THURSDAY, FEBRUARY 13, 1913.

THE NERNST FESTSCHRIFT.

Festschrift W. Nernst zu seinem fünfundzwanzigjärigen Doktorjubiläum gewidmet von seinen Schülern. Pp. vi+487. (Halle a.d.S.: Wilhelm Knapp, 1912.) Price 21.60 marks.

THE present volume of scientific papers, dedicated to Prof. W. Nernst by his present and past pupils on the twenty-fifth anniversary of his promotion to the doctorate, is a splendid tribute to the success of Nernst as a great investigator and creator of investigators. It contains forty-four papers dealing with physico-chemical subjects, many of them of great interest and importance. Their great variety forms a striking testimony to the extraordinary range and scope of the investigations which Nernst himself has personally carried out or directed and supervised.

Nernst's laboratory at Göttingen first became famous as a centre of electrochemical research, whilst at the present day his laboratory in Berlin is known all the world over as the headquarters of chemical equilibrium and affinity, not to mention molecular and atomic dynamics. His investigations have carried him from the ion of Arrhenius to the energy-quantum of Planck. Everywhere throughout this brilliant career the investigations of Nernst have been of fundamental importance for the growth and development of chemical and physical science. The science of physical chemistry in particular has reaped a bountiful harvest. The physical chemists of the world, in common with many other men of science, will therefore join heartily with Nernst's own pupils in congratulating him on the splendid work he has done, and in wishing him many years yet of successful scientific productivity.

It would be quite impossible in the space at our disposal even to enumerate, much less to describe in detail, the papers published in the *Festschrift*. This will be apparent when one recollects that it runs to nearly 500 pages. It must suffice, therefore, to indicate the nature of a few of the most interesting.

E. Abel has investigated the equilibrium (iodine-hydrolysis) $3I_2+3H_2O \rightleftharpoons 6H^{\cdot}+5I'+IO_3'$ in the presence of sodium acetate. In combination with the work of Sammet, the results obtained by Abel form one of the most extensive and searching verifications of the law of chemical equilibrium in aqueous solutions.

E. D'Agostino and G. Quagliariello discuss mathematically the curve of Log $[H^{\cdot}]$ as a function of the number of mols. acid or base added to a solution of a base or acid respectively, or to a solution of an amphotere. They show both theoretically and by practical numerical examples how the molar concentration, molecular weight, and dissociation-constants of a solution of an unknown acid, base, or amphotere can be deduced from such curves. Their method promises to be of great importance in dealing with proteids.

P. Askenasy and A. Solberg discuss the thermal decomposition of potassium permanganate. F. Bergius contributes an interesting paper on the formation and dissociation of calcium superoxide. Max Bodenstein and F. Kranendieck conclude from an investigation on the velocity of decomposition of ammonia in quartz vessels that the decomposition occurs in the pores of the quartz glass and is regulated by the diffusion of the ammonia into these pores.

K. Bornemann finds for the reduction-potential of hydrogen peroxide in aqueous solution $\epsilon_h = -0{\cdot}66 \pm 0{\cdot}03$ volt, and for the oxidation-potential $\epsilon_h = -1{\cdot}80 \pm 0{\cdot}03$. Both potentials are referred to that of hydrogen in a solution of the same $H^{\cdot}$-concentration.

A. Coehn and G. Grote contribute a long and valuable paper on the action of ultra-violet light on aqueous vapour and on electrolytic gas (hydrogen + oxygen).

R. Höber describes a new method of determining the inner electrical conductivity of blood cells. J. R. Katz applies Nernst's equation for "ideally concentrated" solutions to the phenomena of *Quellung*. Wl. Kistiakowsky gives an interesting account of the effect of motion on electrode-potentials and the phenomena of periodic passivity. F. Krüger discusses the formation of ozone by the silent discharge. F. A. Lindemann, in a most interesting paper, investigates mathematically the forces acting between the atoms of solid bodies. R. Lorenz gives an account of the present position of the question as to the electrolytic dissociation of molten salts. L. Michaelis discusses the iso-electric point of the "electro-amphoteric" colloids. E. and D. Müller determine the velocity coefficient of chlorate formation by an electrolytic method. N. Parravano and G. Sirovich discuss generally the phenomena of crystallisation in ternary systems. H. Pick contributes some interesting results on the molecular state and ionisation of aqueous solutions of hydrofluoric acid. R. Ruer and E. Scharff have investigated the effect of light on an anodically charged platinum electrode. O. Sackur discusses from a mathematical point of view the relation of the energy-quantum to the kinetic theory of gases and the calculation of Nernst's chemical constants.

