finds that Sutherland's expression no longer holds at these low temperatures. The deviation is slight in the case of carbonic oxide, but considerable in the case of ethylene. In both gases the viscosity is greater at low temperatures than the formula makes it, with the value of c for higher temperatures. Dr. Zimmern finds that the density of the gases is also high at these temperatures, and is disposed to attribute the high values of both quantities to polymerisation in the gases at low temperatures.

THE July issue of *The Chemical World* fully maintains the high standard of the six preceding numbers. The editor has produced an attractive blend of modern technical and analytical practice with advanced scientific research. In the current number, the technical papers deal with the new industry of manufacturing autogenously welded aluminium tanks and vessels, the manufacture of "Mond gas," the treatment of water by the "Permutit" system and its sterilisation by the addition of excess of lime. The analytical papers deal with the estimation of potash in fertilisers, soil extracts, and plant ashes by the use of perchlorate instead of platinum salts, the examination of cellulose, the estimation of nickel and cobalt with the help of dimethylglyoxine, and of

nitrates with the help of salicylic acid and of diphenylamine. The scientific papers deal with the synthesis of alkaloids, magnetic susceptibility, and the allotropy of sulphur. There is also an excellently illustrated article on the scientific department of the Imperial Institute. The journal is performing a very real service in presenting in popular form a review of some of the most striking developments in the science and practice of chemistry.

OUR ASTRONOMICAL COLUMN.

RADIUM AND THE SOLAR CHROMOSPHERE.—In No. 4589 of the *Astronomische Nachrichten*, Prof. Dyson directs attention to a possible relationship between the six principal lines in the spark spectrum of radium, as determined by Runge and Precht, and certain lines recorded by himself and Sir Norman Lockyer in the spectrum of the chromosphere observed at various eclipses. The agreement between the wavelengths is shown in the following table :—

Radium spark		Chromosphere			
		Dyson		Lockyer	
λλ	Int.	λλ	Int.	λλ	Int.
(1) 3649·75 ...	50	3649·66 ...	1	— ...	—
(2) 3814·58 ..	100	3814·67 ...	6	3814·7 ...	3
(3) 4340·83 ...	50	Hγ		Hγ	
(4) 4436·49 ...	20	— ...	—	4436·6 ...	1
(5) 4682·36 .	50	4682·20 ...	2	4682·5 ...	2–3
(6) 4826·12 ...	20	— ...	—	4826·0 ...	<1

The first line is identified by Dyson in the chromosphere as an iron line, while Fe and p-Ti are given by Lockyer for the second. The third would be hidden by the Hγ line in the eclipse spectrum, and the fourth is near a manganese line; other strong lines of manganese are, however, absent. The fifth line is given by Lockyer as possibly due to proto-yttrium, and most of the other strong enhanced lines of this element are possibly represented in his 1898 record of the chromospheric spectrum. For the sixth line, weak in the chromosphere, no other origin has been suggested.

Prof. Dyson also compares the spectrum of radium emanation, given by Dr. Royds, with that of the chromosphere, but arrives at no conclusive result. He suggests, however, that the coincidences already found are worthy of further attention.

PHOTOMETRIC OBSERVATIONS OF MIRA.—From observations made at Catania, Prof. Bemporad finds that a minimum of the variable star *o* Ceti occurred on January 20, four days earlier than the date predicted by the Guthnick ephemeris; the magnitude at minimum was 9·6. The observations were carried right through from the previous maximum (mag.=3·4), which took place on June 26, 1911, also four days before the predicted time. The date of the minimum is confirmed by Prof. Nijland, who, with a telescope "finder" at Utrecht, found the minimum magnitude to be 10·1. (*Astronomische Nachrichten*, No. 4589.)

THE ECLIPSE OF APRIL 17.—A large number of photographs and accounts of the April eclipse of the sun is published in the July number of *L'Astronomie*. Of special interest are the reproductions of series of pictures from kinematograph films. On one strip, taken by M. Lobo at Ovar, at central phase, the sun is represented by six or seven disconnected bright dots, the only suggestion of a continuous limb being that the dots are obviously on the circumference of a circle. A photograph taken from the balloon "Le Globule," apparently shows traces of the corona.

A complete set of fifty-four photographs taken at the Hamburg Observatory is reproduced, with other photographs, in No. 4584 of the *Astronomische Nachrichten*, while in No. 4587 of the same journal, Dr. K. Graff gives an interesting sketch of the moon's profile and a set of curves showing the distribution and relative heights of the various mountains.

A SECOND METEORITE FIND IN SCOTT COUNTY, KANSAS.—A roughly wedge-shaped fragment of a meteorite, weighing about 1900 grams, is briefly described by Mr. George Merrill in No. 1905, vol. xlii., of the Proceedings of the U.S. National Museum. The stone was found by Mr. J. T. Freed, of Scott City, and from the slightly glazed surface of an obvious fracture it is not improbable that other fragments may yet be found. The polished stone is of a greenish colour, and contains particles of iron and iron sulphide, one to two millimetres diameter, evenly disseminated throughout its mass. A fragment of the stone, 175 grams in weight, is in the U.S. National Museum collection, the main mass remaining in the possession of Mr. Freed.

ASTRONOMICAL SOCIETIES.—The report of the Hampstead Scientific Society for 1911 shows the existence of an energetic and well-organised astronomical section, which uses the observatory on practically all fine nights, and holds meetings at which many interesting papers are read. The current report contains a lecture on "Star Streams," given by Mr. Eddington, and some reproductions of drawings of Mars made by members throughout the 1911–12 opposition. Venus near inferior conjunction was also regularly observed.

The seventh annual report of the Antwerp Astronomical Society shows that the society, with nearly 250 members, is in a flourishing condition. Its popular lectures in French and Flemish are well attended, and its instruments are well used. During the present year the society hopes to acquire a much larger and better equipped observatory on the roof of a proposed new communal school.

THE MUSEUMS ASSOCIATION AT DUBLIN.

