THURSDAY, JULY 11, 1912.

THE PHYSICAL CONSTITUTION OF THE EARTH.

Some Problems of Geodynamics. Being an Essay to which the Adams Prize in the University of Cambridge was adjudged in 1911. By Prof. A. E. H. Love, F.R.S. Pp. xxvii + 180. (Cambridge: University Press, 1911.) Price 12*s.* net.

THIS book consists of a number of discussions of important questions of geophysics. The nature and bearing of these will be best understood if we cast a rapid glance at the modern history of the subject. Fifty years ago the theory of the constitution of the earth was generally regarded as complete, in the sense that almost everything was thought to be known that was in the nature of things ascertainable. The external shape and the distribution of density in the interior were assumed to be such as are consistent with primitive, or indeed with present, fluidity (except for a superficial crust); and a certain reasonable law of density, viz., that of Laplace, was regarded as, if not actually demonstrated, at all events highly probable. The theory was a monument of mathematical skill, and had indeed evoked mathematical methods which had proved to have an ever-increasing value in other fields; but as a speculative mine it was held to be practically worked out.

The popular view as to the actual internal fluidity of the earth had indeed been questioned by Hawkins. His arguments, based on the phenomena of precession and nutation, were taken up by Thomson in 1862, from which epoch we may date the beginnings of the modern revolution in the subject. This particular line of reasoning proved, however, to be more abstruse than was at first recognised, and had to be revised at a later period; it is scarcely referred to in the work now under notice. Another line of attack, initiated by Thomson, proved more convincing. He pointed out that the existence of tides which can be observed implies a high degree of effective rigidity in the earth as a whole. A quantitative estimation is difficult, owing to the unavoidable imperfections of tidal theory; but the amplitudes which the long-period tides at all events (lunar fortnightly and solar semi-annual) would have on an absolutely rigid earth may be regarded as known, and the comparison with observation appears to show distinctly that the earth itself does as a matter of fact yield to tidal distorting force, but only to such an extent as if its rigidity were comparable with that of steel.

This conclusion is supported by the direct observation of the lunar disturbance of gravity, suggested originally by Thomson, attempted by G. H. and H. Darwin, and at length carried out successfully, with amazing skill and perseverance, by Hecker. The perplexing result obtained by Hecker at Potsdam, and found also to a somewhat lesser degree by Orloff in similar observations at Dorpat, that the yielding appears to be sensibly greater in the N.-S. than in the E.-W. direction, has excited much speculation. Some relation to the earth's axis of rotation is at first sight indicated; and Prof. Love has accordingly devoted an important section of his researches to a discussion of the theoretical effects of rotation and of the correlated ellipticity of the meridian. His calculations show, as might have been anticipated, that no difference at all comparable with that which is observed is to be accounted for in this way. The only remaining suggestion at present in the field is that the effect is due to the direct attraction of the Atlantic tidal wave, and to the deformation produced by its weight in the neighbouring regions of the earth.

The theoretical calculation of the tidal deformation of an elastic globe, which forms one of Thomson's most massive contributions to mathematical method, was naturally based on certain simplifying assumptions, among which was that of incompressibility. Prof. Love contributes the very interesting extension to the case of compressible solids. The result shows that the compressibility will increase the amount of yielding, as is required by general principles; but it appears that, on any reasonable supposition applicable to the case of the earth, the difference, though appreciable, is not such as to affect the general validity of inferences based on former results. In this connection the author contributes another chapter to an important problem of mathematical physics by investigating the periods of free vibration of a homogeneous, but compressible, and gravitating globe.

The same analysis enables Prof. Love to discuss very fully the question, raised a few years ago by Jeans, as to the gravitational stability of the earth. It is conceivable, and indeed proved to be possible, that a gravitating mass might be in equilibrium in such a condition that the loss of gravitational energy consequent on some particular type of deformation might exceed the gain of elastic energy, in which case there would of course be instability. The question arises whether the actual large-scale irregularities of the earth's surface, which have been very fully analysed by Prof. Love in a previous publication, may not be, as it were, the record of a catastrophe

of this kind at some former stage in the earth's history. It is impossible here to summarise the discussion, which is somewhat intricate, but Prof. Love's verdict—and there can be no better authority—is, on the whole, unfavourable to the suggestion.

The concluding sections of the book deal with the propagation of seismic waves. This is at the present time a question of the highest interest. Instruments have been greatly improved, and the records make an increasing claim to be regarded as faithful transcripts of the earth-movements. Phases more or less conspicuous are recognised in the diagrams, and are successfully used for the location of distant centres of disturbance. But the details of the records, and in particular the predominance, at different stages, of oscillations of various periods, offer much that is perplexing. For instance, it is difficult to account for the resolution of a transient shock, as it proceeds, into a series of oscillations of gradually changing period except on the hypothesis of something analogous to "dispersion" in optics, the essence of which is a variation of wave-velocity with wave-length. General elastic theory, on the other hand, suggests constant wave-velocities, whether in the case of the longitudinal and transverse vibrations, which are supposed to be propagated through the body of the earth, and to constitute the first and second phases of an earthquake disturbance, or in that of the larger "Rayleigh" waves, which travel over the surface. This theory, however, takes no account of gravity, or of variation of density and elastic properties with depth. Prof. Love has no difficulty in showing that when such circumstances are taken into consideration some amount of "dispersion" must ensue.

There is another particular in which the general theory appears to be inadequate. When the larger waves set in at any place, the horizontal displacement of the ground may at first be partly or even mainly transverse to the direction of propagation, whereas in the "Rayleigh" type of waves the horizontal component is longitudinal. Prof. Love meets this difficulty by the hypothesis that the earth consists of a comparatively thin crust, resting on a core which is denser and of different elastic properties. In this way it is possible to reconcile the fact of transverse displacement with (practically) superficial propagation; moreover, dispersion, almost as a matter of course, makes its appearance. We believe that this theory is worthy of careful examination; but much remains to be done in the way of quantitative as well as qualitative comparison with actual seismograms, before any decisive verdict can be passed upon it.

It will be seen from the above rapid outline that the work under review deals with problems of great difficulty, but of the utmost interest, in a rapidly developing branch of science. It is needless to say that they are treated with great mathematical skill. The book received, indeed, the Adams Prize for the year 1911. This prize is remarkable, even among similar foundations, for the high quality of the work which it has called forth. Many of the treatises thus produced, *e.g.*, Maxwell's essay on Saturn's rings and Routh's on stability of motion, not to mention others by living authors, have become classics. It is no slight praise to say that Prof. Love's work is worthy of the distinguished company in which it finds itself.

H. L.

ELECTRICAL ENGINEERING.

The Elements of Electrical Transmission. A Text-book for Colleges and Technical Schools. By Prof. O. J. Ferguson. Pp. vii+457. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1911.) Price 15s. net.

Direct and Alternating Current Manual. With Directions for Testing, and a Discussion of the Theory of Electrical Apparatus. By Prof. F. Bedell. Assisted by Dr. Clarence A. Pierce. Second Edition, enlarged and revised. Pp. xiii+360. (London: Constable and Co., Ltd., 1912.) Price 8s. net.

Storage Batteries. The Chemistry and Physics of the Lead Accumulator. By Prof. H. W. Morse. Pp. v+266. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1912.) Price 6s. 6d. net.

Maschinen und Apparate der Starkstromtechnik: ihre Wirkungsweise und Konstruktion. Erster Teil: "Gleichstrom." Zweiter Teil: "Wechselstrom." By Gustav W. Meyer. Pp. xiv+590. (Leipzig and Berlin: B. G. Teubner, 1912.) Price 15 marks.

"ELECTRICAL Transmission" covers a somewhat wider field than indicated by the title, for the author has included also some notes on hydraulics, water and steam turbines, Diesel engines, boilers, working cost of prime movers, switch-boards, transformers, induction, synchronous and commutator motors, measuring instruments, and other matters pertaining to the use and sale of electricity after it has been transmitted. In treatment the book is thoroughly practical, although, as may be expected, American practice predominates. This is no drawback, since for high voltage long-distance transmission English readers cannot do better than study the details of the work done in America, but there

are also some features in English and Continental practice which are worthy of study and should therefore not be omitted in a handbook on the subject. Thus the Merz-Price safety device, which has made the linking-up of the power-stations on the north-east coast possible, and is now also extensively used on the Continent, is not even mentioned, the subject of graded cables is dismissed with a few lines, there is no mention of Nagel's condenser bushings, and the hexagonal arrangement of duplicated power lines, now almost universal in Switzerland, is also ignored.

Another rather serious omission is that of the Thury D.C. system of transmission. This has been in successful operation on the Continent for many years at voltages exceeding 100,000, and it has quite recently been taken up by Mr. Highfield in England. Some of the information as to conductors might have been given in a more scientific way. Thus the "breaking weight" for hard and annealed copper wire is given in pounds with reference to the B and S gauge. It is also to be regretted that the author has not emancipated himself from the unit called the "circular mil." There is no difficulty in expressing the area of a wire in square inches, or square mils if a smaller unit is desired, but to use the C.M. is unscientific and confusing.

The constants of a transmission line are treated in a clear manner, and the transition from the single to the polyphase circuit is made in an easy and natural way, the mathematics employed being throughout of an elementary kind and easy to follow. Unfortunately the author lets his vectors rotate clockwise, which must be a little irksome to those readers who have, in conformity with the decision of the Turin Congress, accustomed themselves to think of vectors revolving counter-clockwise.

In "Direct and Alternating Current Manual" we have a second and improved edition of a book which appeared three years ago under the title, "Direct and Alternating Current Testing." Although the book is primarily concerned with the testing of machinery, it does not simply give instruction how such tests should be made, but it also gives digests of the theory of the machines themselves. The only exception to this is the chapter on wave analysis, where Runge's method for eighteen known ordinates is given without proof. The instruction is, however, so clear and exemplified by a numerical example that the reader cannot fail to apply the method correctly.

Two chapters only are devoted to D.C. machine tests. There we find some of the well-known methods described, but the statement on page 46 that in a shunt motor the iron losses are independent of the load will scarce be confirmed by engineers who have made such tests carefully. Chapter iii. treats of alternators, and especially of the relation between excitation and terminal voltage. We are told about the "optimistic" and "pessimistic" methods of determining drop, but these favourite expressions of American writers do not carry us very far in separating the two causes, namely, inductance and armature ampere turns, which combined produce the drop. This chapter is rather disappointing. It is also somewhat tiresome that throughout the book the authors use copious foot-notes, sometimes in correction of a statement made in the text. The general properties of alternating current circuits and transformer tests are treated in Chapters iv. and v., but the treatment is rather elementary and does not include some important tests, such, for instance, as heating and efficiency of large transformers. We are merely told on page 177 that a heat run is "usually made by some kind of opposition or pumping back method, of which there are several." Then follows a general description of one such method, but as no diagram of connections is given, the few lines of text will not be of much use to the student.

The following chapters, dealing with polyphase currents, are more satisfactory, especially the analysis of the effect of upper harmonics in star and mesh three-phase systems and power and power factor measurements. Next follow chapters on the induction motor and the circle diagram, frequency changers, synchronous motors, but the single-phase commutator motor is not discussed.

"Storage Batteries" is an unpretentious, but very attractively written little volume. In discussing the general principles of chemical storage of energy the author starts from Faraday's laws of electrolysis and takes the reader by easy stages to the predetermination of the E.M.F. of any combination, to the ionic theory, the cell-reaction, and finally to the theory of the reversible lead accumulator. When dealing with the relation between discharge rate and capacity, the author makes use of Peukert's formula $I^n t = \text{constant}$ (though without acknowledgment), and gives a very instructive series of curves, showing how the exponent varies in different types of cells. Examples are also given of some commercial types of cells, and amongst these it is interesting to find the Edison cell, about which so much has been written and so little is known.

The last book on the above list is an exhaustive treatise on apparatus and machinery concerned with heavy electrical engineering. The book will be found useful not only by students, but even more so by men in practical work. The author is not content to give the theory of machines,

their mode of working, and the principles underlying the construction, but he gives the actual construction by working drawings and excellent pictures and detailed instruction required in the workshop.

The space available for this review does not permit of an enumeration of the contents in detail; it must therefore suffice merely to mention the main headings. The first three chapters deal with continuous current. We find here measuring instruments, switchgear, rheostats, accumulators, D.C. machines, special types of motors as used on railways and for winding engines, speed control, and the use of D.C. apparatus generally. The rest of the book is taken up with A.C. work. Here, again, we start with measurement and the construction of measuring instruments, then follow switchgear and safety appliances, the construction and testing of generators, parallel working, converters, transformers, synchronous and asynchronous motors, starting and regulating devices, and finally commutator motors. It is an excellent book and will be found useful by all practical men who work on scientific principles. GISBERT KAPP.

PRINCIPIA MATHEMATICA.

Principia Mathematica. By Dr. A. N. Whitehead, F.R.S., and Bertrand Russell, F.R.S. Volume ii. Pp. xxxiv+772. (Cambridge: The University Press, 1912.) Price 30*s.* net.

THE main features of this important work have been described in a previous notice (August 31, 1911, p. 273). In the present volume the authors come more directly into contact with what may be called traditional arithmetic and algebra, the three parts being devoted to cardinal arithmetic, relation-arithmetic, and series respectively. Our old familiar friend, the family of natural numbers, appears under the head of "inductive cardinals"; besides this, and preceding it, we have a discussion of various types of cardinals, definitions of addition, multiplication, and exponentiation valid for transfinite, as well as finite, numbers; thence we proceed to the study of intervals, progressions, the first transfinite cardinal, and the axiom of infinity.

The section on relational arithmetic almost brings us back to formal logic again; it is a sort of analogue to ordinal arithmetic, and, as the authors point out, it is in the present context mainly important as a preparation for the doctrine of series, which immediately follows. The mathematical reader will be struck by the fact that a relation which generates a series is analysed into one which possesses three separate and independent properties. Important technical terms here are "section" and "segment" (pp. 624 *et seq.*), and in all this connection the contributions of Dedekind and Cantor make themselves felt. The final section brings us to the general problems of convergence, limit, and continuity; and the reader who has the courage to learn the new symbolism will now find that there has been a real philosophical advance in the period between Cauchy and Cantor; or perhaps it would be better to say that Cantor has initiated a new era of research, so far as any one man is truly an initiator.

Analogies are always dangerous, and in nothing more so than in pure mathematics; but one cannot help feeling that all this recent investigation of the elements of mathematics has some affinity to the chemical analysis of molecules into their atoms. Perhaps it may not be absurd to carry the metaphor a little further. Electricians have proved that the atom of the chemist is a much more complicated entity than he imagined; it is possible that the present irreducibles of the mathematician may dissociate, if subjected to still severer tests. If this be so, the resolver will be either a mathematician or a metaphysician, or a combination of both; and even he may not (indeed, probably will not) arrive at ultimate conclusions with which the human spirit will rest content.

It would be very unfair not to point out that the authors, by immense and ungrudging work, have fused together the discoveries of many searchers (including themselves) into as near a homogeneous whole as present circumstances permit. G. B. M.

DISEASE-DISSEMINATING ARTHROPODS.

Entomology for Medical Officers. By A. Alcock, C.I.E., F.R.S. Pp. xx+347+136 text-illustrations. (London: Gurney and Jackson, 1911.) Price 9*s.* net.

IT has well been said that tropical medicine is nowadays largely a matter of entomology, and it is to the recognition of this fact that the volume before us owes not only its appearance, but also much of the knowledge epitomised in its pages. The term "entomology" is interpreted by the author in the "old inclusive Latreillian sense," and we consequently find ourselves concerned not merely with insects, but with the Arthropoda as a whole, or rather with those groups of this enormous phylum with which the medical officer in the tropics at the present day must needs have a nodding acquaintance or something more.

In view of the transcendent importance of the Diptera in connection with disease, it is not surprising to find that nearly half of the volume is

devoted to this order. In dealing with the Culicidæ (mosquitoes), Colonel Alcock's good sense is shown by his retention for this much "classified" family of the original subdivision into the two subfamilies Corethrinæ and Culicinæ; it should be noted, however, that, in deference to the principle that designations of groups of equal value should have similar terminations, the author has since adopted for the four groups into which the Culicinæ are divided a nomenclature somewhat different from that given by him in this book. Another detail worthy of mention is the treatment of the Anopheline mosquitoes as belonging to the single genus Anopheles, instead of to more than twenty so-called genera; whatever genus-makers may say, this course is undoubtedly convenient for the medical officer, besides being for the most part in strict accordance with the principles of true taxonomy.

Exigencies of space forbid us from referring at length to other classes and orders, and it must therefore suffice to state that while groups admittedly noxious, such as the fleas, lice, bugs, ticks, and scorpions, receive adequate consideration, the reader who wishes to learn something of friendly or neutral Arthropods will not refer to this volume in vain. Derivations and explanations of generic and other names are a useful feature of the book, which is copiously illustrated with clearly-drawn figures, and is distinguished wherever possible by a literary touch too often conspicuously absent from zoological text-books. By the compilation and publication of this volume Colonel Alcock has placed students of tropical medicine under a debt of gratitude which they will not find it easy to repay, and every medical and sanitary officer in the tropics may confidently be recommended to add the book to his necessarily limited library. E. E. A.