G. Tammann discusses the effect of temperature on crystalline form. H. v. Wartenberg con-

tributes some interesting data on the thermochemistry of silicon. F. Weigert has an important paper on the effect of oxygen in retarding and inhibiting photochemical reactions. It will be evident from this very brief summary that the Nernst *Festschrift* is full of interesting material and is in every sense worthy of the distinguished physical chemist in whose honour it was published.

F. G. DONNAN.

FUNCTION THEORY.

Lectures on the Theory of Functions of Real Variables. Vol. ii. By Prof. J. Pierpoint. Pp. xiii+645. (Boston, New York, Chicago and London: Ginn and Co., 1912.) Price 20*s.* net.

THE main topics of this volume are proper and improper integrals, series and products, point-sets and aggregates, continuity and discontinuity, and the geometrical notions derived from intuition. In style and method it follows the same lines as vol. i.

The first thing to notice is the substitution of "metric set" instead of "measurable set" for a set of points the upper and lower contents of which are equal. In chapter xi. we have the theory of the upper and lower measure of any set which can be enclosed by a countable aggregate of metric sets. The treatment is quasi-geometrical, after the manner of Minkowski, but, of course, all the arguments used are purely arithmetical. In this, as in all other parts of the subject, we are struck by the variety of cases presented by the strict arithmetical theory, where intuition suggests one definite conclusion. There are so many new symbols used that it is difficult to give an account of this valuable and original discussion of measure; it concludes with a theorem which may be regarded as an extension of the statement that, if a finite segment is divided into any finite number of parts, the length of the segment is the sum of the lengths of the parts. It is extremely interesting to compare the analytical theorem, and those which lead up to it, with the geometrical theorem, taken as obvious by all previous generations of mathematicians.

Another novel feature of the work is the author's definition of improper integrals. This is given on p. 32, after a statement of two other current definitions. It leads (pp. 402 *sqq.*) to a discussion of improper Lebesgue integrals, and an extended theory of the change of order of integration in a multiple integral. The theory of Fourier series is discussed from the same point of view, and we are thus led to see that the Fourier expansions are valid for cases which do not satisfy the conditions of Riemann and Dirichlet. Lebesgue, in fact, has made an addition to the theory of trigonometrical series so great that it ought not to be ignored in any treatise dealing with them with any attempt at completeness.

The sections which deal with geometrical conceptions are those which are likely to have the greatest educational effect upon the mathematical student. If we define an analytical curve by the equations $x=\phi(t)$, $y=\psi(t)$, where $\phi(t)$, $\psi(t)$ are one-valued continuous functions of a real variable t in a certain interval, then the curve is continuous, and, if closed, bounds a region in the plane (x, y). But it need not have a tangent at every, or any, point: it may fill up a plane area, such as a square, and no arc of it need have a finite length. Anything more remote from the conclusions of ordinary intuition it is hard to conceive. At the same time, all these statements have been proved with the utmost degree of rigour at present attainable, and seem to be proof against all possible objections.

In a similar way, the definition of the area of a surface as the limit of that of an inscribed polyhedron was shown to be fallacious by Schwarz (whose proof is reproduced on p. 626). The author gives a definition of the area, based upon the assumption $x, y, z=\phi(u, v), \psi(u, v), \chi(u, v)$, where ϕ, ψ, χ are functions of the independent real variables u, v, which range over a certain field. Thus we are brought back once more to Gauss's classical memoir as the first analytical treatment of surfaces destined to be of permanent value in the widest sense.

Practically, a good deal of the success of a mathematical treatise depends upon its symbolism. Dr. Pierpoint seems to have fairly hit the mark; his new symbols are not too many to remember, and each of them crystallises an important conception. Undoubtedly we shall have, before very long, a new and generally accepted system of symbols. At present we are in a state of comparative chaos, just as at the time of the invention of the infinitesimal calculus. The sooner this is ended the better; and it might be appropriately discussed by the next mathematical congress, if there is any prospect of agreement.