AFTER an interval of eighteen years, Dublin has for the second time been the meeting-place of the Museums Association. The gathering lasted from Tuesday, July 9, until Friday, July 12, inclusive. No observant attendant at both meetings could fail to be struck by the widening of interest noticeable in the recent, as compared with the earlier, meeting. In 1894 the members of the association, except for a preliminary municipal reception, were left very much to themselves, and the papers and discussions dealt for the most part with questions of museum technique. This year the proceedings were opened by the Lord Mayor of Dublin, who attended in state, and the Viceroy of Ireland was present at the association's annual dinner. An official welcome was also personally offered by the Secretary of the Department of Agriculture and Technical Instruction. The programme of the meeting was drawn up to illustrate the relation of museums to general education, and though art collections and picture galleries furnished the special subject of most of the papers, the principles expounded might be also applied by the natural history curator.

The president, Count G. N. Plunkett—like his predecessor of 1894, the late Dr. Valentine Ball—is director of the National Museum in Dublin. In a thoughtful address he pointed out that nowadays even a small town desires a museum in touch with popular wants and national life; that a well-arranged museum is more instructive than a text-book, because less dogmatic and more incentive to thought; and that the museum gallery ought to be, as much as the class-

room, a centre of education. In a paper on the influence of museums on the reform of classical studies, the Rev. Prof. H. Browne followed up these ideas by insisting that the facts and conclusions of archæology, as they may be illustrated by a well-chosen collection, remove from classical studies the sense of unreality; and by complaining that Continental museums do more than British institutions for classical teaching. Mr. James Ward (headmaster of the Dublin Metropolitan School of Art), in a paper on the relation of schools of art to museums, made a somewhat similar complaint in deploring the scanty representation of good examples of modern applied art in our national institutions as compared with those of many Continental cities. In the discussion on this paper, Mr. H. Bolton (of the Bristol Museum) laid stress on the help given to students of decorative design by the loan of specimens of birds, insects, and shells from the zoological collection under his care. The presence of Dr. F. A. Lucas (director of the American Museum of Natural History, New York) was exceedingly welcome at the meeting, and he contributed a valuable paper on the school work of some American museums. At Brooklyn and New York, loan collections made up for schools led to lectures to children in the public museum galleries, and the establishment of these was followed by exhibits in the galleries arranged so as to appeal especially to school children. In the discussion on one of the papers, Dr. N. Annandale (director of the Indian Museum, Calcutta) directed attention to the possible danger of popularising exhibits, labels, and guides to such an extent as to discourage thought on the part of the casual visitor, and actually to repel the earnest student. Dr. Lucas, in reply to this, expressed the opinion that the student can take care of himself, and that it is impossible to make things too easy for the general public in museums.

There were several technical papers on both art and natural history subjects. The educational aspect of the curator's work was, however, the predominant feature of a distinctly profitable and well-attended meeting. In 1913 the association proposes to gather at Hull, under the presidency of Mr. E. Howarth (of the Public Museum, Sheffield).

A NEW SYSTEM FOR PREVENTING COLLISIONS AT SEA.[1]

SIR HIRAM MAXIM long ago established a high reputation as a mechanical engineer, and is the author of many ingenious inventions, amongst which machine guns and flying machines are probably the best known. The loss of the *Titanic* led him to ask: "Has science reached the end of its tether? Is there no possible means of avoiding such a deplorable loss of life and property?" "At the end of four hours," he adds, "it occurred to me that ships could be provided with what might be appropriately called 'a sixth sense' that would detect large objects in their immediate vicinity without the aid of a search-light." Having worked out the invention in considerable detail, and satisfied himself of its value by means of experiment, Sir Hiram Maxim has secured patents for the apparatus in the leading countries of the world, and now publishes a full description of the system and a justification of his belief in its practical success if adopted.

The mode of treatment followed in the pamphlet is popular, and is obviously intended to meet the case of readers unfamiliar with acoustics. Considerable space is devoted to descriptions and illustrations of a so-called "sixth sense" as it exists in bats, which, even when blinded, are able to find their way through tortuous passages, to avoid unseen obstacles, and to capture their food. That section of the work will receive no attention in this brief notice. Nor need anything be said respecting lengthy references made by Sir Hiram Maxim to Tyndall's well-known experiments on the transmission of sound through air under various conditions of the atmosphere, including fog. The facts and conclusions therefrom to which reference is made are well known to men of science and to all persons concerned with aids to navigation; the real interest of the present publication lies in its suggestion of a means by which the author hopes to lessen the risk of collision occurring between ships, or between ships and icebergs, derelicts, and other obstructions to navigation, when they cannot be seen at any reasonable distance.

The suggested apparatus embodies a modified form of "siren," through which high-pressure steam can be made to flow in order to produce sound-waves having about fourteen to fifteen vibrations per second, and consequently not coming within the range of the human ear. These waves, it is asserted, would be capable of travelling great distances, and if they struck against a body ahead of the ship they would be reflected towards their source, "echo waves" being formed. The second part of the apparatus, or "receiver" for these echo waves, consists of a large diaphragm tightly drawn over a drum-shaped cylinder. Atmospheric pressure is always to act equally on both sides of the diaphragm, which can "vibrate freely in response to the waves of the echo, and its vibrations are made to open and close certain electrical circuits, which ring a series of bells." Audible notice is thus to be given of any obstruction situated above the water surface and ahead of the ship. A third device provides a means of obtaining diagrammatic records of the disturbances in the air ahead of the ship, and its intended operation is thus described:—"When there is no noise, except that due to the action of the sea waves, a wavy line is produced; but whenever the vibrations sent out by the vibrator strike an object and return, the wavy line on the paper becomes very much increased in amplitude." Sir Hiram Maxim conceives that it may become possible to send out a series of pulsations that will travel over a distance of 100 miles and be receivable by his "recorders," and he anticipates being able to approximately determine from these records both the distance and the size of any object which may reflect the waves. It is unnecessary to dwell upon the details of his methods of approximation; they can be studied in the pamphlet by any person interested therein.