TRANSFORMER DESIGN.

The Design of Static Transformers. By H. M. Hobart. Pp. xv+174. (London: Constable & Co., Ltd., 1911.) Price 6*s.* net.

A BOOK from the pen of Mr. Hobart invariably commands respectful attention and, we may add, is invariably pleasant reading. The volume before us is no exception, and moreover presents the results of Mr. Hobart's wide experience—that is to say, within the range of subjects taken up in this volume—with great conciseness. Perhaps one of the most valuable parts of the book is that labelled "Introductory," which occupies the first eleven pages. The last nine of these pages constitute a survey of the development of the "static" transformer, and the survey is, to the engineer whose recollections carry him back over the period covered, freshingly interesting, and to the student it is full of instruction. Beginning with reference to the pioneer investigations of other workers, to which student and engineer alike are exhorted to give heed, Mr. Hobart culls from his own past experience and recollections incidents which illustrate in the most striking way what is really a typical sample of the commercial development of a scientific piece of apparatus. No better example than Mr. Hobart's experience with watt-meters could be given to impress students with the way in which difficulties should be met and with the way in which, when so met, they lead invariably to progress. We cannot leave this excellent part of the book, all too brief as it is, without expressing hearty approval of the statement that "the subject of transformer design cannot be covered by the enunciation of rules, formulæ and constants, but that the designing of a transformer . . . will for many years continue to afford ample scope for careful thought and work."

There is some inconsistency in the remark on page 16 that "it is rare to find a graduate who has the remotest idea of how to proceed in designing a commercial transformer" with the statement a few lines below that "there are very many practical points based on long experience" and "it is particularly true of transformer designing that past experience goes a long way." Mr. Hobart, however, puts at the disposal of the inexperienced graduate a digest of his own lengthy and valuable experience.

Of that part of the book which constitutes the main reason for its existence, in our opinion the chapter on "The Design of the Windings and Insulation" is the weakest, and not only so, but is distinctly weak. The whole matter is dismissed in 5½ pages, of which one whole page and practically three others are occupied by illustrations. The method of arriving at the dimensions of the secondary conductor is entirely skipped, and no reference whatever is made to any requirements in the way of insulation beyond that made in the vaguest of terms in the text and the details stated in bare terms upon the drawings. To go to the other extreme, we find in the chapter on the "Heating of Transformers" the most excellent treatment, the subject being dealt with both broadly and in detail in the most valuable manner. The chapter on "Cases and Tanks" is also one which will fill a very decided gap in the literature relating to transformers.

We cannot dismiss reference to this work, so excellent in itself, without deploring the occurrence of grammatical and similar inaccuracies and inconsistencies.

OUR BOOKSHELF.

The Hunterian Lectures on Colour-Vision and Colour-Blindness. Delivered before the Royal College of Surgeons of England on February 1 and 3, 1911, by Prof. F. W. Edridge-Green. Pp. 76. (London: Kegan, Paul and Co., Ltd., 1911.) Price 3*s*. 6*d*. net.

THESE lectures are two in number, and the lecturer devoted the first to his views of colour-vision and colour-blindness, the second to the means of detecting colour-blindness from a practical point of view. The first lecture describes Dr. Edridge-Green's explanation of colour-vision, for which he indicates visual purple as an essential factor. A large portion of the lecture is devoted to the visual purple and describes various phenomena which he has observed in reference to it. The "pros" are well given, but the "cons" are more or less absent. It is the latter which have led other investigators to reject the idea that this sensitive matter can fully explain the different phenomena which occur in colour-vision and colour-blindness. The true function of visual purple has to be further investigated. The part of the lecture which is devoted to a description of Dr. Edridge-Green's theory of colour-vision has been presented to the public in various publications. We need scarcely summarise the theory. It is one of several theories which have been propounded by different investigators, and, like all, is open to criticism.

The second lecture is devoted, as we have said, to the practical detection of colour-blindness. In it he describes the various tests which he has devised. The first is the lantern test. The lantern he describes in great detail, and informs us where it is to be obtained. Whether this test is efficient he proceeds to discuss. Then he tells us of his pocket wool tests, and how to use them. He finally gives us a description of his colour-perception spectrometer. This last instrument is ingenious, and answers the purpose for which it is required by the author. These lectures show that Dr. Edridge-Green has devoted much time and labour in evolving his theory. It is beside the mark to say whether we agree with it or not. Where energy is expended in scientific work, some step forward in furthering "natural knowledge" is sure to be forthcoming, and we may prognosticate that this will be the case with the author.

Les Sciences de la Nature en France au XVIII^e Siècle. By Prof. D. Mornet. Un Chapitre de l'Histoire des Idées. Pp. x+291. (Paris: Armand Colin, 1911.) Price 3.50 francs.

THIS is a scholarly and interesting discussion of a remarkable period in the history of natural science—an almost heroic period, with Buffon as one of the grand figures. It is as a chapter in intellectual development that the author considers the history of natural science in France in the eighteenth century, but it is significant of the book that it continually brings us to contemplate science as a social phenomenon.

The first part of the book deals with natural science finding itself, its struggle with theological intrusions, its process of purification. The second part deals with the organisation of science; the third with its diffusion and triumph. A fine picture is given of the confusion in the early eighteenth century, the credulity, the survivals of interpretation, the curiosity-collecting, the discovering of providence in nature, the nomenclature craze, and the determined opposition to scientific inquiry besides. But there were men of thews and sinews who would not be discouraged; foundations were laid sword in hand, methods were discovered, and organisation grew with confidence.

Dr. Mornet tells us eloquently of science in its struggle for existence and of its increasing fitness thereby. He shows us how spiral-like the progress of science is, so often coming back on a higher turn to perennial problems, for they racked their brains in the eighteenth century just as we do to-day, over materialism and animism, mechanism and vitalism, automatism and real agency. Repeatedly, too, he brings us to see that "la science porte en elle des forces qui l'ont toujours poussée vers la vie." "The study of natural history in the eighteenth century suffices to show that life and speculation very quickly join hands."

The Gateways of Knowledge: An Introduction to the Study of the Senses. By J. A. Dell. Pp. xii+171. (Cambridge: University Press, 1912.) Price 2*s*. 6*d*.

MR. DELL is a schoolmaster in a Somerset school. He has read about and become interested in experimental psychology. In this book he seeks to interest his colleagues, and shows how boys and teachers may cooperate in experiments to their mutual advantage. It is intended, then, both for teacher and for pupil. The experiments have evidently been employed by the writer among his own pupils; they are suitable, we are told, for children of from twelve to fifteen years of age.

An admirable preface is contributed by Mr. Hugh Richardson, from which we cannot refrain from quoting the following sentences: "Hitherto the laboratory psychologist has often regarded the schoolmaster as too untrained and too ignorant to be a competent ally as an experimenter in mental fields. . . . But now these studies are beginning to interest the rising generation of schoolmasters. If some of us were not so busy organising laboratories and propagating cookery recipes for oxygen and chlorine, we might have leisure to explore the material lavished around us in the minds of our pupils."

As for the book itself, it is deserving of the highest praise. The text is most clearly written. The experiments demand the simplest apparatus conceivable. Exercises and problems upon the experiments are scattered through the book. There are chapters on the brain and sense organs, on touch, heat, cold, and pain, on the machinery and experience of movement, on taste, smell, hearing,

on light and the eye, on how the eye is used in seeing, on the experience of sight, on action, and on memory. C. S. M.

The "J.R.B." Patent Adjustable Curve Ruler. (London: W. H. Harling.) Price 7*s.* 6*d.*, 10*s.*, and 12*s.* 6*d.*

DRAUGHTSMEN and students of engineering will find this curve ruler a useful addition to their stock of instruments. The instrument consists of a transparent strip of celluloid, which may be bent to fit any given curve, or to pass through a series of plotted points. The strip is clamped to two slotted brass bars, one of the clamps forming a swivel, which may be locked at any horizontal angle. The slotted bars may be clamped in any position and at any angle to a slotted wooden bar, which holds the whole appliance. Two other slotted brass bars may be clamped to the wooden bar in any position, and have hooks formed at the outer ends; these assist in bending the celluloid strip into the proposed curve, and give steadiness to the strip. Two celluloid strips are supplied, one about 0·05 and the other about 0·1 inch in thickness.

We have tested the appliance in drawing several curves, such as a curve to fit four points plotted at random, and the curves of a beam when loaded in various ways, and find that the maker's claims are justified. Curves of large or small radii of curvature are easily produced, and these are even and regular; the appliance is adjusted very simply, and retains the shape when once set, so that a curve may be duplicated many times.

Post Mortems and Morbid Anatomy. By Dr. Theodore Shennan. Pp. xv+496. (London: Constable and Co., Ltd., 1912.) Price 18*s.* net.

DR. SHENNAN is to be congratulated on having written a treatise that gives a full and lucid account of the whole art of performing necropsies; of studying scientifically the evidences of disease in the organs and tissues of the body, so far as these can be investigated in the post-mortem room; and of making permanent preparations of the material so obtained, either for investigation in the laboratory or for demonstration purposes in museums.

There is, perhaps, no branch of the work of the practising medical man for which such a guide-book is so urgently needed; and this work is sure to prove most helpful not only to the practitioner who is called upon to do autopsies, but also to the student who is acquiring a practical knowledge of pathology.

Though lacking originality, either in treatment or in matter, it is probably the most complete and well-balanced text-book in English dealing with practical pathology.

The illustrations are for the most part successful reproductions of photographs taken by the author and Mr. Norman; but some few of them (*e.g.*, Fig. 79) might with advantage have been replaced by drawings.

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.

WITH regard to the subject of "Forced Vibrations" dealt with by Prof. Perry in his letter in NATURE of June 27 (p. 424), Prof. E. H. Barton, of Nottingham, puts the matter very clearly on p. 150 of his "Text-book of Sound," 1908, where he states:—"The frequency of the impressed force to make the amplitude a maximum is *lower* than that natural to the system with friction, while the frequency of the impressed force to make the kinetic energy a maximum is *above* that natural to the system with friction, and equals that if friction be absent." "Moreover, the squares of these three frequencies form an arithmetical progression whose common difference is proportional to the square of the damping coefficient."

I think Prof. Perry means to convey that these slight eccentricities from syntonic symmetry may be negligible in acoustical investigations (owing to their being well within the limenal region of physiological audition), but may rise to values at which they can be no longer neglected in other branches of interest, such as the æther-acoustics of radio-telegraphy, &c.

Prof. Perry would be doing real service by furnishing a non-mathematical explanation of these eccentricities; the graphical demonstration is a somewhat lengthy process. JOHN L. DUNK.

July 1.

Mendel and Nägeli.

MR. L. DONCASTER has recently given one explanation of the strange neglect of Nägeli to appreciate the results of Mendel. Perhaps the following footnote from Eimer's "Organic Evolution" (tr. J. T. Cunningham, 1890), p. 53, may supply another:—"Nägeli in the introduction to his book speaks very severely of those who without any justification undertake to express opinions upon the origin and evolution of organisms. He claims this right exclusively for physiologists, and counts among the non-physiologists both Darwin and Haeckel. Against such a close corporation I protest."

The "book" referred to seems to be the "Mechanische-physiologische Abstammungslehre," published in 1884, and Mendel, who, if I remember rightly, was a professor of physics, is not likely to have fared better than Darwin or Haeckel, except for his then obscurity, at the hands of his distinguished correspondent. The treatment of Fleeming Jenkin's criticisms by Darwin himself forms a pleasing contrast to this misplaced pontificality. H. H. O'FARRELL.

The Avenue, Kew Gardens, July 1.

CONGRESS OF UNIVERSITIES OF THE EMPIRE.

IN an article which appeared in our issue of June 13 it was stated that fifty-four universities would send delegates to this Congress. The nascent university of Calgary was subsequently excluded from the official list, on the ground that for the present it proposes to confine its degrees to agriculture. It is not difficult to imagine the Secretary's feelings when he found that with the

exception of one of the smallest of the Canadian institutions which boasts the right of conferring degrees every university of the Empire would be represented. At the last moment the Chancellor of the Western University of London, Ontario, arrived in the somewhat better-known city of the same name, and the tale was complete. This is a fact of no small significance, especially when the character of the delegation is considered. Fourteen of the universities over seas were represented by their Executive Heads, and amongst the remaining delegates were thirty-six professors.

The proceedings of the Congress have been so fully reported in the daily Press that it is unnecessary to go into details. We can but attempt to give a general idea of the trend of its deliberations. Each of the six chancellors who presided over its sessions touched upon a different aspect of university work. Lord Rosebery, in his opening address, dwelt, very naturally, upon the importance of the Congress from an Imperial point of view.

"I cannot but help hoping that this congress, when it shall have separated, will leave behind it in some shape or another some permanent channel, however slight, through which the universities of the Empire can continue to communicate with each other when necessity shall arise, either as to methods or as to men, or to obtain hints from each other as to the best ways of working out their several problems." "I do not think that any intelligent observer can watch the course of the world without seeing that a great movement of unrest is passing over it—I cannot doubt for good. For the purpose of guiding that movement we need all the men that the universities can give us—not merely the higher intelligences that I have spoken of, but also men right through the framework of society from the highest to the lowest, whose character and virtues can influence and inspire others."

Lord Curzon pleaded that whatever further developments may occur in professional and technical education—and it is inevitable that it should become still more highly specialised—there is need for the humanities. Mr. Balfour, presiding over the session devoted to a discussion of the special problems which face a university in the East, dwelt upon the "collision which must occur between the growth of scientific knowledge in all its branches, and the traditions, beliefs, customs, which, after all, are the great moulding forces of social man." Lord Rayleigh placed the advancement of his subject in the forefront of a professor's duties. He also strongly urged the exaction of a higher standard of English from students, and of the capacity of giving expression to their thoughts. Lord Kenyon, who took the place of Lord Haldane, whose new duties made it impossible for him to attend, presented the case for the modern universities. The veteran Lord Strathcona gave an eloquent account of the history of university education in Canada.

Among the subjects which attracted most attention may be mentioned the specialisation of universities. Sir Alfred Hopkinson, Dr. T. H. Warren, Sir Arthur Rücker, and Sir J. J. Thomson pointed out that it is no longer possible for any university to represent all branches of knowledge. Any attempt at external control would be a fatal mistake. Universities must meet local needs; they must also give the most generous opportunities to the departments over whom their greatest teachers preside. As the Vice-Chancellor of Manchester expressed it—

"A great teacher arose in some subject—no one could foresee where it would be—he attracted students to hear him, drew to his lectures and laboratories men keen in pursuit of learning and science, whose researches he would direct, encourage, and stimulate. A wise university would provide him with assistants, enlarge his laboratories, even when it involved serious strain on its resources."

Specialisation requires greater mobility both of teachers and students. Interchange of teachers was urged by Dr. Barrett, of Melbourne, and others; especially in such subjects as geography, economics, Colonial history, and anthropology the migration of teachers would be as valuable to themselves as to the students and to the smaller universities which cannot maintain chairs in subjects for which the demand is relatively limited. Prof. Smithells urged the whole-hearted acceptance of technical and professional subjects and their embodiment in the university system on the same basis as other subjects, since universities alone can exact such a standard of preliminary training as makes higher work and progress possible.

As was to be expected, the question of entrance tests gave rise to an animated discussion, in which Mr. Matheson, Sir Edward Busk, Sir Christopher Nixon, Sir Alfred Hopkinson, Sir Oliver Lodge, and representatives of the Colonies took part. The balance of opinion was strongly against a uniform matriculation examination, and equally strongly in favour of "greater trustfulness in accepting one another's results." If A. is satisfied that the students which it admits have received a satisfactory school education, B. should allow them to enter its portals without further examination, even though they have not complied with all the tests which it imposes upon its own matriculants.

As a tribute to the memory of Dr. R. D. Roberts, the first secretary of the Congress, who died last November, a whole session was set aside for the subject of University Extension, to which he devoted his life.

The project for establishing an Imperial University Bureau was warmly advocated by Dr. Parkin, and accepted by the Congress with equal enthusiasm. One of the delegates of the University of London opposed it at the private meeting, on the ground that the work would be done more effectively by the Education Department, but when the vote was taken he had but one supporter. All the other delegates present voted in its favour. It will be primarily a bureau of information. In its journal or yearbook will be recorded all changes in subjects taught, equipment and *personnel* which occur in the universities of the Empire. It will answer the questions of Colonial students who are selecting a university in the Mother Country, and of students and teachers who think of emigrating. Sir

Newton Moore, Agent-General for Western Australia, spoke of the immense saving of labour which such a bureau might have effected in his office last year, when the establishment of the University of Perth was under consideration. The delegates also resolved that it is desirable that the Congress should meet at intervals of five years, and that both in the United Kingdom, in the several great dominions and in India representatives of universities should meet annually.