An Englishman naturally compares this work with that of Dr. Hobson. Dr. Pierpoint has the advantage of writing at a later date, and is thus able to include more recent discoveries; in other respects there is a contrast, which does not detract from the merits of either work, but is more or less typical of the nationalities of their authors. One abbreviates when he can, the other when he feels that he must; one tries to avoid metaphysics, but scarcely succeeds, while the other

never touches on a metaphysical idea. Fortunately, philosophers are becoming more mathematical, and *vice versâ*; so the absorption of science and philosophy into poetry seems much less distant than a century ago. G. B. M.

A YEARBOOK OF SCIENCE.

Jahrbuch der Naturwissenschaften, 1911–1912. Edited by Dr. Joseph Plassmann. Pp. xvi + 452. (Freiburg im Breisgau and London: B. Herder, 1912.) Price 7*s*. 6*d*.

THE twenty-seventh volume of this useful publication is well up to the level of its predecessors. In spite of the great expansion of all the subjects treated, the size of the work has not been increased. This implies a more and more "intensive" treatment, and a careful selection of topics. In physics, the 5000 odd new publications of 1911 have been brought within the compass of forty-eight short notes. The task of selecting one paper out of every hundred must be a formidable one. Dr. Heinrich Konen, to whom it fell, took care to emphasise those which offer a certain amount of novelty or practical utility, such as Lebedef's shortest possible sound-waves (0·2 mm.), which are absorbed by 2½ cm. of air; Rubens's longest light-waves (0·116 mm.); Féry's prism with curved surfaces; and Anderson's collodion copies of Rowland gratings.

The chemistry section is rather insufficiently separated from the industrial section, and so it happens that such things as the utilisation of zirconia, and the preparation of illuminating gas free from CO, are dealt with twice over. Dr. Plassmann himself writes the section on astronomy, and devotes considerable space to Martian questions and the mass of the ring of planetoids. Bauschinger's estimate of the latter, amounting to about one-fiftieth of the mass of Mercury, is supported on optical grounds.

Among the subjects dealt with in meteorology we find Wegener's stratification of the atmosphere, wind velocities, sunspots and weather, an aeronautical weather service, and Birkeland's theory of terrestrial magnetism and allied phenomena. The division of anthropology deals, among other interesting topics, with the origin of numbers and systems of culture, and the classification of human skulls. Other sections deal with mineralogy and geology, zoology, botany, agriculture and forestry, geography and ethnography, medicine and hygiene, aeronautics, and the various technical subjects. The latter include mechanical engineering, electrotechnics, heating and illumination, metallurgy, railway management, mining, ceramics, naval construction, freezing plant, gas industry, and firearms.

A calendar of astronomical events and an obituary complete the work, which may be regarded as an almost indispensable work of reference. It should be stated that it is printed in the Gothic type, and not in the Roman type now usual in German scientific publications.

GEOGRAPHICAL WORKS.

(1) *The Elements of Geography*. By R. D. Salisbury, H. H. Barrows, and W. S. Tower. Pp. ix + 616 + 7 maps. (New York: Henry Holt and Co., n.d.) Price 1.50 dollars. (American Science Series.)

(2) *A Geography of the British Empire*. By Prof. A. J. Herbertson and R. L. Thompson. Pp. 256 + 3 maps. (Oxford: Clarendon Press, 1912.) Price 2*s*. 6*d*. (The Oxford Geographies.)

(3) *Forfarshire*. By E. S. Valentine. Pp. viii + 160 + 2 maps. (Cambridge: University Press, 1912.) Price 1*s*. 6*d*. (Cambridge County Geographies.)

(4) *The Lost Towns of the Yorkshire Coast and other Chapters bearing upon the Geography of the District*. By T. Sheppard. Pp. xviii + 329. (London: A. Brown and Sons, Ltd., 1912.) Price 7*s*. 6*d*. net.

(1) THE American geography under notice emanates from members of the department of geography in the University of Chicago. British writers of geographical text-books have yet to follow German and American writers in work of this advanced character. The present volume forms, therefore, an interesting study, possessing many virtues and certain faults. The writers have followed general theoretical lines, avoiding those of the ancient "cosmography" with its principle of description according to countries.