The main question which arises in considering these proposals is whether, if all that Sir Hiram Maxim anticipates were accomplished, the object at which he aims would be attained, and greater security against collisions achieved, especially in passenger steamships of high speed. Sir Hiram Maxim admits frankly that, except in dark, foggy, or stormy weather, there would be no use for the apparatus unless it was used for communicating with other ships. Wireless telegraphy is obviously far superior for the last-mentioned purpose, and there is a good prospect of its installation being made compulsory for passenger steamers. In the circumstances described, the best chance of avoiding accident is obviously to be found in reduction of speed and close observation. Similarly, when making the land in fog or thick weather, everything must depend upon the caution and skill of commanders; and while it is true (as Sir Hiram Maxim says) that a strong echo

[1] "A New System for Preventing Collisions at Sea." By Sir Hiram S. Maxim. Pp. xv+147. (London: Cassell and Co., Ltd., 1912.)

may be produced by a moderately bold sea front—a condition which is utilised commonly in the coastal navigation of the North Pacific—moderation of speed and careful soundings give practical security in most cases. Prof Barnes, of McGill University, has recently demonstrated the possibility of detecting the presence of icebergs near a ship by means of sensitive recording thermometers, and has exhibited automatically constructed diagrams which confirm the trustworthiness of his methods. The use of submarine bells in connection with lighthouses and lightships, and the fitting of microphonic receivers in Transatlantic passenger steamships and warships during the last eight or nine years, have also become common; and experience has proved this system to be of great value both for picking up lighthouses, lightships, and buoys, and for detecting the close approach of ships to one another in fog. On the whole, therefore, the openings for the additional apparatus suggested by Sir Hiram Maxim do not seem to be numerous or promising, nor is his statement of existing conditions complete. As matters stand, the officers of steamships have very onerous duties to perform, and unless additional apparatus is shown to be required in order to gain increased safety, it is not probable that shipowners or ship captains will favour its introduction, since that action would enlarge the labours of officers whose time and thought are already fully occupied in meeting grave responsibilities. W. H. W.

RESEARCHES AT THE VIENNA RADIUM INSTITUTE.

THE *Mitteilungen aus dem Institute für Radiumforschung*, 12–17, deal with a variety of subjects of radio-active interest. Dr. Przibram describes a method for visualising and projecting on a screen the range of α-rays, depending upon the principle that a cloud of ammonium chloride fumes in an electric field rapidly clears when exposed to α-rays. The cloud is formed between the parallel plates of a condenser, at one end of which is the preparation giving α-rays. On applying a field of 200 volts between the plates the cloud in the vicinity of the preparation clears, leaving a perfectly sharp dividing line marking the extreme limit of the range of the α-rays.

Prof. Meyer and V. F. Hess discuss the heat effect of Hönigschmid's standard radium preparations, which they evaluate at 138 calories per hour per gram of element, all three types of rays being completely absorbed, and numerous other data relating to these preparations. They include an interesting effect produced by one gram of radium after two years on a tube of fused quartz, which splintered and became quite rough on its inner surface, showing that this material is unsuitable for the storing of radium.

L. Flamm and H. Mache deal with the quantitative measurement of the radium emanation in a guard-ring plate condenser, with varying distances between the plates, and compare the values obtained with those calculated by various methods. Przibram also discusses the phosphorus content of the charged particles of phosphorus clouds. Of interest to the physiological chemist is a paper by Knaffl-Lenz and Wiechowski, calling in question the action of the radium emanation and of air exposed to α-rays in decomposing sodium mono-urate into easily soluble substances, and giving the negative results of many experiments.

Finally, a botanical paper on the sprouting of plants under the action of radium is contributed by Molisch, and is accompanied by plates which recall those illustrating the action of fertilisers. Shoots of *Syringa vulgaris* and *Aesculus Hippocastanum* are depicted showing those which have been subjected to the action of radium rays and of the radium emanation, and which, like Aaron's rod, have sprouted, while those not so treated have not. The action of the radium must not be overdone, or the plants are killed, and it is only of effect if applied during the rest period of winter in the end of November or in December. In addition to the varieties mentioned three others showed positive and four others negative results. Naturally the radium emanation, applied to the plant under a bell-jar, gives better and more pronounced results than the direct radiation. F. S.

EXPERIMENTAL RESEARCH IN AËRONAUTICS.[1]

Experiments on Airship Models.—During the past year further experiments have been made on the resistance of airship models, and on the forces and moments acting on inclined models of different forms. The resistance measurements included some tests of special shapes, made at the request of the superintendent of the Royal Aircraft Factory; and an investigation to determine the effect of bluntness of tail on the relative air flow and on the resistance. From visual observations and photographs of the flow past models in the small water channel, made with the aid of coloured streams, it was noted that the flow in the tail region even of an elongated model was very slow. It was inferred that truncation or modification of the tail within this "dead" region should have little effect on the head resistance. A model was accordingly made in which successive sections of the tail were removable, and it was found, as expected, that the effect of the removal of portions of the tail within the "dead" region was negligibly small. In the model tested, the full length of tail was about twice the maximum diameter, and it was found that a length of 0·8 of the diameter, from the tip, could be removed without appreciable effect on the head resistance. It follows, therefore, that within this region the tail may be rounded off or otherwise modified without loss of speed; a gain in lifting power is thereby secured, while the less pointed form presents advantages from the constructional point of view.

In addition to the model experiments above described, an interesting series of determinations of the head resistance of eight different airship forms was carried out at the Royal Aircraft Factory. These models were made of goldbeaters' skin, and were about 18 ft. in length, and 3 ft. in diameter. The method employed was to tow the models horizontally through the air at different velocities, the speed being maintained by means of a falling weight. The conclusions arrived at from these experiments were generally in accordance with those deduced from the measurements made on small models of the same forms in the water channel at the National Physical Laboratory. From the point of view of total balloon resistance alone, a fineness ratio, or ratio of length to maximum diameter, of 6½ to 1 was found to be most efficient; but taking into account the other resistances in the completed airship, it was concluded that it might be desirable to reduce the fineness ratio to about 5¼ to 1.