The entertainments offered to the Congress were of remarkable interest. The Government invited the delegates to lunch at the Savoy Hotel. They were seated at thirty round tables, with a member of the Government or the Chancellor of a University at each. Prince Arthur of Connaught, President of the General London Committee, replying to the second Royal toast, said that the Royal Family had shown its appreciation of a university training by giving the Heir to the Throne the opportunity of sharing it for the last two generations, and that a university course is contemplated for the Prince of Wales. Mr. Lewis Harcourt, in a most felicitous speech, proposed the toast of the Congress, to which Lord Rosebery and Principal Peterson, of the McGill University of Montreal, replied.

In the evening Prince Arthur received the delegates in the Marble Hall of the University of London. Chancellors and Vice-Chancellors grouped themselves behind the Prince. The conversazione which followed was attended by 2500 people, most of the men and many of the ladies in academical robes. On Wednesday and Thursday, delegates were invited to dinner by the Clothworkers', Merchant Taylors', Fishmongers', Vintners', and Leathersellers' Companies; the Countess Beauchamp received them later at her house in Belgrave Square. The Victoria League and the Marchioness Dowager of Bute gave a garden party. There was an "at home" at the Mansion House. The Royal School of Medicine for Women gave an "at home." Mrs. E. B. Sargant gave a delightful party at Claridge's. The Principal and Staff of King's College invited a large number of delegates to dinner. The British Academy arranged the second annual Shakespeare lecture for the Monday night, and followed it with a *soirée*. The delegates from overseas are now on tour, receiving similar hospitality at Oxford, Birmingham, Manchester, Liverpool, Leeds, and Cambridge. Before the meeting in London they visited the Scottish universities, Dublin and Durham.

Not the least important result of the meeting of the Congress will be the Report, which will necessarily be a bulky volume, since it will contain, in addition to all the papers prepared for and speeches made at the Congress, appendices of information regarding the regulations and practices of all British universities with regard to the matters which were discussed at the Congress. It will be published early in the autumn, and will be obtainable from the Congress Office, University of London.

GEODETIC WORK IN THE ORDNANCE SURVEY.[1]

IT is with very great pleasure that we record the issue of the first of a new series of Professional Papers by the Ordnance Survey. The fundamental work of the Survey is recorded in a series of volumes which form one of the most important contributions to geodesy that have been made; but in more recent years new material has oftener been referred to in the annual progress reports than dealt with thoroughly in special publications such as the one before us. At the present time, when there is already high-grade work in hand, and much more will be required in the survey of all parts of the Empire, the experience gained by the great survey establishments is of the highest value to those engaged on similar work in the oversea Dominions and the Crown Colonies.

The present paper deals with the measurement of a base-line at Lossiemouth, which is the outcome of a representation made by the Council of the British Association for the Advancement of Science in 1908 to the Board of Agriculture and Fisheries, that it was highly desirable to ascertain the accuracy of a portion of the principal triangulation of the United Kingdom remote from the principal bases at Salisbury Plain and Lough Foyle.

Three invar tapes, 100 feet long, were employed, and the first two chapters of the paper describe the preliminary operations and the procedure employed in making the measurements. The next three chapters contain a very valuable and interesting account of the standardisation of the 10-foot Ordnance Intermediate Bar, OI_1, at the Bureau International des Poids et Mesures at Sèvres, the standardisation of a subsidiary standard bar, OI_2, at Southampton, and of a 100-foot base, as well as of two standard invar tapes, at the same place.

In the field a 100-foot base was laid down with the aid of these two standardised tapes, and with it the three invar tapes which were used for the measurement of the base were compared on four occasions during the work.

The last two chapters contain a very useful discussion of the theory of tapes in catenary, due to Prof. O. Henrici, F.R.S., and Captain E. O. Henrici, R.E., which ends with a summary of the errors affecting a base measurement, omitting, however, the possibility that the tapes or wires may not always be at the same temperature as the air. All possible errors should be considered in determining the probable accuracy of a base, and not only the discrepancy between the two or more measurements made, as is sometimes the case. The final value for the base is given as 23,525·97944 feet, with a probable error of 1 in 900,000.

1 "An Account of the Measurement of a Geodetic Base Line at Lossiemouth in 1909, together with a Discussion of the Theory of Measurement by Metal Tapes and Wires in Catenary." Ordnance Survey Professional Papers. New Series, No. 1. Pp. 39. (London: H.M. Stationery Office; Wyman and Sons, Ltd.; Edinburgh: Oliver and Boyd; Dublin: E. Ponsonby, Ltd., 1912.) Price 2s.

We should have welcomed details of the measurements actually made on the different sections, for these are not given. The sections were of the length that could be measured in a day, and apparently between ten and twenty of them were comprised in the base, since they were from 1200 to 2400 feet in length; three measurements were made with different tapes, but we see no mention of each section being measured in both directions. A comparative table, setting forth all the measurements for each section, the temperatures, tensions employed, time occupied, &c., as well as the character of the weather encountered, would have been of much interest, for at least on one day we are told that the wind made measurement impossible. A plan of the base site and a section of the line would also have been very useful to geodesists, who will look forward with interest to further publications of this character by the Ordnance Survey. H. G. L.

THE SHEFFIELD MEETING OF THE BRITISH ASSOCIATION.

PROVISIONAL PROGRAMME OF SECTIONS.

ARRANGEMENTS for the programmes of the various sections of the British Association at the meeting to be held in Dundee on September 4–11 are now approaching completion. By the courtesy of the Recorders of the sections we are able to give a forecast of the main subjects to be brought forward for discussion. Judging from this provisional statement, the scientific proceedings of the meeting promise to be of wide interest.

SECTION A (MATHEMATICS AND PHYSICS).—The presidential address in Section A will be delivered at 10 o'clock on Thursday morning, September 5, by Prof. H. L. Callendar, F.R.S. The principal items arranged by the committee for subsequent days consist of three discussions. The first, to be held in conjunction with Section G (Engineering) is to be opened by Prof. J. A. Fleming, on the subject of the scientific theory and outstanding problems of wireless telegraphy. In his opening remarks, Prof. Fleming intends to put forward a large number of questions which still require an answer, and to make suggestions of his own towards supplying a complete answer. It is expected that Prof. A. E. Kennelley, Prof. A. G. Webster, and Prof. A. Sommerfeld will be able to attend, together with a large number of British investigators, and it is hoped that the meeting will form an exceptional opportunity for physicists, mathematicians, and engineers interested in this question to expound their own and criticise each other's views. The second discussion is on the atomic heat of solids, and is to be opened by Dr. F. A. Lindemann, of Berlin. Section B will collaborate in this discussion. There is probably no subject which combines in a greater degree speculation and experiment, and there is certainly none which can claim to be more the question of the present day, and it is intended that the discussion should familiarise English scientific men with the subject. The third is on series in spectra, with Prof. E. T. Whittaker as its opener. Dr. Whittaker is expected to deal with it chiefly from the dynamical point of view. Papers are coming in, but the programme is still incomplete. Those who desire to read papers are reminded of the new order of the council that "no abstract shall appear in the annual report unless it is in print before the meeting," and no abstract can be so printed unless received during this month.

SECTION B (CHEMISTRY).—The proceedings of Section B should prove very attractive to followers of organic chemistry and its biological application. A sitting will be devoted to the carbohydrates and allied subjects, at which papers will be read by Prof. Irvine, Dr. A. Harden, Dr. S. Mills, and Dr. E. F. Armstrong. These should provide a valuable account of the progress which is being made in this field. A second sitting will be occupied by a discussion of a more general nature on the migration of groups: Dr. A. McKenzie will open this with a summarised account of the Walden rearrangement, and a second paper will be read by Prof. K. J. P. Orton. At a joint meeting with the Botanical Section, fixed for Friday, September 6, several important papers are promised of interest to agriculturists and botanists, as well as to chemists. Dr. J. V. Eyre will deal with the enzymes of flax and the variations of the flax plant with locality, and it is expected that some discussion will ensue as to the possibility of reviving the growth of flax in the British Isles. Mr. A. Compton, of the Pasteur Institute, will give an account of some of the recent French work on plant enzymes; Prof. F. Keeble and Dr. E. F. Armstrong will deal with the biochemistry of flower pigmentation. Other papers on organic chemistry are promised from Dr. R. H. Plimmer, Prof. C. R. Marshall, and Dr. J. K. Wood. A joint meeting will be held with Section A, when, following the discussion on specific heats, papers will be read by Dr. A. Holt, Dr. C. H. Desch, Prof. H. Marshall, and Mr. A. J. Berry.

SECTION C (GEOLOGY).—A large number of important papers has been promised for the meeting at Dundee, and these include several which will form the basis of discussions. Dr. Gordon, of the Geological Department of Edinburgh University, will read a paper on the fossil flora of the Pettycur Limestone, Fife, and its bearing on botanical evolution, which will be followed by a discussion, in which several leading members of the Botanical Section have promised to take part. A paper by Dr. J. S. Flett on the sequence of volcanic rocks in Scotland in relation to the Atlantic-Pacific classification of Suess, will also form the basis of a discussion, which, as several leading petrologists are expected to be present, should prove of considerable interest. Papers dealing with the recent discoveries of fossil remains in the Chert and Green Schist Series of the Highland border, north of Stonehaven, and in the neighbourhood of Aberfoyle, will be read by Dr. Campbell and Dr. T. J. Jehu, and the latter will also give an address on the geology of the country round Dundee and St. Andrews. Dr. Peach and Dr. Horne will contribute a joint paper on the Archæan rocks of the Island of Lewis. In all about twenty-five papers have been promised up to the present time. Excursions will take place during the meeting, including a visit to the famous fossil fish locality at Dura Den, where the quarry has been specially reopened, and at the close of the meeting a joint excursion with the Geologists' Association to Aberdeen and Arbroath has been arranged.

SECTION D (ZOOLOGY).—The president of the section is Dr. P. Chalmers Mitchell, F.R.S. There will be a joint discussion with Section K on the origin of life, opened by Prof. E. A. Minchin, and a joint discussion with Section I on physiological conditions in aquatic animals. Prof. A. Pütter (Bonn) will speak upon this subject. Among the papers to be brought before the section are the following:—Life-history of a water beetle, Balfour Browne; note on some results of the

Aberdeen University bird-migration inquiry, A. L. Thomson; metamorphosis and origin of the flat fishes, Dr. H. M. Kyle; on Scottish fisheries, 1898–1912, Prof. MacIntosh, F.R.S.; life-history of Echinocardium, Prof. MacBride, F.R.S.; the survey of the fresh-water fauna of India now being conducted by the Indian Museum, Dr. Nelson Annandale; the fresh-water plankton of Lough Neagh: a seasonal study of the form variation in plankton organisms, Dr. W. J. Dakin; and the so-called speech in lower animals, Prof. R. J. Anderson. A collection of specimens and material of zoological interest will be on exhibition, and many zoologists have promised to contribute to it.

SECTION G (ENGINEERING).—Prof. Barr, the president of this section, will probably take for the subject of his address the relation of the engineer to the public, and the responsibility which rests upon the engineering profession of carrying out works of public utility with due regard to the convenience and public health of the community, and a high standard of æsthetics. A joint discussion on wireless telegraphy with Section A will be opened by Dr. Fleming, and a discussion on the gas turbine will also take place with Dr. Dugald Clerk and Herr Holzwarth, of Mannheim, as the principal speakers. The committee on gaseous explosions will present a report on the turbulence of gases in engine cylinders and other matters. An interesting group of papers relating to naval architecture has been arranged for. Prof. Biles will deal with the rolling of ships; Prof. Gibson will describe his experiments on the suction between passing vessels; Mr. Axel Welin will read a paper on lifeboats for ocean-going steamers; and Prof. Henderson will consider various problems of propulsion in air and water. The navigation of the air will also be dealt with in a paper by Prof. Chatley on the control of aëroplanes. The road problem will be the subject of a paper by Sir John H. Macdonald, and a paper will be given by Mr. Wimperis on the acceleration of a motor-car. Arrangements have also been made for a group of papers relating to the materials of construction. Mr. Haigh will describe a new machine for alternating load tests; Prof. Coker will read a paper on optical and electrical methods of determining the stress distribution in springs and other bodies; Prof. Hopkinson will give an account of some further experiments on the force of a blow, and Mr. Larard will show some kinematograph pictures of torsion tests. Papers on telephone circuits by Prof. Kennelly, alternating-current motors by Dr. Wall, and magnetic hysteresis by Prof. E. Wilson, have also been arranged for. Mr. R. S. Whipple will give an account of a new coal calorimeter, and Dr. Owens will describe some experiments on the effect of town air on the strength of building stones.

SECTION H (ANTHROPOLOGY).—The president, Prof. G. Elliot Smith, F.R.S., will read papers on early attempts at mummification in Egypt, and on the physical character of the ancient Egyptians of the second and third dynasties. A paper by Prof. G. A. Reisner will describe his excavations at the pyramids of Giza, and Prof. W. M. Flinders Petrie will give an account of early dynastic discoveries. Mention may also be made of papers by Mr. J. E. Quibell on excavations at the Sakkara Pyramids, and by Dr. F. Wood Jones on the ancient and modern Nubas. Mediterranean archæology will be covered by communications from the British School at Athens, including an account of recent excavations at Halos in northern Greece, by Messrs. A. J. B. Wace and M. S. Thompson, and a paper by Mr. T. E. Peet on megalithic monuments in the Mediterranean area. In British archæology, Mr. Marett will describe fresh evidence of palæolithic man in Jersey, Mr. Willoughby Gardner the excavation of a hill fort near Abergele, and the Rev. O. Blundell his investigations of artificial islands in Scottish lochs. The ethnographical papers include Dr. W. H. R. Rivers's communications on conventionalism in primitive art and on navigation among primitive peoples, and Dr. C. S. Myers's description of Sarawak music.

SECTION I (PHYSIOLOGY).—This year will be distinguished by the number of well-known foreigners attending the section, more than twenty having accepted the invitation to be present. Apart from the address of the president of the section, Dr. Leonard Hill, F.R.S., and the reports of the various committees, the provisional progamme is given below. One day (Friday) is to be devoted to psychology. A discussion on the relation of mind to body, in which Prof. Latta, Sir T. S. Clouston, Dr. J. S. Haldane, and Dr. H. J. Watt will take part, will be one of the features of this day. The following papers will also be read: Dr. J. L. McIntyre, rôle of memory in animal behaviour; Mr. C. W. Valentine, on a suggested physiological theory of the horizontal vertical illusion; Mr. S. Dawson, on binocular and uniocular brightness discrimination. A discussion on the physiology of aquatic organisms with Section D (Monday) will be opened by Prof. B. Moore; Prof. A. Pütter will also take part. On Tuesday a discussion will be held on animal nutrition (see agriculture). Prof. Heger, of Brussels, has promised a kinematograph demonstration, and the following papers will be read:—Prof. Leon Asher, on permeability of cells and a new method of vital staining; Prof. Max V. Frey, striated muscle under the action of veratria; Dr. E. Gley, le métabolisme du calcium chez l'animaux éthyroidés; Prof. Francis Gotch, colour perimetry in the dark-adapted eye; Prof. A. Kossel, die guanidingruppe im proteinmolkül; Prof. J. J. R. Macleod, the relationship of the adrenal gland to the sugar content of the blood; Prof. C. R. Marshall, (1) the physiological action of quaternary methyl, ethyl, and methyl-ethyl ammonium compounds, (2) on coriamyortin and tutin, (3) the pharmacological action of nitric esters; Dr. R. R. Rentoul, the prevention of mental degeneracy; Dr. A. P. Waller, (1) Herbert Mayo and the facial nerves, (2) the electrocardiagram by the oscillograph.

SECTION K (BOTANY).—The main purpose of the address of the president, Prof. F. Keeble, will be to show that the Mendelian method used by students of genetics in investigating the inheritance of plant and animal characters is an invaluable adjunct to the physiologist. In illustration of the need of this co-operation between genetics and physiology an account will be given of the result of recent research in the origin of plant pigments. In the course of this account the work done on the subject by Prof. Keeble in collaboration with Dr. Armstrong, will be described. A morning sitting will also be devoted to a joint meeting with Section B (Chemistry), during which kindred subjects will be discussed. The basis of the discussion will be the recent work of Dr. Eyre on enzymes, a summary of which will be given by Mr. Compton. The discussion will be followed by papers on genetics and related subjects. A joint meeting has also been arranged with Section D (Zoology), at which the question of the origin of life will be introduced by Prof. E. A. Minchin, F.R.S. On Monday afternoon a semi-popular lecture will be given by Mr. Burkill on the botany of the Abor expedition. The lecturer will present the results of a study of the hills of eastern Himalaya, and his account will be illustrated by numerous lantern slides taken during the expedition. Papers have also been submitted dealing with various points related to the bacteria gymnosperms, ecology, physiology, and palæontology.