The difficulties of obtaining results of high accuracy by the method of towing light models of this character through the air are very great, but nevertheless a comparison of the measurements of head resistance thus made on models of 3 ft. diameter, with those

[1] From the Report of the Advisory Committee for Aëronautics for the Year 1911–12. (London: Wyman and Sons, Ltd.) [Cd. 6249.] Price 2*d*.

given by tests in water of ebonite models of 1 in. diameter, is of much interest. The difference between the densities of the two media, air and water, is not a source of difficulty in such comparison: the relative resistances are directly proportional to the densities of the media, and allowance for the difference in density is thus readily made. According to the law of dynamical similarity, referred to in previous reports, and clearly enunciated by Lord Rayleigh in the report for 1909–10, the quantities on which variation in the resistance coefficient may be expected to depend are the relative dimensions, the relative velocities, and the "kinematical viscosities." The velocities in the two sets of experiments, made at the Aircraft Factory and the National Physical Laboratory respectively, were 20 ft. per second and 1·78 ft. per second. The kinematical viscosities of air and water are in the ratio of 13 to 1. Employing the law of dynamical similarity the two series of experimental determinations enable a provisional estimate to be formed of the effect on the coefficient of head resistance of change in velocity, and of change in dimensions. Mr. Bairstow, of the National Physical Laboratory, has made the calculation, and employing the data so obtained, has estimated the resistance of a full-sized balloon, with smooth surface, of 40 ft. diameter and of specified form, with fineness ratio of 6 : 1, when travelling at the rate of 40 miles per hour, to be 320 lb. weight.

To obtain further information on this important question of the variation of the resistance coefficient with dimensions, a large wooden model of an airship, 6 ft. in length and 1 ft. in diameter, has been made at the laboratory, and its resistance will be determined by towing tests in the William Froude National Tank. These experiments are now in progress. A further model, 4 in. in diameter and 2 ft. long, is also under construction for towing tests in the tank, and it is hoped that a comparison of the various experimental results available may lead to valuable conclusions as to the relation between the resistance of models and of the full-scale machines, and may furnish data sufficient to enable the prediction, from observations on models, of the absolute magnitudes of the forces acting on full-sized airships and aëroplanes to be made with more confidence than is at present possible.

Investigation of the Pressure Distribution Round a Thin Plate and an Aërofoil.—The object of these experiments was to examine closely the character of the air flow round a thin plate or an aërofoil, and to investigate the way in which the total "lift" and "drift"—apart from friction—on the whole plate are built up from the pressures, or "suctions," at different regions of the upper and lower surfaces.

The detailed results and distribution curves, which will be given in the Technical Report, exhibit many points of interest, and of importance in aëroplane design. Thus for the aërofoil tested there was a particular angle at which the upper, convex surface gave its maximum contribution towards the total lift, and another, different angle at which the under, concave surface gave the maximum effect. It thus appeared to be a possibility that by variation of one of the surfaces improved efficiency could be obtained.

The nature of the pressure distribution on the convex surface of the aërofoil presents some remarkable features. At inclinations commonly occurring in flight practice, from 5° to 10°, the negative pressure on the convex surface is a maximum, and reaches a very high value, at a point immediately behind the leading edge of the "plane." The same fact is shown in the distribution curves for different aërofoils at an angle of 6° given by M. Eiffel, who has also carried out a large number of experiments in the plotting of pressure distribution, to which the National Physical Laboratory measurements may be regarded as complementary.

Another interesting feature of the results obtained for the aërofoil is that at an inclination of about 12½° there is a marked change in the pressure intensity on the convex surface, and from 12½° to 20° the conditions of flow appear to be so unsteady that no readings of the pressure intensity could be made, the pressure varying incessantly and erratically within wide limits. This critical region is also indicated, in a less marked manner, by the measurements made on the concave surface.

Effect of Separate Variation of the Upper and Lower Surfaces of an Aërofoil.—In continuation of the investigation above described, into the pressure distribution, the effect has been examined of varying one surface only of the aërofoil, the curved under surface of the aforementioned aërofoil being replaced by a plane.

The general conclusion arrived at is that, as a first approximation, each of the surfaces of an aërofoil can be independently designed; the second approximation, due to interaction between one surface and the other, is sufficiently small to be regarded as of the nature of a correction.

The curves obtained for the lift and drift, and the ratio of lift to drift, show clearly the effect of replacing a cambered under surface by a plane one. Over the useful range of inclinations from 7° to 12°, the ratio of lift to drift is nearly the same for both aërofoils, but the lift coefficient at 10° decreases from 0·48 to 0·42. It follows from this that about 14 per cent. increase in wing area would be required to produce the same lift.

Effect of Variation of the Spacing of the Two Planes in a Biplane.—These experiments were made with two facsimiles of a wing form of the Blériot type, and the "gap" between the two planes was varied from 0·4 to 1·6 times the breadth of either plane. The results were corrected for the resistance of connections. They show appreciable loss of lift per unit area as compared with the single plane; when the "gap" is equal to the breadth of either plane, the loss is 17 per cent. Even with a "gap" equal to 1·6 times the breadth, the loss is still as much as 10 per cent. The "drift" values for the biplane do not differ greatly from those for the single plane; the percentage losses in the ratio of lift to drift are thus nearly of the same magnitude as those in the lift.

The advantage that might be gained by employing a wider spacing than the usual one, with a gap equal to or slightly greater than the breadth of a plane, is, of course, to some extent, counterbalanced by the increased resistance and added weight due to the extra length of struts necessary. The best spacing depends on the conditions of design, and is different if the speed be required to be kept constant from that most suitable for a machine having wings of fixed area. For flight speeds ranging from 40 to 60 miles an hour the best biplane spacing is in the neighbourhood of that most commonly adopted, with a "gap" approximately equal to the chord.

Effect of Camber.—The effect of variation of the camber of the upper surface, and also of the lower surface, has been investigated. As already stated, it had been previously shown that, to a first approximation, the upper and lower surfaces might be independently designed. The experiments on the variation of camber of the upper surface were made on aërofoils having their lower surfaces plane. The amount of camber of the upper surface giving a maximum value of the ratio of lift to drift was found to be about 1 in 20, as compared with Eiffel's value of 1 in 13·5.

The experiments on the effect of varying the camber of the lower surface were made on an aërofoil in

which the camber of the upper surface was about 1 in 10. It was found that the ratios of lift to drift were practically unaltered by the change of camber in the lower surface, but the lift coefficient at a given angle of incidence increased steadily with increase of camber, the gain in lift amounting to about 17 per cent. for a lower surface camber of 1 in 16, as compared with a plane under surface.

Other Experiments in Connection with Aëroplanes.—Mr. O'Gorman has placed before the committee a considerable programme of further experimental work on aëroplane models, in relation to questions which have arisen in connection with constructional work proceeding at Farnborough. A scheme for further work has been approved by the committee, and this will be proceeded with as rapidly as circumstances permit. The committee held that the necessity of advancing more rapidly with these experiments rendered imperative the provision of another air channel; and, as already stated, it has been arranged to build a channel of section 6½ ft. square, for which provision will be made by the Treasury. The increased accuracy in measurement which it is hoped to attain by improved design in the reconstruction of the four-foot channel will also, if realised, appreciably increase the rate at which experimental data can be obtained.

Effect of Blade Area and Pitch on Propeller Efficiency.—At a constant translational speed, the departure from maximum efficiency is negligibly small over a fair range of blade widths, from about 3·4 to 4·8 in. The change of thrust under the same conditions is also small.

Tests have also been made on two series of propellers of different blade widths, in which the pitch was varied somewhat on either side of that obtaining in the original design. Some effects of increase in pitch may be inferred from these experiments; with the wider blades an improvement in efficiency was obtained with the increase in pitch, and in the experiments made the limit of improvement did not appear to have been reached. With the narrower blades the maximum efficiency obtained was for a ratio of pitch to diameter of about 0·80. The investigation of the effect on the efficiency of variation in pitch will be continued.

Experimental Work on Full-sized Aëroplanes.—It was mentioned in last year's Report that arrangements had been made for conducting full-scale experiments. These were commenced early in 1911 under the direction of the superintendent of the Royal Aircraft Factory. The earlier work was directed to the determination of the effect of various modifications in an existing machine. An aëroplane of Farman type was available for the purpose, and the alterations made aimed at diminution of head resistance by various means; the increase of mechanical efficiency by improvement of propeller design and correct correlation of propeller and engine; improvement in the design of the wings; increased ease of control; and improved directional stability. In all these respects satisfactory results have been attained; the alterations have effected a marked improvement in ease of control, stability and speed, with increase of available lift. In connection with this work a standard form of "speed-resistance" and "speed-horse-power" curves has been adopted for setting out the qualities and performances of aëroplanes. This has been found very convenient for purposes of design.

Attention is also being given to the problem of obtaining during actual flight measurements of the principal quantities affecting the behaviour of the machine, a knowledge of which is necessary to enable the conditions of flight to be accurately analysed. Apparatus has been designed for recording the propeller thrust on machines in flight, and measurements are also being made of the relative wind velocity and the gliding angle, while the effect on the stability of modifications in design is being specially studied.

Meteorological Work.—In April, 1911, the Lords Commissioners of H.M. Treasury sanctioned the establishment, by arrangement with the War Office, of a branch of the Meteorological Office, in connection with the Royal Aircraft Factory, at South Farnborough, to supply meteorological information to those engaged in field work, and to carry on the investigation of the upper air for the Advisory Committee under the direction of the Meteorological Office. Mr. J. S. Dines was appointed by the Meteorological Committee as meteorologist in charge of this branch office. Suitable accommodation for this experimental observatory was included in plans prepared for additional buildings at the Aircraft Factory.

This new branch of the Meteorological Office, for which accommodation is to be provided during 1912, is designed to fulfil three functions:—

(1) To supply meteorological information and forecasts in a form directly applicable for the guidance of airmen.

(2) To carry on the experimental work for the Advisory Committee.

(3) To act as an observing station for the Meteorological Office.

Vertical Motion in the Air.—Experiments on vertical air currents have been carried out during the past year by means of balloons tethered to a point on a steel tower 95 ft. above the ground, with a view to the determination of the angular deviation from the horizontal of air currents at a moderate height. The method consists in following the motions of such a tethered balloon with a recording theodolite. The analysis of the records shows that the inclination of the wind direction to the horizontal does not normally exceed 20°, though on one occasion a downward current was observed making an angle of 43° with the horizontal, corresponding in this instance with a vertical component of the wind velocity of about eight miles an hour. As a rule, the larger deviations from the horizontal were not met with on days of strong winds.

The Study of Gusts.—Some account was given in the previous report of the variation found in the gustiness of the wind at different levels. A comparison has been obtained during the past year of the gustiness at two points respectively 36 and 98 ft. above ground, the measurements being made by means of a pressure tube anemometer head. The gustiness at 36 ft. was found to be about 30 per cent. greater than that at 98 ft., for the site where the experiments were made.

In connection with the work on vertical motion, records of wind velocity were taken with a more open time scale than is usual, and these have given some further information of value with regard to gusts. In a gusty wind of normal type, a rise of wind velocity is usually followed almost immediately by a fall of approximately equal amount. In some of these observations, however, cases were found in which a sudden access of wind velocity persisted for at least one minute. Thus a case is recorded in which the wind rose suddenly from 13 to 23 miles per hour, followed by a slight fall and then a further rise to 28 miles per hour; the wind remaining above 20 miles per hour for more than one minute after the first rise. Attention is directed to this special type of velocity change on account of the probability that similar phenomena, though possibly of greater intensity, in the upper air currents may explain one of the types of conditions known to airmen as "holes in the air."