SECTION L (EDUCATION).—Prof. J. Adams, president of the section, has selected as the subject of his address, the possibility of objective standards in education. His aim is to estimate how far education has progressed in its way to be a science, and, with this in view, he proposes to examine the various developments of experimental work in psychology and pedagogy. In the section itself, the papers and discussions will centre chiefly in the subjects which for some years past have been arousing popular interest. Thus the chief matters already down for consideration are vocational training, the present position of mathematical teaching, the psychological processes involved in learning to read, write, and spell, with special reference to their practical bearings, leaving certificates, and the Scottish Education Department. In the discussion of vocational training, Miss Faithfull, of the Cheltenham Ladies' College; Miss Burstall, of the Manchester High School; Mr. J. L. Holland, director of education to the Northamptonshire County Council, Mr. J. W. Peck, clerk to the Edinburgh School Board; and Dr. Morgan, president of the Educational Institute of Scotland, have promised to take part. The discussion on the present position of mathematical teaching is particularly opportune, as it was Prof. Perry's paper on "The teaching of Mathematics," read at the Glasgow meeting of the association, that was responsible for developments that are now being criticised. Among those who have promised to take part are Sir Oliver Lodge, Prof. Perry, Dr. T. P. Nunn, Dr. Pinkerton, Mr. W. P. Milne, and Mr. W. D. Eggar. The discussion on the psychological processes involved in learning to read, write, and spell has been organised by the sectional committee on mental and physical factors involved in education. Papers will be read by Miss Foxley, Prof. Green, Dr. Rusk, Mr. F. Smith, Mr. Dumville, and it is hoped that Dr. C. S. Myers, Mr. Bompas Smith, Dr. Rivers, Mr. W. McDougall, Dr. Wm. Brown, and others will attend and take part in the discussion. The discussion on the Scottish Education Department is to be opened by Principal Sir James Donaldson, and Mr. J. Strong will deal with the Scotch leaving certificate. The reports to be presented to the section deal with the question of overlapping between school and university, the relation of school-books to eyesight, and tests for mental defect.

SECTION M (AGRICULTURE).—The first meeting of the new section of the British Association—Section M (Agriculture)—promises to be of very special interest and importance to the great industry which it is designed to help by the promotion of science in this direction. The district round Dundee is famous for more than one branch of farming, which has been carried to a high degree of perfection, and the following programme shows that the local interests have been made a special feature. On Thursday, September 5, the presidential address will be given by Mr. T. H. Middleton. The remainder of the day will be devoted to papers dealing with milk. On Friday, September 6, Mr. R. H. Rew, of the Board of Agriculture, will read a paper on the sources of the nation's food supply, and Major P. G. Craigie, C.B., will contribute a paper on Scottish agricultural production —half a century's changes. A paper will also be contributed by Prof. J. Wilson, on a consideration of the profits realised from the usual field crops, more especially from temporary pasture. The remainder of the day will be devoted to two special papers on the agriculture of the district. On Monday, September 9, a joint meeting will be held with the Meteorological Department of Section A, the subject being the connection between meteorology and agriculture. Dr. W. N. Shaw, F.R.S., will read a paper on the practice of cultivation in relation to our knowledge of climate and weather, and Mr. A. Watt, secretary of the Scottish Meteorological Society, will open the discussion. Other general papers on this day will deal with the action of quicklime on soil, studies on nitrogen fixation, the rate of evolution of hydrocyanic acid from linseed, the influence of origin and topography on grass lands, and the problem of disease resistance. On Tuesday, September 10, will be held a joint meeting with Section I (Physiology) on the important subject of animal nutrition. The discussion will be opened by Prof. F. G. Hopkins, F.R.S., and continued by Prof. Leon Asher (Berne), Dr. E. P. Cathcart, Dr. C. Crowther, Dr. Leonard Hill, and Dr. Martin Flack, Prof. J. J. R. Macleod (U.S.A.), and Prof. T. B. Wood. This is the first time within recent years—if not the first time at all—when the practical feeder and the physiologist have met, and when the stores of knowledge and experience of the practical man have been drawn upon by the man of science.

NOTES.

WE are informed by the Royal Society that the Mackinnon studentships for the ensuing year have been awarded to Dr. H. M. Kyle (St. Andrews) for a research on the metamorphosis and origin of the flat fishes, and to Mr. A. L. Hughes (Emmanuel College, Cambridge), for a research on the ionisation in mercury vapour produced by ultra-violet light.

THE John Harling fellowship for the encouragement of the study and research in physical science in the University of Manchester, has been awarded to Mr. H. G. J. Moseley, who was until recently an assistant lecturer and demonstrator in the department of physics in the University, and to Dr. T. S. Taylor, now instructor of physics in the University of Illinois.

THE Franklin Institute of Philadelphia, Pa., has awarded the Edward Longstreth medal of merit and diploma to Dr. Charles Baskerville, professor of chemistry and director of the laboratory at the city of New York, for his investigations on the chemistry of anæsthetics.

AMONG the victims of a terrible colliery accident at the Cadeby Pit, Yorkshire, on Tuesday, July 9, were three inspectors of mines, including Mr. W. H. Pickering, chief inspector for Yorkshire and the North Midlands. An explosion took place in the main pit early in the morning, and thirty men were killed by it. A rescue party was at work in the pit later in the day when several additional explosions occurred, and many other lives were lost, among those who suffered death while in the work of rescue being Mr. Pickering. Mr. Pickering was a Fellow of the Geological Society and the author of papers in the Transactions of the Institution of Mining Engineers and other societies. He was an authority on English and Indian coal mining, and founded the Mining and Geological Institute of India. His death will be deeply regretted by a wide circle of friends.

A COMMUNICATION of Prof. C. D. Perrine to the issue of *Science* of June 28 states that upon the recommendation of the Minister of Public Instruction the Argentine Congress has provided in its budget for 1912 a 5-ft. reflecting telescope for the National

Observatory at Córdoba. It is expected to erect this telescope in the mountains to the west of and close to Córdoba, where preliminary investigations have already been made and the meteorological conditions found to be good.

As was announced in the issue of NATURE for January 4 last, the Congress of the Royal Sanitary Institute will be held this year at York on July 29–August 3. The names of the presidents of the various sections into which the work of the congress is divided have already been given. It is now known that the lecture to the congress will be delivered by Prof. Karl Pearson, F.R.S., his subject being "Eugenics and the Public Health." Prof. H. R. Kenwood will give the popular lecture on "The Healthy Home." More than 250 authorities, including foreign and colonial Governments, Government departments, county councils, universities, and societies have already appointed delegates to the congress, and a large attendance is expected. A health exhibition of apparatus and appliances relating to health and domestic use will be held in illustration of the principles and methods discussed at the meetings. Excursions to places of interest in connection with sanitation, a conversazione, garden-parties, and other entertainments have been arranged.

THE International Radio-telegraphic Conference, which has been sitting in London since June 4, has concluded its meetings, and an official statement has been issued showing the main points of the resolutions considered and new regulations proposed. Special consideration was given to the question of the use of wireless telegraphy for the prevention of disasters at sea, and after full discussion the conference passed unanimously a resolution in favour of the principle of compulsory equipment of ships with wireless telegraphy. The new regulations contain several provisions intended to render more effective the service of wireless telegraphy in cases of distress at sea. Ships will in future be required to provide an auxiliary source of power able to work the wireless apparatus for at least six hours. Rules have also been made for both ship and shore stations to suspend work and to listen at the end of each quarter of an hour in cases where it is likely that distress calls might otherwise not be heard. Provision has been made for giving priority of transmission to weather reports from ships and for keeping coast stations supplied with weather forecasts for communication to ships on demand. It is now agreed that all ships should be under the obligation to intercommunicate with one another, irrespective of the system of radio-telegraphy employed. An invitation to hold the next conference in Washington was unanimously accepted, and 1917 was fixed as the date at which the conference will be held.

IN *Man* for June, Mr. C. M. Barreau contributes a paper on the bearing of the heraldry of the Indians of the north-west coast of America upon their social organisation. The intricate system of clans with their phratries is clearly explained, and it is shown that two modes of social grouping prevail in the Kwakiutl tribe. In summer they are arranged in clans, but this organisation is broken up in winter, when they arrange themselves in two large fraternities. This is due to the fact that while the child may belong either to the clan of the mother or father, his right to admission into a fraternity may not only be inherited from his parents, but is often secured by payment or by other means. These fraternities are concerned with ritual dances, dramatic performances and potlatches or feasts, while others initiate members in order to cure disease or practise sorcery. Each clan bears a representation of the animal or object after which it is named, and through which the members are connected by ties of special affinity.

IN *L'Anthropologie* for March-April, Dr. G. Lalanne, under the title of "Bas-reliefs à figuration humaine de l'abri sous roche de Laussel (Dordogne)," describes two remarkable rock carvings, one of a male, the other of a female. The block on which the female carving appears now lies outside the excavation. It represents a woman in profile, holding the horn of a wild ox in her hand, but nothing remains to indicate the expression or the mode of arrangement of the hair. It is apparently of the Palæolithic type which has already been discovered at Brassempouy in the Landes, Menton, and Willendorf in Austria. These discoveries appear to indicate that in the Aurignacian period Central Europe, and possibly the Mediterranean area, were occupied by a negroid race, characterised in the female by well-marked steatopygy, such as that which appears among the modern Bushmen. The male image, on the other hand, displays a delicacy of form which is in direct contrast to that of the female.

IN the June number of *The Zoologist*, Col. Shepherd continues his account of the pharyngeal teeth of fishes, dealing in this instance with those of the carp group (Cyprininæ), in which the lower pharyngeal teeth bite against a callous pad.

WE are glad to see that public interest is being aroused in the potential dangers connected with the house-fly. The case against the insect is stated in a striking article in the July number of *Pearson's Magazine*, which contains the views of several authorities upon public health as to the dangers of its presence. House-flies play no inconsiderable part in the dissemination of certain diseases, and every encouragement should be given to a campaign which aims at reducing their numbers.

TO the *Revue générale des Sciences* of June 15 Mr. Louis Gain, naturalist to the second French Antarctic expedition, contributes a very fully illustrated account of the distribution and habits of the Adélie penguin (*Pygoscelis adeliae*). This bird, which was first met with by Dumont d'Urville in 1841, may be considered the most characteristic inhabitant of the Antarctic continent and islands, never ranging to the northward of 60° S. lat., and communicating, even when not seen, a sign of life to these dreary regions by its oft-repeated, although harsh, cry of *kaah, kaah*.

RECENT observations seem to show that certain yeasts and yeast-like forms may undergo a process of conjugation in some part of their life-cycle. The

process differs considerably in different species. In the Schizosaccharomyces and Zygosaccharomyces the ascus is formed by conjugation of two cells recently derived from a single parent cell. In Debaryomyces the ascus is derived from the fusion of a large cell (macrogamete) with a small cell (microgamete), the former being a mother cell, the latter being a bud derived from this mother cell. In *Saccharomyces ludwigii* and *S. ellipsoideus*, conjugation takes place between the formed ascospores at the moment of their germination. In certain sporing bacteria also, conjugation is stated to occur between sister cells, the zygote giving rise to the spore (A. Nadson and H. Marchand, refs. in *Bull. de l'Inst. Pasteur*, x., 1912, No. 10, pp. 447 and 449).

WE have received a copy of a reprint from an article in vol. iv. of *Verhandl. Naturwiss. Ver. in Karlsruhe*, published by G. Braunsche, of that city, and entitled, "Gomera, die Waldinsel der Kanaren." It is the journal of a German naturalist, who made a traverse and a perambulation of that little-known island for the purpose of studying its biology, inclusive of that of the coast. Although Gomera, which lies somewhat to the south of a point midway between Teneriffe and Las Palmas, forms little more than a dot on our maps of the world, it is really a microcosm, containing as it does lofty mountains, deep valleys, steep cliffs, primeval forests, and many streams and waterfalls, together with ancient towns and villages, and a population numbering thousands. The journal is well illustrated, and contains a list of the animals (of which a few are new) and plants collected by the author.

IN the June issue of *The Journal of Economic Biology*, the editor, Mr. W. E. Collinge, fully endorses the unanimous verdict of gardeners and fruit-growers as to the extremely mischievous nature of the bullfinch, and the great increase in its numbers which has taken place of late years in this country. Mr. Collinge's observations are based on an analysis of the contents of the stomachs of 308 of these birds, which were killed at different seasons in five counties. As the result of this analysis, it was found that from January to May the food of the bullfinch "consists largely of fruit-buds and fruitlets, and in addition to those which are eaten, an equal, or even larger, number are wantonly destroyed by this bird." The author then goes on to observe "that the bullfinch is for quite half the year most destructive in fruit orchards, causing considerable losses to growers, which far outweigh any little good it may do in keeping down the spread of weeds. Indeed, its value in this respect is extremely doubtful, for it certainly helps in the distribution of such weeks as dandelion, dock, groundsel, ragwort, charlock, &c." Although he does not say so in so many words, Mr. Collinge is evidently of opinion that the numbers of these mischievous birds ought to be largely reduced.

THE Bulletin of the Department of Agriculture, Trinidad and Tobago, deals with sugar, cacao, cocoanuts, rubber, and other crops. Mr. Gough has drawn up a useful list of the fungoid parasites of the sugar-cane observed in Trinidad, the material being partly collected by himself and partly gathered from records by Went, South, and others. A report is given of the exhibit of rubber sent to the International Rubber Exhibition of 1911, which was considered by the experts to be promising, and to indicate that the West Indies, though behind the big plantation centres of Ceylon and Malaya, are fast improving, and may become serious competitors in a few years.

THE report of the entomologist for the Dominion of Canada (Dr. C. Gordon Hewitt) shows that the enactment of the Destructive Insect and Pest Act came none too soon, for serious losses have arisen through the attacks of pests imported into Canada with nursery stock from all parts of the world. The brown-tail moth (*Euproctis chrysorrhoea*) has caused a great amount of trouble, having increased very much in certain areas of Nova Scotia and New Brunswick. A systematic campaign has now been started against it. The gypsy moth, narcissus fly, and larch sawfly are under investigation, and other pests are also being studied.

A SERIES of papers is to hand from the Biological Laboratory of the Maine Agricultural Experiment Station, in which Dr. Pearl describes his recent investigations into heredity in poultry and in maize. Fecundity is a highly desirable property in poultry, but it is not a unit character, and no line could be obtained that is absolutely pure in this respect. Lines were studied, however, which breed reasonably true to a definite degree of fecundity, and an analysis of the results is made. The results with maize indicate that certain chemical characters are inherited in essential accordance with Mendelian principles, exhibiting the phenomena of dominance, recessiveness, and segregation. The interesting fact is that no visible character seemed to be correlated with these chemical properties.

A VERY complete account of the fig moth (*Ephestia cautella*, Walk.), by Dr. Chittenden, has been issued as Bulletin 104 of the Bureau of Entomology, United States Department of Agriculture, and in it is incorporated a report by E. G. Smyth of the fig moth in Smyrna. A large proportion of the imported figs were found to be badly infested with this pest, sometimes from 15 to 50 and even higher percentages of infested fruit being present. The approximate proportion was estimated from the amount of excreta. The insect lives on a number of dried foods, and is a serious pest of chocolate; some of the infested material is said to be on the market.

THE first part of vol. iv. of the Journal of the College of Agriculture, Imperial University of Tokyo, is devoted to two papers by Prof. S. Kusano. One of these deals with *Gastrodia elata* and its symbiotic association with *Armillaria mellea*. The orchid Gastrodia is widely spread throughout Japan, and is found growing on rich organic soils, mostly in *Quercus serrata* and *Q. glandulifera* woods. The fungus Armillaria is associated with the orchid, but the relationship is not quite of the usual mycorhiza type, and the exchange of nutritive substances is not equal; Gastrodia appears to be a parasite on the fungus, which suffers by the association.

RECENT issues of *The Agricultural Journal of the Union of South Africa* have contained a series of interesting papers by Dr. Theiler on gall sickness in cattle. The disease shows certain relationships with redwater, and is caused by parasites of the red blood corpuscles, which are called anaplasms to mark their analogy with the piroplasms causing redwater, and are transmitted by ticks. Mr. Burtt-Davy contributes papers on poisonous plants found in the country. Many of these are known to the natives, some being used for arrow poisons, others for criminal purposes, while others again are used by the Kaffir doctors, who, however, have kept their knowledge so secret that white men have been unable to obtain it. Attention is directed in other papers to the value of the fig crop and the methods of working it up for the market.

AN interesting lecture on the investigation of the highest strata of the earth's atmosphere by Dr. A. Wegener (Marburg University) is printed in *Himmel und Erde*, Heft 7, 1912. He refers to the great discoveries made by meteorological observations in kites and balloons, which have already placed our ideas of the structure of the atmosphere on quite a new basis. The decrease of temperature with altitude was formerly considered to continue to the limits of the atmosphere, but the observations above referred to have shown that the decrease ceases at an altitude of about 11 kilometres, and that higher temperatures are recorded at much greater heights. But it is not with these low altitudes that Dr. Wegener is mostly concerned, but with the regions in which certain luminous phenomena are frequently observed, which show that at heights exceeding 200 and possibly 500 kilometres an atmosphere of appreciable density still exists. The article is accompanied by some excellent photographs of auroræ and meteors, and with opinions of different investigators relating to them. The author's investigations have led him to conclude that in the highest strata there must be an unknown gas, in addition to hydrogen, and lighter than this. For this gas he proposes the name "geocoronium," from its similarity to the unknown "coronium" of the solar atmosphere.

FEW places have suffered so repeatedly from destructive earthquakes as the island of Zante. Since the Venetian occupation of the island in the fifteenth century, there have been nineteen disastrous shocks, the two latest of which occurred on January 24 and 25 of the present year. These earthquakes and their successors form the subject of an interesting paper by Mr. G. Bonavia, the director of the Eastern Telegraph Company in Zante (*Boll. della Soc. Sismol. Ital.*, vol xvi., 1912, pp. 59–67). The epicentre was submarine, and lay between the islands of Zante and Cephalonia, but probably nearer to the latter, since it was in this island that the principal disasters occurred. Up to the end of April, the two initial destructive shocks have been followed by twelve strong, thirteen moderate, and forty-eight slight shocks.

MR. VERSFELD has recently examined geologically two areas in German South-west Africa, and has reported the results of his survey in the *South African Journal of Science* (vol. vii., 1911, No. 8, pp. 332–339, with two maps). He describes a part of the country extending from the Orange River for two hundred miles northward, and including the area around the hot springs of Warmbad. Most of the country is occupied by gneiss and granite covered with outliers of the Table Mountain Sandstone, upon which rest patches of Dwyka conglomerate. This ancient glacial deposit must have been very widely spread across the district, and at different places rests directly on all the rocks present. It is the youngest rock represented in the area, so that Mr. Versfeld concludes that the district has been a land surface since Carboniferous times. The second part of this report deals with the diamantiferous gravel along the coast near Luderitz Bay. The gravel has been described as Cretaceous and as marine, owing to the presence of marine shells; but these so-called fossils are only recent mussels and limpets which have been carried inland by the Hottentots. Mr. Versfeld explains the gravel as a subaërial deposit, and regards the diamonds as part of the débris from many diamond pipes. The statement that the matrix of the diamonds had been discovered in the district rests upon their occurrence in some cemented gravels.

WE have received a separate copy of Prof. Mie's paper on the foundations of a theory of matter which appeared in the *Annalen der Physik* for March. The theory is founded on the assumption that electric and magnetic fields occur within, as well as without, an electron; that electrons, in fact, are not bodies embedded in the ether, but portions of the ether itself in a special state, which we designate electrically charged. With the further assumption that the principle of relativity holds and that the electric and magnetic fields, the electric charge and its velocity suffice to specify completely all phenomena of the ether, Prof. Mie proposes to explain in the first instance why indivisible electrons exist, and why the existence of matter should imply necessarily the law of gravitation. Further instalments of his paper will be awaited with interest.

THE early history of Chinese mathematics is discussed in a short note by Prof. D. E. Smith in *The Popular Science Monthly* for June. That the Chinese were not behind other nations in their study of geometry and algebra is shown by (*a*) references to the Pythagorean proposition and a primitive trigonometry in the *Chow-pi* (supposed 1100 B.C.); (*b*) Chang Tsang (152 B.C.), who restored the "Arithmetical Rules in Nine Sections" (possibly 2650 B.C.), containing use of negative numbers, trigonometry of right triangles and simultaneous equations; (*c*) Sun-tsu's anticipation of the Diophantine analysis (probably in the third century); (*d*) the approximations to π, by Tsu Ch'ung-Chin (428–499 A.D.), including the limits 3·1415926 and 3·1415927; (*e*) Wang Hs'iao-t'sing's approximate solutions of the cubic in the seventh century. About the thirteenth century we find anticipations of Horner's method, analytical trigonometry, the so-called Pascal's triangle, spherical astronomy, and other work which leads the author to describe the period as the golden era of native Chinese algebra.

We have received from Messrs. Ozonair, Ltd., 96 Victoria Street, Westminster, London, S.W., a copy of their catalogue of Ozonair portable generators for purifying the air in rooms of from 3000 to 12,000 cubic feet capacity, the current being derived from the supply circuits or from portable accumulators. As the consumption of power is only from 10 to 130 watts, the apparatus can be connected to any lamp-holder or plug. The makers claim that their apparatus generates ozone which is practically free from oxides of nitrogen.

The French Société de Chimie-physique is publishing a series of monographs or lectures upon important topics in physical chemistry. Two of these, by Prof. Arrhenius, "Sur les atmosphères des planètes," and by Prof. Gaubert, "Recherches récentes sur la formation et le facies des cristaux," were issued in 1911; two further issues have just come to hand. These include a series of lectures on alloys by Messrs. Rengade, Jolibois, and Broniewski, and a lecture on "La pression osmotique et le mécanisme de l'osmose," by M. Pierre Girard. The lectures on alloys deal with thermal analysis and microscopic metallography, chemical methods applied to the study of alloys, and the relationship between the structure of alloys and their electrical properties. The lecture on osmotic pressure forms a valuable historical and critical review of the theory of osmotic pressure.

It is often a tedious process to obtain sulphuric acid of the necessary degree of purity for detecting or estimating minute traces of arsenic. In the *Gazzetta Chimica Italiana* (vol. xlii., i., 456) a simple process is described by G. Bressanin for this purpose. It consists in adding 10 c.c. of a 30 per cent. solution of hydriodic acid to a litre of the sulphuric acid, diluted to 50° Bé., leaving for twelve hours for the arsenic to separate, together with other metals, such as lead, tin, and copper, filtering through glass wool covered with a thin layer of asbestos, and finally boiling in a Jena glass vessel to expel the iodine liberated.

Under the title, "Solid Solutions of Iodine in certain Cyclic Hydrocarbons," some interesting observations are recorded by G. Bruni and M. Amadori in the *Gazzetta Chimica Italiana* (vol. xlii., p. 121). It has been known for some years that iodine gives abnormally high values for the molecular weight determined by the cryoscopic method, using benzene as solvent, and Beckmann concluded that this was due to some of the iodine separating with the congealing solvent in the form of a solid solution. In the paper now cited it is shown that *cyclo*hexane, C_6H_{12}, which Mascarelli in 1907 found to form solid solutions with benzene, behaves cryoscopically with iodine exactly in the same way as benzene itself, giving values ranging from 310 to 320 for the molecular weight of iodine instead of 254, calculated for I_2. When a very dilute solution of iodine in benzene or *cyclo*hexane is cooled in carbon dioxide snow, the colour of the solution is scarcely changed at all on solidification owing to the formation of the solid solution; whereas, with an ordinary solvent, such as bromoform or ethylene bromide, which gives normal values for the molecular weight, on solidification the reddish-violet colour disappears to give place to an opaque-greyish appearance, due to minute solid particles of free iodine separating.

Several important papers in the series dealing with water supply have recently been issued by the United States Geological Survey. They deal with the basin of the Missouri, with the lower basin of the Mississippi, with the rivers draining to the western Gulf of Mexico, and with California. It is pointed out in the general introduction to these papers that it is necessary to apply the money appropriated for the work over a wider field than it would be if only the scientific value of the work were under consideration. The appropriations made by Congress are applicable to all parts of the country, and each part demands its proportionate share of the benefits. It has been found, nevertheless, that the work of the Survey in this direction is of great practical value. Records have been obtained at nearly 2000 different points in the United States, including the reading of gauges, the measurements of discharge, precipitation, evaporation, reservoirs, river profiles, and water power, and some investigations have been made also in Alaska and Hawaii. In a special report on the Antelope valley of California, an interesting review is given of the manner in which land was taken up there in the early 'eighties without any knowledge of the available water supplies, how many farms failed in consequence, and even towns were left derelict, and how part of the country has subsequently been brought under cultivation by means of a careful system of irrigation.

OUR ASTRONOMICAL COLUMN.

Magnitude Observations at Harvard College Observatory.—An important contribution to stellar photometry is published in Circular No. 170 of the Harvard College Observatory, where Prof. Pickering gives the adopted magnitudes of ninety-six stars measured in the Harvard polar sequences. The first table gives the magnitudes of forty-six stars in the north polar sequence, the second the magnitudes of twelve stars in the N.P. sequence of red stars, and the third the magnitudes of thirty-eight supplementary standard stars near the north pole. Having had access to a large number of plates taken with different instruments, *e.g.* the 60-inch reflector at Mount Wilson, Prof. Pickering is able to give magnitudes down to the twenty-first; on a plate accompanying the circular an excellent photograph taken with the 60-inch reflector, and showing the stars near the north pole, is reproduced.

The periods of twenty-two variable stars are given in the same circular, with some interesting notes concerning the variations, in some cases irregular, and their connection with possible changes in the spectra.

In Circular 172, Prof. Pickering shows that amateur observers might perform valuable service to astronomy by observing the photographic magnitudes of asteroids and gives lists of suitable asteroids and data concerning them for the current year. The variability of polaris is discussed, from the Harvard observations, in Circular No. 174, and a light-curve showing the nature of the changes is given.

THE ASTROGRAPHIC CATALOGUE.—Part i., vol. viii., of the Catania *Catalogo Astrofotografico* gives 7923 positions of stars shown on fifteen plates covering the area oh. to 3h. R.A., and +53° to 55° declination; excluding repetitions the number of separate stars dealt with is 6916.

In vol. i. of the Perth section of the catalogues, Mr. W. E. Cooke gives the rectangular coordinates and magnitudes of 5646 star images between R.A. oh. to 6h., on plates having their centres at declination −32°, and in vol. v. of the Perth meridian observations, he gives a catalogue of 2043 stars between 35° and 37° south declination for the equinox of 1900. The stars of this latter catalogue are those selected as reference points for the astrographic catalogue, and were observed with the Perth 6-inch transit circle during 1910; they are distributed approximately at the rate of three per square degree.

POSITION OF THE RED SPOT ON JUPITER.—In a brief note communicated to No. 4583 of the *Astronomische Nachrichten*, the Rev. T. E. R. Phillips announces that recent observations made by him at Ashtead show that the red spot on Jupiter has continued to drift rapidly in longitude. Whereas at the end of June, 1911, its longitude (ω_2) was 325°±, in April last it was only 305°−306°.

THE DISEASES DUE TO FILARIA BANCROFTI.[1]

THE subject-matter of the work referred to below may be considered under three headings: (1) The transmission of filaria by mosquitoes. In Fiji the carrier is mainly *Stegomyia pseudoscutellaris*. The developmental stages are carefully described, but some of the illustrative plates are not very good. The author's experiment tending to show that the filarial larvæ find their own way in through the skin is a most interesting one. (2) The clinico-pathological facts, though scattered about the book and not blended into one harmonious picture, form some of the most valuable information supplied. No explanation is suggested for the absence of chyluria, generally taken as a typical filarial disease, nor is any light shed on the pathology of elephantiasis, but the concrete facts as to where really filariæ do occur, and what changes they produce, are a welcome addition to our knowledge. (3) The connection between filaria and the so-called filarial diseases is considered statistically. We have been at some pains to unravel the author's data from a variety of tables most confusingly presented, in which percentages are erroneously calculated and totals wrongly added up. They may be summarised in the following statements:—

(1) The prevalence of filarial diseases is proportional to the prevalence of filariæ larvæ (microfilariæ) in the blood:—

	Bau Per cent.	Oneata Per cent.	Takemba Per cent.	Loma-loma Per cent.
Microfilarial rate	12·5	25·4	31·5	32·88
Filarial disease rate ...	28·9	39·4	58·0	34·2

but, as will be observed, the relationship is not very close.

(2) If we consider *only* those showing microfilariæ in the blood, the *majority* shows signs of disease, viz. 153 with signs, 104 without. Total, 257.

(3) If we consider those *not* showing microfilariæ in the blood, they also show signs of disease, but now in a *minority*. With signs 263, without 409. Total, 672.

(4) Finally, if we consider *only* those showing signs of disease, the *minority* show microfilariæ in the blood. With microfilariæ 153, without 263. Total, 416.

The explanation of this latter fact, which might at first sight appear inconsistent with (2), is presumably that the worms which occur in enlarged glands, &c., get eventually destroyed in these sites, so that the sign of the disease which they have produced remains after the cause—the adult worm—has disappeared. We must also suppose that microfilariæ do not live indefinitely in the blood, otherwise this relationship could not occur, but if they disappear there probably will always be a majority showing signs of disease, but no microfilariæ in the blood.

As regards elephantiasis, its filarial nature is almost entirely based on epidemiological and statistical evidence, for the arguments that apply to the "signs of disease" as a whole apply to it as one of those signs. It should be noted, however, that in thirteen out of twenty-seven cases there were no visibly enlarged glands to account for a hypothetical obstruction, which is commonly presumed to be the cause of the phenomenon.

The arrangement of the book is not all that could be desired. The photographs with a different numbering from the plates are sprinkled among the latter in a way that makes them very difficult to trace, except by reference to the list of illustrations. The subdivision of the paragraphs, *e.g.* 111 (2) C is unnecessarily complicated, and several of those alluded to we have been unable to find. The defects in the statistical portion we have already mentioned. While it is clear that the book represents the results of much work, it also shows that very much more remains to be done.

[1] "Filariasis and Elephantiasis in Fiji." Being a Report to the London School of Tropical Medicine. By P. H. Fahr. Pp. viii+192. (London: Witherby and Co., 1912.) Price 6s. net.

THE ERUPTIONS OF THE ASAMA-YAMA (JAPAN) IN 1909–11.[1]

THE Asama-yama, situated in the central part of the main island of Japan, may be regarded as one of the most active of Japanese volcanoes. Its highest point is 8130 ft. above sea-level, and about 4200 ft. above the surrounding land. The present crater is about 400 ft. in depth and a quarter of a mile in diameter. The earliest recorded eruption took place in A.D. 685, the greatest in 1783. Since this year the volcano has remained comparatively quiet until within the last few years. Since December, 1909, the explosions have been very frequent, more than sixty having occurred within the next two years. The floor of the crater has also risen considerably during the last twenty years, and everything, in the opinion of Prof. Omori, who is closely studying the phenomena, points to the gradual approach of another epoch of great volcanic activity, possibly after a lapse of about twenty years.

At the request of the Japanese Government, the seismological examination of the mountain was undertaken by Prof. Omori, who also made three ascents of the mountain. Temporary seismographical observations were made at Yuno-taira and Ashino-taira, both places being situated on the south-western slope at heights of 4520 and 6300 ft. above sea-level, and in August, 1911, a seismological station of a more permanent character was established near Yuno-taira. The value of these observations consists in the fact that the tremors recorded belong to two distinct types. In one the shocks consisted of minute quick tremors only; in the other they began with slow movements, interspersed after a few seconds with quick vibrations. The earthquakes of the first type were accompanied by no outburst

[1] Abstract of a paper by Prof. F. Omori in the Bulletin of the Imperial Earthquake Investigation Committee, vol. vi., 1912, pp. 1–147.

of the Asama-yama; those of the second type were invariably the result of explosions of the volcano.

Some of the most interesting of Prof. Omori's results relate to the areas over which the volcanic detonations were heard and the ashes deposited. The detonations were produced entirely by air-waves, and were often heard as far as 180 miles from the volcano, although the shaking of the ground was insensible in its immediate neighbourhood. As a general rule, the sound-area diverged from the Asama-yama as apex towards the east or south-east, the sound being unheard at a short distance to the west of the volcano. In some cases the direction of greatest extent of the sound-area did not differ much from that of the prevailing surface-winds; in other cases it differed widely, or was even contrary. In two explosions the sound-area consisted of two detached portions, one including the Asama-yama, the other some fifty or sixty miles farther to the west. In one explosion only, the sound-area diverged from the vicinity of the mountain towards the north-east. But in neither of the last two types is there any relation between the distortion of the sound-area and the direction of the surface-wind.

The areas of ash-precipitation are generally narrow and triangular, the directions varying, with one exception to the west, from east-north-east to east-south-east, being usually in the latter direction. These areas are roughly symmetrical with respect to the sound-areas. The velocities with which the ashes were carried varied from thirty-eight to seventy-eight miles an hour, these being much greater than the velocities of the surface-winds at the time.

Prof. Omori concludes that the principal direction of extension of the sound-area is the same as that of the wind prevailing in the upper strata of the air, probably at a height of about five or six miles, this being the height generally attained by the columns of smoke which rose from the volcano.

C. DAVISON.

THE FRESH-WATER FAUNA OF CENTRAL EUROPE.[1]

PROF. ZSCHOKKE'S (1) monograph, which is provided with three excellent maps, gives a detailed account of the present state of our knowledge of the composition, distribution, and biology of the deep-water fauna of the lakes of central Europe. For purposes of description the lakes are divided into sub-alpine and high-alpine series. Lake Lucerne is taken as a prototype of the former, and an account is given of its various basins and their deep-water organisms. One hundred and ninety-eight samples of the bottom, including some from the maximum depth (214 metres), have been taken, and have been examined by various workers. The bottom of this lake (and of other sub-alpine lakes) is covered with fine mud, in which vegetable remains—fibres, leaves, pollen of conifers, &c.—are everywhere present, and in some places abundant. Among this material large numbers of Oligochæta, Nematoda, and insect-larvæ thrive.