Experiments in progress on the wind towers give

some valuable information as to the width of gusts, *i.e.* as to the lateral variation in the velocity of the wind. From observations taken at two points 40 ft. apart in a line approximately at right angles to the direction of the wind, the conclusion is drawn that the pressures due to the wind velocities at the same instant at two points 40 ft. apart may differ by as much as 50 per cent., and will frequently differ by 25 per cent. Differences of corresponding amount must, therefore, occur in the velocities of the natural wind striking the two wing tips of an aëroplane; thus, in a wind of 10 miles an hour, for an aëroplane travelling at 50 miles an hour, the difference between the pressures at the wing tips might amount to 10 per cent. The observations were, for the most part, taken in strong winds of the order of 30 miles an hour, but the same proportionate variation has been found in lighter winds, though with diminution in the mean velocity of the wind the gusts become of less importance.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—At Emmanuel College a grant of 50*l.* a year for three years has been made to Mr. C. E. Moss, in aid of his researches in connection with his forthcoming work on the British flora. From the Studentship Fund the following award has been made for research by graduates of the college:—a studentship of 120*l.* in stratigraphical geology to Mr. R. D. Vernon.

The summer meeting is to be held from July 27 to August 20, and the principal subject of study will be "The British Empire"; other subjects will, however, also be dealt with. Among the lectures announced we notice the following:—"The Early Exploration of the Empire," H. Yule Oldham; "The Races of the Empire," Dr. E. A. Parkyn; "Australian Resources and Prospects," Sir George Reid; "New Zealand—its Historical, Scientific, and Educational Aspects," Prof. C. Chilton; "Our Frontier Neighbours in India," Col. Sir T. H. Holdich; "Nigeria, British Central Africa, and British East Africa and Uganda," Sir H. H. Johnston; "Universities of the Empire," Dr. A. Hill; "Eugenics and Genetics," Prof. R. C. Punnett, F.R.S.; "Principles of Aërial Flight," G. P. Bailey. In the education section there will be a practical course on "Elementary Experimental Science," by R. H. Adie.

EDINBURGH.—Prof. Greenfield has resigned the holding of the chair of pathology. His resignation is to take effect from September 30 next.

LONDON.—At an extraordinary meeting of the Senate held on July 17, resolutions were adopted approving of the Foundling Hospital site in Bloomsbury for the proposed new headquarters for the University, in accordance with the recommendations contained in a report of the Special Sites Committee, over which Sir Philip Magnus, M.P., presides. Representations are to be made to the Government with the view of obtaining support for the scheme, and the Drapers' Company are to be asked whether they consider the site suitable for the proposed Senate House which they have offered to provide at an estimated cost of 60,000*l.* Lord Haldane is also to be asked to use his influence so that offers of financial support already made to him may be available for the Foundling Hospital site. A motion to refer back the report for further consideration was negatived by a small majority.

Mr. Otto Beit has been appointed a member of the governing body of the Imperial College of Science and Technology, in succession to the late Sir Julius Wernher, for the remainder of Sir J. Wernher's unexpired term of office, viz., four years from June 1, 1911.

OXFORD.—A director of the Agricultural Economics Institute, which is being established by the University in conjunction with the Board of Agriculture and the Development Commission, is to be appointed by the Committee for Rural Economy in October next. Applications must reach the secretary, the School of Rural Economy, by September 30.

PROF. W. M. DAVIS has resigned the professorship of geology in Harvard University. The chair will in future be filled by Prof. R. A. Daly, of the Massachusetts Institute of Technology.

Science announces that by the bequest of the late Dr. F. Bacon, Yale University will benefit by, probably, 500,000 dollars, of which 300,000 will go to the library and 200,000 to the Sheffield Scientific School, for the assistance of students.

THE sum of 3000*l.* has been left to the University of Belfast by Mrs. F. Magrath for the foundation of a "Magrath clinical scholarship," to be given for proficiency in reports of bedside cases open to fourth-year medical students. The Vice-Chancellor, in announcing the legacy, said that it was certain to be of the utmost value in the medical school of the University. A further gift to the University is that of an equatorial telescope, the donor of which is Mr. W. H. S. Monck.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, June 28.—Mr. A. Campbell, vice-president, in the chair.—Prof. E. **Wilson**, B. C. **Clayton**, and A. E. **Power**: Hysteresis loss as affected by previous magnetic history. Hysteresis loss in iron at atmospheric and liquid air temperatures under three different conditions: (1) after the iron has been carefully demagnetised; (2) after it has been subjected to a large force (previous history) of about 26 C.G.S. units; and (3) whilst it is under the influence of an external constant magnetising force after demagnetisation.—Prof. W. M. **Thornton**: Dielectric hysteresis at low frequencies. An attempt to determine from dielectric hysteresis loops the nature of the change of polarisation which gives rise to the absorption of energy.—Prof. G. W. O. **Howe** and J. D. **Peattie**: The efficiency of generation of high-frequency oscillations by means of an induction coil and ordinary spark-gap. The apparatus used was similar to that employed in small radio-telegraph stations. A 10 in. induction coil, operated from cells through a mercury interrupter, supplied power to an oscillatory circuit containing a spark-gap between spherical electrodes. Coupled to this circuit was another oscillatory circuit representing the aërial, and containing a variable resistance which constituted the high-frequency load. The input, output, and efficiency were determined for various degrees of coupling, various aërial decrements, different lengths of spark-gap and with various primary voltages, the object being to determine the effect of these various factors on the working of a small radio-telegraph station.—Dr. A. **Griffiths** and Miss C. H. **Knowles**: The resistance to the flow of water along a capillary soda-glass tube at low rates of shear.—S. W. J. **Smith** and J. **Guild**: The self-demagnetisation of steel. The constituents, iron and iron carbide, are easily traceable in annealed steel, owing to the differences between their magnetic properties. The ferro-magnetic transition point of the carbide is about 500° C. lower than that of the iron.