The author gives a list of 141 species of deep-water animals—Protozoa, Cœlentera, Turbellaria, Nematoda, Rotifera, Oligochæta, Hirudinea, Polyzoa, Crustacea, Hydracarina, Insecta, and Mollusca—occurring in Lake Lucerne, the range of depth and locality of each species being indicated. He then proceeds to the systematic description of the deep-water fauna of the sub-alpine lakes in general, an account of each order or sub-order prefacing the remarks on the constituent species. The notes on each species indicate in which lakes it has been found, the range of depth at which it occurs, and there are in many cases observations on the biology, or on any special features presented by the distribution, including comments on the range of the species in other countries.

There is an interesting discussion on the "Kümmerformen" of the deep-water Mollusca, which are distinguished from their shore-dwelling relatives by their small size, fragile shells, and peculiar form. The author points out that, for instance, in the case of specimens of Pisidium living in deep water, the stillness of the water makes the secure closing of the shell and well-developed hinge-teeth superfluous, the poverty of food accounts for the small size and the frailty of the shells, the equalisation of the seasons and the vanishing of differences of temperature cause the annual rings to become indistinct or to vanish altogether. He maintains that the deep-water Lamellibranchs are the remnants of a glacial fauna, which, in its present refuges, has retained the old glacial "Kümmerform." These forms are, therefore, not secondary, as they have been regarded, but ancestral.

The deep-water fauna in general, especially the Rhizopoda, Turbellaria, Entomostraca, and Hydracarina, is shown to be a mixture of elements of two chief kinds. Some of the organisms represented are to be found within wide limits of temperature (eurythermic), and are truly cosmopolitan; others are restricted to waters of low temperature (stenothermic), and are to be regarded as the remains of a glacial or post-glacial fauna. The expectation of some earlier writers, that the investigation of the deep-water fauna would reveal a centre of origin of new species, is not realised.

(2) This memoir forms the second part of the account of the natural history of this "Grossteich," a small lake about 3 and 1·6 km. in extreme length and width respectively. The object of the researches, begun in 1899, and carried on since 1908 by the aid of a laboratory built near the lake, has been the complete investigation of the general biological phenomena of a single water-basin; in fact, an intensive study of these phenomena, in a small, suitable, and easily accessible lake. The investigation has been divided into sections, dealing respectively with the geological, hydrographical, chemical, botanical, and zoological aspects, each in charge of a separate worker.

The present volume contains a record of the faunistic and biological observations on the littoral Cladocera, prefaced by a description of the lake, of the surrounding hilly country, and of the sources of water supply. The qualitative and quantitative apparatus used in collecting the aquatic organisms of the lake is described; this included a "rotator," practically a short half-cylinder, which by a rapid turn can be made to take, by a single scoop, a sample of the surface water down to a depth of about 50 cm. A list of fifty-nine species of littoral Cladocera from this lake is given. Doubtless the great variety of the shore conditions accounts for the richness of the fauna, but the large number of species recorded is due to the numerous collections made and to the careful study devoted to them. The author remarks that probably a few (about nine) species may be added to his list by subsequent researches, as several well-known Cladocera have not yet been taken in the lake, *e.g.* the genus Bythotrephes, and *Bosmina longispina* and its relatives.

For faunistic purposes the lake is divided into eight

[1] (1) "Die Tiefseefauna der Seen Mitteleuropas." Eine geographisch-faunistische Studie. By Prof. F. Zschokke. Pp. vi+246+3 maps. (Leipzig: Dr. Werner Klinkhardt, 1911.)

(2) "Der Grossteich bei Hirschberg in Nordböhmen." Naturwissenschaftliche Untersuchungen veranlasst und herausgegeben von der Gesellschaft zur Förderung deutscher Wissenschaft, Kunst und Literatur in Böhmen. II. "Die Biologie der litoralen Cladoceren." Untersuchungen über die Fauna des Hirschberger Grossteiches. 1 Teil. By Dr. V. H. Langhans. Pp. viii+101+62 figs+30 plates. (Leipzig: as above.)

more or less independent regions, each with its own biological character. The distribution of the Cladocera in each of these is given, with a discussion of the reasons why certain species occur in all the regions, whereas others are found in only one or two. By means of sixty-two diagrams, in the form of curves, the sexual period of each species (and variety) of Cladocera captured is shown, and the stations at which these species have been found are marked on thirty-eight maps of the lake, on which also the various shore conditions (*e.g.* the nature of the aquatic plants) are indicated. This investigation has evidently been carried out in a very thorough manner, and affords a good example of the intensive method.

J. H. A.

AGRICULTURAL EDUCATION IN THE UNITED STATES.[1]

THE object of the interesting volume referred to below is sufficiently indicated by the title and subtitle. The public schools are those of elementary and secondary grade. In his introductory note, Mr. Judd ascribes the present great activity shown by the United States in agricultural education to (*a*) the large number of persons engaged in agriculture; (*b*) the value of its products; (*c*) the necessity, in connection with rural depopulation, for making farm activities attractive; and (*d*) the desirability of laying greater emphasis on outdoor experiences in the education of children.

The volume first gives an account of the U.S. Department of Agriculture, organised in 1862. During the last twenty years a sum approximating to twenty-one million pounds sterling of public money has been spent on agricultural research and education in the States, mostly through the Department, which since 1889 has worked with the Association of American Agricultural Colleges and Experiment Stations, at first for the organisation of collegiate instruction, and more recently with a view to place agricultural school teaching on a sound basis. The U.S. Bureau of Education has played the part of a correlating influence, exercised through its publications, legislation, and the land-grant colleges.

Much has also been done by the State Departments of Education. Prof. Davis considers the State agricultural colleges as the most important agent in agricultural education, and they are now assisting the elementary and secondary schools by various extension methods, by organising departments of agricultural education, and by conducting summer schools for teachers. After dealing successively with State normal schools, national education and other associations, educational periodicals, and periodical literature, the author gives an account of State organisations for agriculture, and farmers' institutes. In 1908 there were 4643 regular and a number of special institutes, attended by more than two and a half million persons.

"The function of the farmers' institute is to educate the people on their own ground. It is a phase of extension work that carries education directly to the localities in which the people live. It deals less with individual men on their farms than with small communities or groups of men; it therefore has the opportunity to exert great influence in developing the social life of rural neighbourhoods" (p. 90).

Next follow accounts of agricultural societies, boys' agricultural clubs, and elementary and secondary schools. Of schools the author speaks as follows (p. 126):—

"Agricultural colleges are now well established, and their problems are largely matters of detail and of research. The problems of agricultural education are now being shifted to the secondary schools offering agricultural instruction. There is a great diversity, not only in respect to types of schools, but also as to methods, time devoted to the subject, equipment, qualification of teachers, and in other respects. But of the widespread interest there can be no doubt. The results on the whole promise much for the development of rural education and redirection of rural schools."

The work concludes with a short chapter on text-books, and a valuable bibliography with annotations. Nor is a good index forgotten.

Prof. Davis may be congratulated on a most valuable and thoughtful expert contribution to the literature of his subject. The problems he discusses are at present engaging very serious attention in this country on the part of the Boards of Agriculture and Education, and of those concerned with all grades of agricultural and rural instruction, to whom the book is heartily recommended, though all the methods advocated are not necessarily suited to Britain, *e.g.* the teaching of agriculture as such at the school stage. There is also room for difference of opinion as to the lines on which farm institutes are best organised.

J. R. AINSWORTH-DAVIS.

HURRICANES OF THE WEST INDIES AND OTHER TROPICAL CYCLONES.

THE Journal of the Washington Academy of Sciences of May 19 contains an abstract of a useful paper, by Dr. O. L. Fassig, on the above subject, intended to appear as a special Bulletin of the U.S. Weather Bureau. An analysis of 135 storms recorded by the Bureau from 1876 to 1910 in the West Indies shows that their paths closely coincide with the two branches of the great equatorial current of the North Atlantic. The path of greatest storm frequency begins near the Windward Islands, and runs nearly due west to Jamaica, gradually turns north-west, recurves in the eastern part of the Gulf of Mexico, and passes out north-easterly over the North Atlantic. A secondary track extends from the northern group of the Windward Islands across the Bahamas, recurves east of Florida, and passes out also north-easterly into the Atlantic.

The path pursued by an individual storm depends to a great extent upon the point of its origin. Those that originate far to the east, as they generally do in August and September, are most likely to move west-north-west for a considerable distance before recurving, while those which originate in the western waters of the Caribbean Sea, as those do in the early season and in October, move north-west or north along the recurve of the normal track. Some of the more important facts given in the tables show that the storms may occur in any month from May to November, but that the great majority take place from August to October; that the area in which they originate is between latitude 12° and 28° N. and longitude 55° to 95° W.; that their mean annual frequency is 4; and that the mean daily velocity in the first branch and in the recurve is 260 miles, and in the second branch 390 miles. Conditions favouring the formation of the cyclonic systems are produced by changes in the positions and intensities of the so-called permanent areas of high and low atmospheric pressure.

[1] "Agricultural Education in the Public Schools." A Study of its Development, with Particular Reference to the Agencies Concerned. By Prof. B. M. Davis. Introduction by C. H. Judd, Director of the School of Education, University of Chicago. Pp. vi+163. (University of Chicago Press, Chicago, Ill.; Cambridge University Press, London and Edinburgh, 1912.) Price 4*s.* net.

THE MANUFACTURE OF NITRATES FROM THE ATMOSPHERE.[1]

Pauling Furnace.

THIS furnace was invented by Mr. H. Pauling, of Gelsenkirchen, and he took the idea from the well-known horn-break lightning arrester (see Fig. 4). It has two hollow iron electrodes, arranged to form a

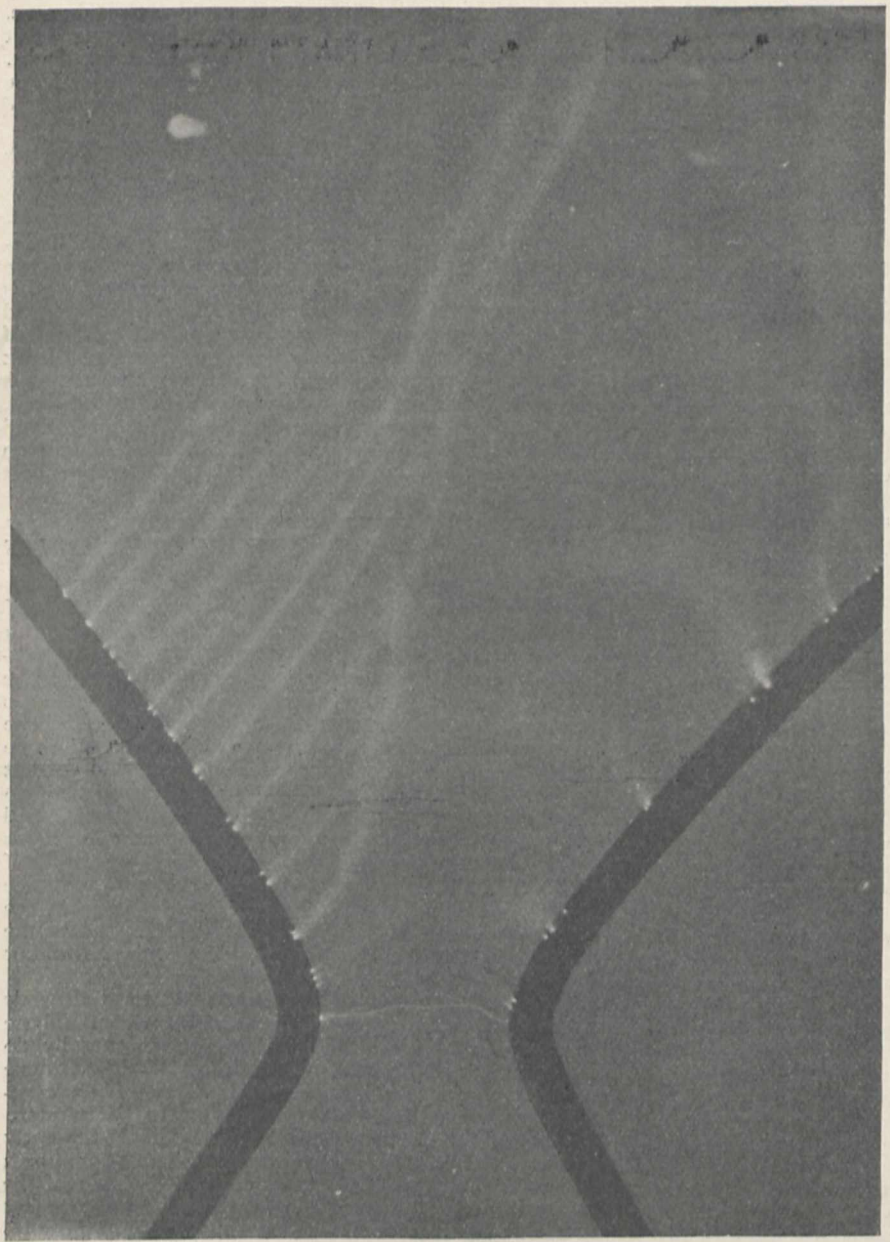

FIG. 4.—Arc flame between horn electrodes. From photograph by Mr. Lustgarten of Manchester.

V, which at the lowest point is about 4 cm. across, as shown in Fig. 5. At this point there are two lighting knives, which can be approached to within a few millimetres, and are readily adjustable. The arc strikes across and runs up the diverging electrodes by reason of the natural convection currents and the repelling action of its own magnetic field, but principally because of a blast of heated air from an air-duct immediately below. The arc diverges as it follows the shape of the electrodes, and it attains a length of about a yard. At each half-period of the alternating current a fresh arc forms, so that the result is the equivalent of a triangular sheet of flame.

An important feature is that the wall which divides the two parts of the furnace is hollow, and gas and air which has been through the furnace previously and been cooled is blown through this central passage. As will be noticed from Fig. 5, this mixture of cool gas and air strikes into the top of the arc flame, and serves to cool the gases which have just been formed. The two arcs are in series, and the furnaces work in sets of three, one to each phase. Each furnace, therefore, receives single-phase current at 6000 volts, fifty periods per second.

At Gelsenkirchen there are twenty-four such furnaces, each taking 400 kw. at 4000 volts.

The arcs are started by means of copper starting-knives, which can be approached to within a few millimetres at the bottom, where the two horns come together. When the arc has been started, these starting-knives are withdrawn, and the larger space between the electrodes is then sufficient to let the hot air from the *tuyère* pass through freely. The starting-knives last twenty hours, whereas the main electrodes, which are of steel and water-cooled, last 200 hours.

The works of La Nitrogène Cie., at La Roche-de-Rame, Hautes Alpes, France, have nine Pauling horn-arrester furnaces of 600 horse-power each in operation, and nine more of 1000 horse-power each are being added.

The general lay-out of the plant is shown in Fig. 6, and it will be noted that the furnaces are arranged in sets of three, one furnace to each phase.

The fresh air for the furnaces is supplied by a 250 horse-power turbo-compressor running at 3000 revolutions, and before it gets to the furnace *tuyères*, it passes through a preheater. The air travels through the furnace at 1200 ft. per second.

When the gases come from the furnaces their temperature is about 1000° C., and the nitric oxide content 1·15 to 1·5 per cent. They first pass through

[1] Abridged from a paper read before the Royal Society of Arts on May 15 by Ernest Kilburn Scott. Continued from p. 465.

the preheater, and give up some of their heat to the fresh air going to the furnaces.

The gases then pass through the two cooling towers which are outside the furnace-house. Each of these towers is 16 ft. in diameter and 40 ft. high, and filled with fire-brick. When the bricks of one tower have become hot the gases are switched over to the other tower. Fresh air is then drawn through the heated tower by means of the chimney (85 ft. high), and the brickwork in it is thus cooled.

The gases are sucked out of the cooling tower by a 15 horse-power fan and forced into the oxidation tower, which is built of reinforced concrete, and measures 33 ft. diameter and 75 ft. high. Here the temperature having fallen to 600° C., oxidation to NO_2 goes on rapidly.

From the oxidation tower there are two pipe-lines, and one takes some fixed gas and air back to the furnaces, where it is passed through the central passage and comes in contact with the freshly fixed nitrogen at the top of the arcs. In this way the fresh gas is cooled without being diluted.

A second pipe-line of aluminium takes the remainder of the gases to the absorption towers, each

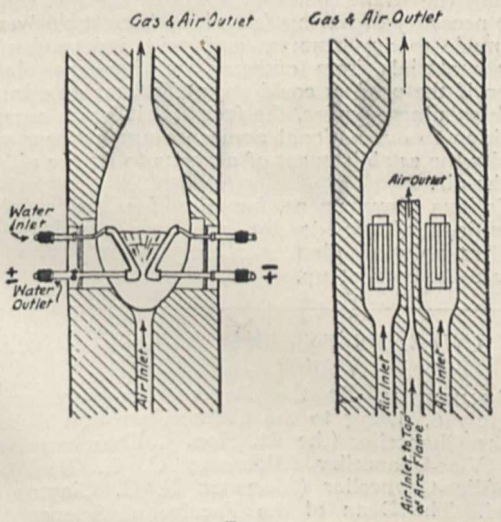

FIG. 5.

of which contains 250 tons of stoneware packings. The gases pass from 1 to 5, whilst the water, gradually accumulating more and more acid, flows in the opposite direction, namely, 5 to 1. *Montejus* operated by compressed air raise the solution to the top of the different towers.

The gases from No. 5 absorption tower still contain a small amount of NO and NO_2. They are passed through an acid filter, in which the last traces of acid are condensed, and then pass to the nitrite towers. These contain sodium-carbonate solution, and the gases react with it to form sodium nitrite, having a concentration of 20 per cent. This is submitted to evaporation, the hot furnace gases being used for the purpose, and white sodium-nitrite crystals are obtained containing 95 per cent. of nitrite and 3 per cent. of nitrate.

Some idea of the efficiency of the plant may be obtained from the fact that Mr. Pauling guarantees 60 grams of 100 per cent. HNO_3 per kw.-hour of electrical energy, measured at the entrance of the electric transmission line into the factory, and also that the electro-chemical plant proper will cost about 120 francs (5*l*.) per kilowatt.

The Southern Electro-Chemical Co. of Nitrolee, South Carolina, in the United States, has a 4000 horse-power plant on the Pauling system for manufacture of calcium nitrate. Electric energy is generated by two water-power plants at Great Forks and Rocky Creek.

Calcium Cyanamide.

The discovery of calcium cyanamide came about as the result of a research by Dr. Franck and Dr. Caro, who were following on the lines of some previous work of Playfair and Bunsen. Their immediate object was to make cyanide of potassium for the recovery of gold from tailings, and they incidentally found that barium carbide absorbed nitrogen to form barium cyanamide. By using calcium carbide they obtained a similar reaction according to the formula

$$CaC_2 + 2N = CaCN_2 + C.$$

It was then found that by treating calcium cyanamide with hot water it gave off ammonia according to the equation

$$CaCN_2 + 3H_2O = CaCo_3 + 2(NH_3),$$

and this gave rise to the idea of using it as a manure.

As carried out at the Odda Works, the calcium

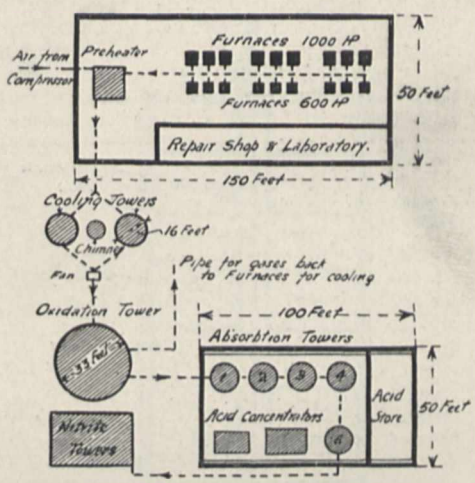

FIG. 6.—The lay-out of the works by La Nitrogène Cie, France.

carbide, broken into pieces, is delivered to crushing machines, from which it passes to mills in which it is ground fine, the whole of these operations being effected automatically in an air-tight plant so as to prevent acetylene gas being given off. It is of interest to note that the glowing mass from the calcium carbide furnace cannot be used straight away.

The powder is then filled into electric furnaces, of which, in the first installation at Odda, there were 196, each holding 300 kg.

Fig. 7 is a rough sketch of the furnace, and it will be noticed that down the centre there is a cardboard tube to provide a space for the carbon pencil. After the carbide has been filled in, the carbon pencil is fixed in position, and the lid fastened down and made air-tight.

Alternating current is now switched on, and the temperature is raised to 800° to 1000° C. The cardboard tube and certain cardboard partitions which had been placed in the furnace when the calcium carbide was run in, are burnt up, and they leave spaces allowing the nitrogen gas, which is there admitted under pressure, to circulate freely. Electric current is kept on for twenty-five hours, and at the end of thirty-five hours all the nitrogen has been absorbed as shown by the meter being stationary.

At Odda this nitrogen is made by the Linde distillation process, but in one of the French factories the Claude process is used.

Thirty tons of calcium cyanamide, containing 18 per cent. of nitrogen, can be made in 196 furnaces per day of twenty-four hours.

When it is turned out of the furnace the cyanamide looks like black clinker. After being broken up it is fed into jaw crushers, and then goes to roulette mills, where it is ground up fine for market.

It is then packed in a paper-lined bag, which is in a jute bag. For tropical countries there are two outer jute bags.

Recently, improvements have been introduced at the Odda Works, whereby with the same amount of power and labour the output has been increased from 12,000 tons to 15,000 tons per annum.

The furnaces are now being made to hold 450 kg. instead of 300 kg. Another improvement is that the cyanamide is treated with enough atomised water to reduce free carbide to less than ½ per cent.

From the point of view of engineers in this country, the installation of A. G. Stickstoffdunger at Knap-

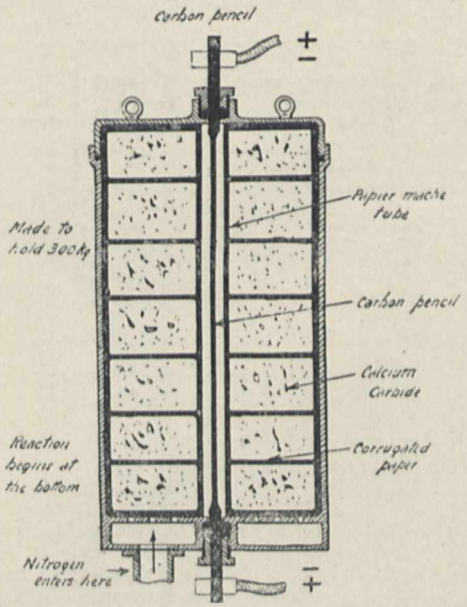

FIG. 7.—Electric furnace for making calcium cyanamide.

sack, in Germany, is perhaps the most interesting, because gas, generated from cheap brown coal, is used in gas engines to generate the electric current.

Although calcium cyanamide is mostly employed as a manure, it has other uses. For example, by treating with superheated steam, very pure sulphate of ammonia is obtained. Ammonium nitrate and dicyandiamide are also made from it.

Explosives.

Although manures form the main outlet for the products of these electric fixation of nitrogen processes, there are other important uses.

At the Notodden Saltpetre Factory ammonium nitrate is made by bringing the nitric acid into contact with ammonia liquor from our English gasworks. The ammonia nitrate crystallises out, and when dry it contains 35 per cent. of nitrogen, and it sells in this country at about 27*l.* a ton. It is the principal constituent of many of the explosives for mines.

Dicyandiamide, $C_2N_4H_4$, which is made by treating calcium cyanamide with water, when it crystallises into broad needles or prisms, is being used for mixing with explosives. It contains 66 per cent. of inert nitrogen, and is used for lowering the temperature of the explosion.

This is of importance, because ordnance powders rapidly destroy rifling in guns on account of the high temperature. The importance of this is shown by the statement made publicly in 1905 that the 12-in. gun Mark VIII. used on fifteen British battleships could not stand more than fifty rounds full charge.

Nitric acid is, of course, the main constituent of gun-cotton, dynamite and smokeless powders, &c., and at the present time we are mainly dependent on overseas supplies of raw material from which to make the acid. In case of war we should undoubtedly be in a very serious position, for whereas most Continental countries have plants for the fixation of nitrogen from the air, this country does not make a single ounce.

It will be remembered that at the time of the Napoleonic wars the French had difficulty in obtaining saltpetre with which to make powder; it behoves us, therefore, not to be caught in the same predicament. A few rounds from a broadside of modern guns blow away into the air as much nitrogen as was used during the whole course of a war of the last century. The necessity of having factories where explosives can be made to any amount, and quite independently of raw materials from overseas, is therefore obvious. Even if the product could not at first compete in price with existing supplies, the fact that it was a necessary addition to our national assurance against war would justify the establishment of a works to fix the nitrogen of the air.

Various Government factories for the supply of munitions of war do not pay from a strictly competitive point of view, yet everyone recognises that they must be kept up.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—At the Degree Congregation held on July 6, owing to the absence, through ill-health, of the Chancellor (the Rt. Hon. J. Chamberlain) and the Vice-Chancellor (Alderman C. G. Beale), the Pro-Vice-Chancellor (Alderman F. C. Clayton) presided. The Dean of the Faculty of Science (Prof. J. H. Poynting, F.R.S.) was also unable to be present through indisposition.

An honorary degree of LL.D. was conferred on Mr. W. E. Garforth, president of the Institution of Mining Engineers. The Principal presented Mr. Garforth as "one of the captains of a great and important industry, being managing director and general manager of large collieries in South Yorkshire. As an engineer, his energy and ability have been vigorously devoted to the progress of mining science. By his efforts in the systematic application of scientific principles to coal mining, he has rendered high service to the country, and has done much to further the safe working of mines; an honoured representative of a great profession, himself an investigator and inventor."

The following were admitted to the degree of D.Sc.:—G. Barlow, C. L. Boulenger, G. A. Shakespear, A. J. Lotka, and M. Stuart.

The Principal expressed the hearty thanks of the University to the Pro-Vice-Chancellor for his gift of the statue of King Edward VII., which had recently been unveiled by Mrs. Chamberlain, the wife of the Chancellor. He also referred to the extension of the work of the University in connection with the Workers' Educational Association as "an event which might have important consequences."

After the Congregation, the Guild of Graduates, presided over by Dr. Ethel M. R. Shakespear, entertained a number of distinguished visitors at luncheon. The Lord Mayor, in replying to the toast of "The City," expressed his regret that, at the time when the University applied to the City Council for assistance, an unusual spirit of economy seemed to be abroad. In his opinion the city was expecting a very great deal from the University in return for a comparatively small pecuniary grant. He also expressed the opinion that a great need of the city was for more university graduates on the City Council and on public bodies generally, and he heartily invited the graduates to take a more active share in municipal life, where their help would be eagerly welcomed.

Mr. Herbert Heaton has been elected to a new assistant-lectureship in economics. Mr. Heaton has studied at the University of Leeds and the London School of Economics. His services will be devoted partly to the Faculty of Commerce and partly to the extension work in connection with the Workers' Educational Association.

OXFORD.—A party of the foreign and colonial delegates to the 250th anniversary of the foundation of the Royal Society has been invited to visit Oxford on Friday, July 12. The proceedings at Oxford will include a Convocation in the Sheldonian Theatre, at which honorary degrees will be conferred; a lunch given by the Warden and Fellows of All Souls' College, and a garden-party in the grounds of Wadham College, the scene, during the Commonwealth, of some of the meetings from which the Royal Society afterwards took origin.

In view of the resignation by Prof. Odling of the Waynflete professorship of chemistry, which he has held for forty years, a committee has been appointed to collect subscriptions for the foundation of an "Odling Scholarship" for the encouragement of chemical research. Subscriptions towards this memorial of Prof. Odling's services will be received by Dr. H. B. Baker, F.R.S., Christ Church; Rev. G. B. Cronshaw, Queen's College; and Mr. H. B. Hartley, Balliol College.

EDINBURGH.—At the Graduation ceremony on July 5, the honorary degree of LL.D. was conferred upon Lieut.-Col. Bailey, formerly lecturer on forestry in the University; Prof. J. Theodore Cash, F.R.S., Regius professor of materia medica in the University of Aberdeen; Dr. J. S. Flett, director of the Geological Survey of Scotland; Dr. W. Warde Fowler; Prof. W. C. M'Intosh, F.R.S., professor of natural history in the University of St. Andrews; Dr. R. Munro; Sir James Porter, K.C.B., Director-General, Medical Department, Royal Navy; Sir Thomas Rayleigh, formerly Vice-Chancellor of the Calcutta University; and Mr. J. L. Robertson, Chief Inspector of Schools for Scotland.

DR. S. J. M. AULD, lecturer on agricultural chemistry and head of the chemical department at the South-Eastern Agricultural College, Wye, has been appointed to the professorship of agricultural chemistry at University College, Reading.

PRESIDENT T. N. VAIL, of the American Telegraph and Telephone Co., has presented to the Massachusetts Institute of Technology the Dering library, containing a large collection of comparatively recent works on electricity, the value being estimated at about one hundred thousand dollars, and with it Mr. Vail has given some tens of thousands of dollars for its maintenance. Mr. G. E. Dering, who died in January, 1911, was more than forty years collecting his library, which was the chief hobby of his life. He gave an unlimited order to Mr. Nutt for all the books, in whatever language, that were offered that appertained to electricity or electrical engineering, and he collected in all about thirty thousand volumes. About three-fifths of the whole library treat of electricity, and the collection of volumes on iron and steel is also practically complete.

THE London County Council decided in 1910 that from August, 1911, the council's grants in aid of polytechnics and certain technical institutions should take the form of block maintenance grants fixed for a period of three years. The governing bodies of the ten polytechnics have each submitted applications for a block grant for the triennial period 1911–14, together with a statement of the general policy of the educational work which they propose to undertake. The governing bodies propose no new departure during this first period, but the grants applied for are nevertheless always in excess of those received in 1910–11. Each application has been the subject of careful consideration by a section of the Higher Education Subcommittee, and the grants finally decided upon are given in the following table:—

	Block grant applied for	Percentage increase over the 1910–11 grant	Grant decided upon
	£		£
Battersea Polytechnic ...	12,500	47·72	10,500
Birkbeck College	6,993	27·77	6,600
Borough Polytechnic ...	11,731	37·06	10,634
City of London College..	5,800	46·39	—
Northampton Polytechnic Institute	8,892	36·88	7,330
Northern Polytechnic ...	9,293	31·72	8,100
Regent-street Polytechnic	13,172	9·77	12,500
Sir John Cass Technical Institute	5,790	82·42	4,450
South Western Polytechnic	14,186	51·84	11,500
Woolwich Polytechnic...	13,338	36·70	10,865
Totals	£101,695		£82,479

The grant shown in column 4 is subject to slight reductions in some cases for the sessions 1912–13 and 1913–14.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 27.—Sir Archibald Geikie, K.C.B., president, in the chair.—Lord **Rayleigh**: Electrical vibrations on a thin anchor ring.—Hon. R. J. **Strutt**: The molecular statistics of some chemical actions. (1) Where ozone acts on a silver oxide surface, every collision results in the destruction of the ozone molecule concerned. (2) An active nitrogen molecule must, on the average, collide 500 times with an oxidised copper surface before it is destroyed. (3) Two molecules of ozone at 100° C. must, on the average, collide 6×10^{11} times, before the right sort of collision occurs for chemical union.—C. V. **Boys**: Experiments with rotating films. An apparatus is described whereby a film may be rotated in its own plane, and in which air at atmospheric pressure above and below the film is rotated also at the same speed. Twenty experiments are described which refer mainly to the ring and spiral patterns of colour that may be produced to the development of black films and patterns and to the instability of the margin of the black.—Prof. H. E. **Armstrong** and E. H. **Rodd**: Morphological studies of benzene derivatives. III. Para-dibromo-benzene-sulphonates (isomorphous) of the "rare earth" elements—a means of determining the directions of valency in tervalent elements. Para-dibromo-benzene-sulphonates of lanthanum, neodymium, praseodymium, cerium, gadolinium, and sama-