The carbide is also magnetically harder at ordinary temperatures and possesses greater coercive force, although, like iron, it is magnetically very soft at temperatures near the transition point. In consequence of these facts, the effect of heat upon the residual magnetism of an annealed steel rod is peculiar and at first sight mysterious. As the temperature rises the residual magnetism falls continuously until it becomes zero in the neighbourhood of 200° C. It then changes sign and reaches a maximum negative value at about 220° C. Beyond this, the negative magnetisation decreases slowly, and finally becomes imperceptible between 700° C. and 800° C. If the rod is cooled from 800° C. it remains without perceptible polarity as the temperature falls; but if the heating is interrupted before the whole of the residual magnetism is destroyed the behaviour on cooling is quite different.

EDINBURGH.

Royal Society, July 1.—Dr. Horne, F.R.S., vice-president, in the chair.—The late Dr. Alexander **Bruce** and Dr. J. W. **Lawson**: Multiple neuroma of the central nervous system; their structure and histogenesis. The paper was based upon the record of a rare condition found *post-mortem*, in which a number of small nodules were discovered scattered through the spinal cord and the *medulla oblongata*; and its main import was the question of the origin and relation of the nerve fibre to the nerve cell. Of the two views (1) that the fibre is an outgrowth of the cell, (2) that the fibre arises separately from the cell and afterwards unites with it, the latter seemed to fit in better with the observations.—Dr. G. E. **Allan** and John **Brown**: The transformation of ferric oxide into magnetic oxide. On the experimental side the paper was an elaborate investigation into the magnetic changes which accompany heating and cooling of ferric oxide. These changes indicated certain chemical transformations. One of the conclusions was that magnetite may be formed at a comparatively low temperature in rocks which contain hæmatite.

PARIS.

Academy of Sciences, July 8.—M. Lippmann in the chair.—J. **Boussinesq**: Errors, sometimes important from the theoretical point of view, introduced in the simplifications necessary for the consideration of actual systems.—G. **Bigourdan**: Time signals, and a method of producing them.—Henry Le **Chatelier**: The determination of atomic weights by Hinrichs's method. The author points out the fallacy of this method of calculating the "true" atomic weights.—El. **Metchnikoff** and Al. **Besredka**: Inoculation against typhoid fever. Experiments made on chimpanzees showed that, after injection under the skin, the bacilli were absent from the general circulation and from the excreta, and that the animals did not act as carriers of typhoid. The method has since been used in a large number of cases, and a full account will be published in the *Annales de l'Institut Pasteur*.—M. **Gouy**: Pressure at the surface of the sun. The author concludes that the visible portions of the sun consist of gases and vapours in a state of very great rarefaction.—R. de **Forcrand**: The system water-cyclohexanol. The existence of a hydrate is possibly indicated by the solidification curve.—A. **Buhl**: The extensions of the formula of Stokes.—Ch. N. **Moore**: The factors of convergence in double series, and on the double series of Fourier.—Patrick **Browne**: The generalised problem of Abel and its applications.—Jean **Chazy**: The limitation in degree of the coefficients of differential algebraical equations with fixed critical points.—Arnaud **Denjoy**: The absolute convergence of trigonometrical series.—René **Garnier**: The representation of the integrals of irreducible equations of the second order, with fixed critical points, by means of the theory of linear equations.—A. **Guillet** and M. **Aubert**: Expression for the force between two electrified conductors.—A. **Tian**: Variations in the radiation of the quartz-mercury lamp with treatment and time of use. The formation of hydrogen peroxide from water containing oxygen, and also the ozonisation of oxygen, are produced by rays of very short wave-length. On the other hand, ozone and the peroxide are energetically decomposed by rays in the middle portion of the ultra-violet. The feeble production of hydrogen peroxide and of ozone by quartz-mercury lamps with a high voltage is due, not to a diminution in the radiation producing these substances, but to a great increase in the rays which cause their destruction.—L. **Dunoyer**: The conductivity of sodium vapour. The conductivity of pure sodium vapour does not differ greatly from that of ordinary gases.—G. **Millochau**: A contribution to the study of oscillatory discharges.—Ph. A. **Guye**: The law of mass-action. Considerations as to the conditions under which the law of mass-action is rigorously applicable.—Eugène **Wourtzel**: Density and compressibility of nitrosyl chloride. The exact weights of a litre of NOCl at 0° C., and under pressures of 287 mm. and 720 mm., were determined in order to control the atomic weight of chlorine and to examine the deviations of nitrosyl chloride from Boyle's law. The weight of one litre (N.T.P., latitude of 45°, at sea-level) was 2·9919 grams, and the molecular weight thus found differs by only 1/5500 from the calculated value, taking N = 14·008 and Cl = 35·460, a difference which is within the limits of experimental error.—C. **Chéneveau**: The viscosity of solutions. Experiments show that if the existence of hydrates in solution be admitted, those indicated by the viscosity measurements are not in general the same as those indicated by measurements of the refractive index.—M. **Chouriguine**: The alloys of platinum with aluminium. These metals form a coloured compound of the formula $PtAl_3$, and also another compound richer in platinum.—M. **Lasègue**: Chlorous acid. Barium chlorite was obtained by passing the gases produced by the reduction of chloric acid by tartaric acid into baryta water. It was purified by conversion into the insoluble yellow lead chlorite, and then reconverted into chlorite of barium, from which the acid was obtained by the action of sulphuric acid. Chlorous acid is very unstable, and decomposes according to the equation $4HClO_2 = 2H_2O + 3ClO_2 + Cl$.—Marcel **Guichard** and Pierre Roger **Jourdain**: Gases evolved from aluminium.—Paul **Lebeau**: A new determination of the atomic weight of uranium. The salt $UO_2(NO_3)_2,2H_2O$ (which does not lose its water even on exposure over phosphorus pentoxide) is reduced to UO_2 by heating in a current of hydrogen. The ratio thus found gives U = 238·5, a number agreeing exactly with that found by Richards and Merigold by analysis of the tetrabromide, UBr_4.—Henri **Golblum** and Mlle. Hélène **Gunther**: Electrolytic estimation of manganese and its separation from iron.—J. B. **Senderens** and J. **Aboulenc**: Catalytic production, in the wet way, of esters of the cyclohexanols. The best yields of esters are obtained by heating the mixture of cyclohexanol and organic acid with 3 per cent. by volume of sulphuric acid to 100°–110° C., for about an hour.—Maurice **Lanfry**: Action of hydrogen peroxide on acetothienone.—E. **Léger**: Constitution of the aloïns from Natal aloes. These substances are glucosides derived from *d* arabinose.—J. **Pavillard**: Concerning *Diplopsalis lenticula*.—A. Eckley **Lechmere**: Some new moulds from the Ivory Coast.—M. **Radais** and A. **Sartory**: Comparative toxicity of various poisonous