rium are described.—Karl **Pearson**: The intensity of natural selection in man. The following statement has recently received much currency:—A high infant death-rate in a given community implies in general a high death-rate in the next four years of life, while low death-rates at both age-periods are similarly associated. The evidence in support of the statement is not valid; it consists solely in showing that a bad environment raises both infant and child death-rates. The statement is not true even when no correction is made for differential environment. The question of a selective death-rate is the question of whether natural selection—Darwinism—applies to man. The present paper does not determine how far a rising infant death-rate is really the cause of a falling child death-rate, but its aim is to show that there is no such general rule as that stated to hold. If that rule were a demonstrable truth, then we might confidently assert that Darwinism did not apply to civilised man. As a matter of fact, others methods of inquiry indicate that at least 60 to 70 per cent. of the deaths in civilised human communities are selective, *i.e.* due to the elimination of those with inferior constitutional powers of resistance.—Dr. T. M. **Lowry**: Optical rotatory dispersion. Part i. The natural and magnetic rotatory dispersion in quartz of light in the visible region of the spectrum.—J. J. **Manley**: The apparent change in mass during chemical reaction.—Dr. W. H. **Eccles**: The diurnal variations of the electric waves occurring in nature, and on the propagation of electric waves round the bend of the earth. The natural electric wave train radiating from a lightning discharge produces, it is well known, a disturbance in apparatus for the reception of wireless telegraph messages. Normally these disturbances form a steady stream of faint or loud clicks in the receiving telephones. The rate at which they are received at a station varies from hour to hour during the twenty-four hours, and also with the season, but as a general rule the disturbances—or "strays" as they are often called—heard at night are stronger and more frequent than those heard in the day. The change from day to night and from night to day conditions is very noticeable at sunrise and sunset. It is chiefly this transition period that is investigated in the present communication. In order to explain the phenomena the author develops a hypothesis which is based on a proposition to the effect that the velocity of electric waves through ionised air increases with increasing ionisation.—Rev. A. L. **Cortie**: Report on the total solar eclipse of 1911, April 28. Communicated by the Joint Permanent Eclipse Committee.—W. Hamilton **Wilson**: An experimental investigation of the influence of the condenser on the working of a Ruhmkorff coil, together with a practical outcome thereof.—Prof. D. Fraser **Harris** and Dr. H. J. M. **Creighton**: Studies on the reductase of liver and kidney. Part i.—Prof. M. W. **Travers** and Ramu Chandra **Ray**: Borohydrates. Part i.—Prof. G. N. **Stewart**: The specific conductivity of solutions of oxyhæmoglobin.—J. W. **Gifford**: The existing limits of uniformity in producing optical glass.—Prof. A. C. **Seward**: A petrified Williamsonia from Scotland.—Prof. A. W. **Porter** and Dr. F. W. Edridge **Green**: Negative after-images and successive contrast with pure spectral colours. A definite portion of the retina was fatigued by steadily gazing at an isolated region included between two definite wave-lengths in the Edridge green colour perception spectrometer. After the fatiguing light had been viewed for a period of about 20 seconds, the eye was turned to a screen on which a spectrum was situated, so that the after-image formed a band running right across the spectrum on the screen and occupying its centre. Experiments were also made with the spectrum replaced by monochromatic bands, and on the appearance of the sodium flame after fatigue to various colours. It is held that the facts described cannot be explained on either the Hering or Young-Helmholt theories. The explanation on the Edridge-Green theory of colour-vision is the same as that given for other facts of simultaneous contrast (Proc. Roy. Soc., B, vol. lxxxiv., 1912, p. 546).—Leonard **Hill** and M. **Flack**: The relation between capillary pressure and secretion. II. The secretion of the aqueous and the intra-ocular pressure.—Prof. W. B. **Bottomley**: Some conditions influencing nitrogen fixation by aerobic organisms.—J. G. **Wilson** and F. H. **Pike**: The effects of stimulation and extirpation of the semicircular canals of the ear and their relation to the motor system.—W. **Wilson**: The absorption and reflection of homogeneous particles.—Prof. H. M. **Macdonald**: The effect of an obstacle on a train of electric waves.—Dr. Walter **Wahl**: Optical investigations of crystallised nitrogen, argon, methane, and some of the simpler organic compounds of low melting points. A quartz glass vessel, holding a very thin layer (0·05 mm.) of substance between polished quartz glass plates, has been constructed. In this vessel N, A, CH_4, &c., have been crystallised and investigated crystal-optically:—(1) Nitrogen crystallises in the regular system; (2) argon is regular; (3) methane is regular; (4) ethyl-ether is rhombic. Ethyl alcohol, acetone, methyl alcohol, and carbon bisulphide are monoclinic or triclinic. Methylalcohol occurs in two polymorphic forms, changing reversibly into each other.—Sir W. de W. **Abney**: Colour-blindness and the trichromatic theory. Part iv. Incomplete colour-blindness. In this communication the author shows how a simple test is capable of giving a quantitative measure of the degree of colour-blindness which a colour-blind person possesses. By matching a single colour of the spectrum with the colour of the light coming from such a solution as of chromate of potash the degree of colour-blindness can be immediately determined. Further, he gives a method by which any displacement of the green or red sensation curves can be measured with great accuracy.—Prof. W. H. **Young**: The multiplication of successions of Fourier constants.—C. E. **Haselfoot**: The diffusion of ions into gases at low pressure.—Prof. J. S. **Townsend** and T. T. **Tizard**: Effect of a magnetic force on the motion of negative ions in a gas.

DUBLIN.

Royal Dublin Society, May 21.—Mr. R. Ll. Praeger in the chair.—Prof. G. H. **Carpenter**: Injurious insects and other animals observed in Ireland during the year 1911. Among the insects mentioned are the Diptera, *Trichocera fuscata* (injurious to swedes) and the narcissus-fly (*Merodon equestris*), the larvæ of both being described. There are records of several sawflies, including *Fenusa pumilio* on raspberry, and *Nematus erichsonii* on larch. Slugs (Arion and Agriolimax) have been observed eating the bark of the Weymouth pine.

June 25.—Mr. R. Ll. Praeger in the chair.—J. J. **Dowling**: Steady and turbulent motion in gases. Following Osborne Reynolds's well-known work on the flow of water through tubes, the author extends the investigation to gases, and verifies Reynolds's formula for the critical velocity at which turbulence sets in, viz. $V_c=\frac{K.\eta}{\rho a}$ (where a is the tube radius, η the viscosity, and ρ the density). Different gases are experimented with, and the effects of temperature examined. A new type of critical velocity is also found to exist, and is discussed. This second critical velocity is found to vary according to the equation $(V_c-k')=\frac{K'\eta.a}{\rho}$ (where K' and k' are new constants). An ionisation method is

used to detect the critical points.—Dr. J. H. **Pollok**: The vacuum tube spectra of some non-metallic elements and compounds. The spectra were taken with the new form of quartz vacuum tube devised by the author. Photographs were shown of the spectra of sulphur, selenium, tellurium, chlorine, bromine, iodine, and phosphorus, the chlorides and fluorides of boron and silicon, and of boron trioxide. In each case photographs were taken both with and without a Leyden jar, and extended from λ7000 to λ2000. An examination of these photographs showed that the general conclusions arrived at by the author in regard to metals and their compounds, hold also with the non-metals. When no Leyden jar is used, bands are seen due to the molecules of either the elements or their compounds, and a larger or smaller number of lines may also be seen, according to the facility with which the molecules are decomposed at a high temperature. When a Leyden jar is introduced the bands either wholly or partially disappear, and a strong line spectrum is obtained of the element, or of each of the constituent elements of the compound, under observation.—Miss Genevieve V. **Morrow**: The influence of self-induction on the spark spectra of the non-metallic elements. The spark spectra of ten non-metallic elements were examined by sparking carbon or gold electrodes in an atmosphere of each of the elements or their compounds under ordinary conditions of pressure. It was shown that the effect caused by self-induction was in some cases rather remarkable. In the case of carbon and nitrogen two of the bands usually attributed to cyanogen disappeared when no self-induction was present, one alone remaining, which would tend to show that this band is due to carbon and not due to cyanogen. With hydrogen and gold electrodes the effect was very remarkable, the gold spectrum practically disappearing, and only that of hydrogen showing when self-induction was introduced, and exactly the opposite effect is produced when the atmosphere is composed of an electro negative element. All compounds when sparked, either with or without self-induction, show only the lines of the line spectra of their components, and no bands due to the compounds are seen.

PARIS.

Academy of Sciences, July 1.—M. Lippmann in the chair.—J. **Boussinesq**: The reason why the differential equations of mechanics are of the second order rather than of the first; in other words, why the accelerations of material points and not their velocities are determined.—Georges **Lemoine**: The velocity of decomposition of hydrogen peroxide under the influence of heat. For dilute solutions the reaction is monomolecular. This is not the case for concentrated solutions, and these solutions have been investigated in detail, experimentally and theoretically.—A. **Chauveau**: Investigations on stereoscopic images.—M. **Gouy**: The continuous spectrum of metallic vapours and the solar photosphere. From the experiment described the author concludes that the parts of the sun from which we receive radiations contain metallic vapours in an extremely rarefied condition.—C. E. **Guillaume**: Study of the vertical movements of the Eiffel Tower. A stretched invar wire was arranged to give a record of the variation in height of the second storey (116 metres).—W. H. **Young**: The generalisation of Parseval's theorem.—A. **Leduc**: The expansion of saturated water vapour.—R. **Ledoux**: The electrical properties of the copper-tin alloys. Curves are given showing the resistivity and thermo-electric power of alloys containing various percentages of copper and tin.—G. **Reboul**: Photo-electric phenomena and the absorption of light.—Mme. **Ramart-Lucas**: The synthesis of α-phenyl-αβ-dimethylhydrocinnamic acid.—J. **Frézouls**: The catalytic addition of hydrogen to benzylidene-acetophenone: symmetrical diphenylpropane and dicyclohexylpropane.—V. **Grignard** and E. **Bellet**: The synthesis of nitriles in the cyclanic series. Bromocyclohexane is converted into the magnesium compound $C_6H_{11}.Mg.Br$, and this in ethereal solution reacts with cyanogen, giving the nitrile $C_6H_{11}.CN$. The generality of the method is shown by several examples.—E. E. **Blaise**: Syntheses by means of mixed organo-metallic derivatives of zinc: α-halogen derivatives of ketones. The method of preparing ketones of the type R.CHCl.CO.R is based upon the interactions of a chloracetal and zinc alkyl iodide.—A. **Wahl** and M. **Boll**: Ortho- and para-methoxybenzoylglyoxylic esters.—Emile **André**: The action of hydrazine upon the β-substituted ethylenic amino-ketones.—Jacques **de Lapparent**: The basic eruptive rocks associated with the granite of Haya.—C. **Gerber**: The latex of the fig, a vegetable pancreatic juice with a predominating proteolytic diastase.—Jean **Daniel**: A case of xenia in the bean.—L. **Blanc**: The influence of sudden variations of temperature on the respiration of plants. Sudden changes of temperature do not cause a stimulation of the plant respiration.—François **Kövessi**: The electrolytic effect of the continuous current on the cells of living plants. A continuous electric current exerts a direct influence upon living plants, and this is traceable to electrolytic phenomena.—Paul **Godin**: Unequal growth at the time of puberty and the pathological states which determine it.—A. **Quidor**: A new stereoscopic microscope with a single objective. The light bundle furnished by the objective is divided into two symmetrical portions by reflecting prisms. Much higher magnification is possible by this arrangement than with the usual double objective binocular.—Louis **Lapicque**: Excitability of the iterative nerves and the theory of their working.—E. **Vasticar**: Corti's fibres and their connections with the sensorial epithelium.—L. **Camus**: Passive vaccinal immunisation and serotherapy.—F. **Mesnil** and J. **Ringenbach**: The action of serums from Primates on the human trypanosomes from Africa.—M. **Laveran**: Remarks on the preceding communication.—Gabriel **Bertrand** and F. **Medigreceanu**: The presence of manganese in the animal kingdom. From fifty-one determinations on forty species, it is found that manganese is always present in the animal organism, the Mammalia containing this element in the smallest proportions.—A. **Fernbach** and M. **Schoen**: The biochemical production of levulose. The author has discovered an anaërobic bacillus which converts saccharose into a levulane, the latter giving levulose nearly quantitatively on hydrolysis.—Em. **Bourquelot** and M. **Bridel**: Synthesis of the glucosides of alcohols by means of emulsin: β-methylglucoside, β-ethylglucoside, and β-propylglucoside.—Charles **Jacob** and Paul **Fallot**: The Portland, Neocomian, and Meso-cretacian Rhynconella of the south-east of France.—R. **Anthony**: The encephalus of the fossil man of La Quina. The type approaches the anthropoids more closely than the existing human type.

CALCUTTA.

Asiatic Society of Bengal, June 5.—Hanindra Nath **Banerjee**: An investigation into the Ayurvedic method of purifying mercury by *Allium sativum* or garlic-juice. A previous paper (Proc. Chem. Soc., 27, 398) describes the action of garlic-juice on metallic lead and mercury. The present paper gives the results of detailed investigations, showing that oil of garlic, while not acting on pure mercury, readily attacks lead and other impurities, forming with them a greyish-blue amorphous mass of sulphides which may

be removed. Surgeon-Captain F. F. **MacCabe**: Larvicides in action. The writer of this paper commences by pointing out that kerosene oil practically always fails to kill larvicides, as they manage to "take cover" from it, and even can breath through it, and he makes an exhibit to prove that it kills water-snails, which he has discovered are greedy feeders on mosquito eggs. He then relates a number of experiments made with substances likely to act as larvicides, and tells of successful results obtained by him with a paste the basis of which is chloride of lime and of other successful results obtained by passing of low-tension electric currents through the water.

BOOKS RECEIVED.

Liverpool Marine Biology Committee. L.M.B.C. Memoirs on Typical British Marine Plants and Animals. xx., Buccinum (the Whelk). By Dr. W. J. Dakin. Pp. viii+115+8 plates. (London: Williams and Norgate.) 4*s*. 6*d*.

Chemisches Experimentierbuch. By O. Hahn. Pp. 165. (Leipzig: Quelle & Meyer). 1.80 marks.

Unsere Wasserinsekten. By G. Ulmer. Pp. v+165. (Leipzig: Quelle & Meyer). 1.80 marks.

Aus der Vorgeschichte der Pflanzenwelt. By Dr. W. Gothan. Pp. 184. (Leipzig: Quelle & Meyer.) 1.80 marks.

Deutschlands Bodenschätze. I., Kohlen und Salze. By L. Milch. Pp. 151. (Leipzig: Quelle & Meyer). 1.25 marks.

Himmelskunde. By Prof. U. Marcuse. Pp. 135. (Leipzig: Quelle & Meyer.) 1.25 marks.

Handbuch der vergleichenden Physiologie. Edited by H. Winterstein. 23 Lief. Band I., 1 Hälfte, 3. 24 Lief. Band III., 2 Hälfte, 4. (Jena: G. Fischer.) Each 5 marks.

Union of South Africa. Mines Department. Geological Survey Memoir, No. 6—The Geology of the Murchison Range and District. By A. L. Hall. Pp. 186+plates. (Pretoria: Government Printing and Stationery Office.) 7*s*. 6*d*.

A Critical Revision of the Genus Eucalyptus. By J. H. Maiden. Vol. ii., pt. 4. Pp. 131–164+plates 61–64. (Sydney: W. A. Gullick.) 2*s*. 6*d*.

The Chemical Constitution of the Proteins. By Dr. R. H. A. Plimmer. Pt. i., Analysis. Second edition. Pp. xii+188. (London: Longmans and Co.) 5*s*. 6*d*. net.

Memoirs of the Boston Society of Natural History. Vol. vii., Phylogeny of the Echini, with a Revision of Palæozoic Species. By R. T. Jackson. Pp. 491+plates 76. (Boston, Mass.: The Society of Natural History.)

The Dynamics of Mechanical Flight. By Sir G. Greenhill. Pp. iii+121. (London: Constable and Co., Ltd.) 8*s*. 6*d*. net.

The Beyond that is Within and other Addresses. By Prof. E. Boutroux. Translated by J. Nield. Pp. xvi+138. (London: Duckworth and Co.) 3*s*. 6*d*. net.

Paul Drudes Physik des Aethers auf Elektromagnetischer Grundlage. Zweite Auflage. By Prof. W. König. Pp. xvi+671. (Stuttgart: F. Enke.)

The British Bird Book. Edited by F. B. Kirkman. Section IX. Pp. 413–609+plates. (London and Edinburgh: T. C. and E. C. Jack.) 10*s*. 6*d*. net.

Journal of the College of Science, Imperial University of Tokyo. Vol. xxxi., Flora Koreana. By T. Nakai. Pp. 573+xx plates. (Tokyo: The University.)

The Elements of Inorganic Chemistry. By W. A. Shenstone. Sixth edition. Edited by R. G. Durrant. Pp. xii+567. (London: E. Arnold.) 5*s*.

The Application of Science to Industry. Souvenir of the Congress of the Universities of the Empire, London, 1912. Pp. 112. (London: Burroughs, Wellcome and Co.)

Allgemeine Botanik. By Prof. A. Nathansohn. Pp. viii+471. (Leipzig: Quelle & Meyer.) 10 marks.

Cambridge County Geographies: North Lancashire. By Dr. J. E. Marr. Pp. xii+180. (Cambridge University Press.) 1*s*. 6*d*.

The Testing of Wood Pulp. By Sindall and Bacon. Pp. 148. (London: Marchant Singer and Co.)

The Triuneverse: a Scientific Romance. By the Author of "Space and Spirit." Pp. xiv+221. (London: C. Knight and Co., Ltd.) 5*s*. net.

An Introduction to Psychology. By Prof. W. Wundt. Translated by Dr. R. Pinter. Pp. xi+198. (London: Allen and Co., Ltd.) 3*s*. 6*d*.

Memoirs of the Geological Survey. Summary of Progress of the Geological Survey of Great Britain and the Museum of Practical Geology for 1911. Pp. iv+90. (London: H.M.S.O.; E. Stanford and others.) 1*s*.

Vorschule der Geologie. By Prof. J. Walther. Fünfte Auflage. Pp. viii+237. (Jena: G. Fischer.) 2 marks.

Mémoires sur l'Electricité et l'Optique. By A. Potier. Pp. xx+330. (Paris: Gauthier-Villars.) 13 francs.

Bureau des Longitudes. Réception des Signaux Radio-télégraphiques transmis par la Tour Eiffel. Pp. 56. (Paris: Gauthier-Villars.) 1.75 francs.

Sub-Alpine Plants or Flowers of the Swiss Woods and Meadows. By H. S. Thompson. Pp. xv+325. (London: G. Routledge and Sons, Ltd.) 7*s*. 6*d*. net.

The Early Naturalists: their Lives and Work (1530–1789). By Dr. L. C. Miall. Pp. xi+396. (London: Macmillan and Co., Ltd.) 10*s*. net.

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