fungi. *Amanita phalloides, A. verna, A. mappa,* and *Volvaria gloiocephala* are all about equally toxic in the fresh state; but on drying, *A. mappa* loses its toxicity, whereas the others are not affected to any extent.—A. **Magnan**: Influence of diet on the liver and kidneys of ducks.—J. **Vallot**: The appearance of large quantities of *Desoria glacialis* on the surface of a glacier.—E. **Kayser**: influence of nitrogenous matter on the production of ethyl acetate in alcoholic fermentation.—Pierre **Thomas** and Mlle. Madeleine **Lebert**: Action of certain cholesterin derivatives in increasing the number of red blood-corpuscles.—M. **Javillier**: The influence of zinc on *Aspergillus niger.*—A. **Kiesel**: The influence of various acids and acid salts on the development of *Aspergillus niger.*

BOOKS RECEIVED.

The Love of Nature among the Romans. By Sir Archibald Geikie. Pp. xi+394. (London: J. Murray.) 9*s.* net.

Studies in Luminescence. By Profs. E. L. Nichols and E. Merritt. Pp. vii+225. (Washington: Carnegie Institution.)

The Influence of a Magnetic Field upon the Spark Spectra of Iron and Titanium. By A. S. King. Pp. iii+66+6 plates. (Washington: Carnegie Institution.)

Über die Einwirkung von Wasser und Natronlauge auf Baumwollcellulose. By Dr. M. Robinoff. Pp. ii+94. (Berlin: Gebrüder Borntraeger.) 3.60 marks.

Illustriertes Handbuch der Laubholzkunde. By C. K. Schneider. Zwölfte (Schluss-) Lieferung. Pp. 817–1070. (Jena: G. Fischer.) 8 marks.

The Tungsten-mining Industry in New South Wales. By J. E. Carne. Pp. 102. (Sydney: A. W. Gullick.) 2*s.* 6*d.*

Report on Scottish Ornithology in 1911, including Migration. By E. V. Baxter and L. J. Rintoul. Pp. 80. (Edinburgh: Oliver and Boyd; London: Gurney and Jackson.) 1*s.* 6*d.* net.

University of London. Francis Galton Laboratory for National Eugenics. Eugenics Laboratory Memoirs XVII. A Second Study of Extreme Alcoholism in Adults, with Special Reference to the Home Office Inebriate Reformatory Data. By Dr. D. Heron. Pp. iv+95. (London: Dulau and Co., Ltd.) 5*s.* net.

Les Cavernes de la Région Cantabrique (Espagne). By H. A. del Rio, L'Abbé Prof. H. Breuil, and Père L. Sierra. Pp. viii+265+100 plates. (Monaco: A. Chêne.)

Soil Conditions and Plant Growth. By Dr. E. J. Russell. Pp. viii+168. (London: Longmans and Co.) 5*s.* net.

Researches on Cellulose. By C. F. Cross and E. J. Bevan. III. (1905–10). Pp. x+173. (London: Longmans and Co.) 7*s.* 6*d.* net.

Black's Modern Guide to Harrogate. Edited by Gordon Home. Pp. 128. (London: A. and C. Black.) 1*s.*

An Introduction to Practical Physics for Colleges and Schools. By Prof. E. H. Barton and Dr. T. P. Black. Pp. vii+188. (London: E. Arnold.) 3*s.* 6*d.*

Maps: How they are Made; How to Read Them. By Prof. H. N. Dickson. Pp 66. (London: G. W. Bacon and Co., Ltd.) 6*d.*

The British Museum Reading Room. A Handbook for Students. By R. A. Peddie. Pp. vii+61. (London: Grafton and Co.) 1*s.* net.

First Year's Course of Chemistry. By J. Sinclair and G. W. M'Allister. Pp. vii+165. (London: G. Bell and Sons, Ltd.) 1*s.* 6*d.*

L'Éducation Physique ou L'Entrainement complet par la Methode Naturelle. Exposé et Résultats. By G. Hébert. Pp. 85. (Paris: Viubert.)

Vorlesungen über vergleichende Tier- und Pflanzenkunde. By Prof. A. Wagner. Pp. viii+518. (Leipzig: W. Engelmann.) 11 marks.

An Introduction to the Infinitesimal Calculus. By Prof. H. S. Carslaw. Pp. xii+137. (London: Longmans and Co.) 5*s.* net.

The Second Danish Pamir Expedition: Studies on the Vegetation of the Transcaspian Lowlands. By O. Paulsen. Pp. v+279. (Copenhagen: Gyldendalske.)

Allgemeine Elektrotechnik. By Prof. P. Janet. Translated by F. Süchting and E. Riecke. Erster Band. By F. Süchting. Pp. vi+269. (Leipzig and Berlin: B. G. Teubner.) 6 marks.

Bau und Leben der Bakterien. By Prof. W. Benecke. Pp. xii+650. (Leipzig and Berlin: B. G. Teubner.) 15 marks.

Norse Tales. By E. Thomas. Pp. 159. (Oxford: Clarendon Press.) 2*s.*

Illustriertes Handbuch der Laubholzkunde. By C. K. Schneider. *Register.* Pp. vii+136. (Jena: G. Fischer.) 5 marks.

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