After a short general discussion of the earth as a planet, and of its main features, we find a proper importance awarded to climate and weather, to which seven chapters are devoted out of a total of twenty-one. After these the authors deal with the oceans, then the "materials of the land" (soils, minerals, etc.), and lastly land-forms, with the consideration of the forces which shape them, and their influence on human conditions and on life generally. This is probably the best order that could be followed, though throughout the long section on climate there is some temptation to wish that a few more leading facts concerning the configuration of the surface and the other subjects of the later sections had been transferred to an introductory chapter, so that the student should be, at the outset, more clearly in possession of

the exact meaning of the importance to be attached to the climatic factor.

A tendency observed in other American text-books is also to be noticed in this—that of introducing details which can scarcely be considered to have any relation with geography, even following the widest connotation of that term. The very close details of output in the economic chapters provide an illustration in point, valuable as they are, no doubt, in themselves. This book is very fully illustrated; many both of the diagrams and of the views are on too small a scale to fulfil their purposes properly.

(2) The "Geography of the British Empire," by Prof. Herbertson and Mr. Thompson, is arranged on a simple descriptive plan, and illustrated with a very large number of sketch-maps mostly showing very clearly the special points which they are intended to show, though not all are free from the charge of over-reduction. The book is of an elementary character, and little or no endeavour is made to deal with the inter-relation of the various parts of the Empire, though these are treated individually with a due sense of proportion. This proportionate treatment, within the compass of one volume, is in itself a valuable educational achievement, indicating what should be the first object of geographical teaching in British schools. It may be regretted, perhaps, that the coloured physical maps are confined to the representation of the British Isles.

(3) The Cambridge County Geographies have unquestionably improved since the inception of the series, and Mr. Valentine's volume on Forfarshire maintains the standard. In general reputation for scenic and kindred interests the eastern counties of Scotland have suffered in contrast with the western, yet Forfarshire is an area possessing many natural beauties, both on the coast and inland: its archæological interests are considerable, and its economic importance is high. All these aspects are clearly illustrated, both textually and by means of photographs, though the statistics freely quoted in the economic connection will not long maintain their value. The descriptions of ancient remains and buildings (for which Forfar is scarcely surpassed by any other Scottish county) are specially good.

(4) Mr. Sheppard provides a complete physical and historical setting for his study of the villages of Holderness which have been destroyed by the encroachment of the sea on the land. He cites authorities very fully, and has investigated old maps with great care; there is a chapter on these, with a number of reproductions, some of which have been reduced so far that not only the minutiæ, but also the more salient features, are lost; in such cases the reproduction of the pertinent section of the map on a larger scale would have been preferable. There are many appropriate photographs and reproductions of old prints. In one respect the title of the book does less than justice to its scope, for the last six chapters are descriptive of the East Riding generally, and will serve as a useful guide to that district.

The books by Mr. Valentine and Mr. Sheppard both contain, as it happens, an explanation of the word "shire"; the two writers curiously disagree on the point.

OUR BOOKSHELF.

Photography of To-day. By H. Chapman Jones. Pp. 342+plates. (London: Seeley, Service, and Co., Ltd., 1913.) Price 5*s.* net.

THERE are a variety of text-books of photography in the market, one of which is by Mr. Chapman Jones. On turning to the work under review, to our great relief it is found to be of a totally different character from the ordinary variety. It contains no formulæ for developers or for anything else, but is what it professes to be—"a popular account of the origin, progress and latest discoveries in the photographer's art, told in non-technical language"—and is illustrated with excellent illustrations of pictorial art, and with some passable diagrams. The author commences with light and its effects, then continues with lenses, and follows on with a short history of photography told in a bright and readable manner.

The history of photography before the use of gelatine is cut rather short, but perhaps it is well, as those who read the work will, as a rule, be those who use a Kodak—the "press the button and we do the rest" kind of people. To such photographers the chapters on the gelatine process will be read with pleasure, and will at all events enable them to talk rationally about their hobby, which is seldom the case at present, with few exceptions, and it may be that by reading it they may wish to "press the button" and do the rest themselves. The printing processes are fully described, as are instantaneous photography and telephotography. Truth and error in photography have a chapter devoted to them. There is a saying as to "lying like a photograph." Mr. Chapman Jones lets photography down easily in this respect.

The author has produced a book which it is a pleasure to read, and with some small omissions has carried out its intention admirably. Allusion has already been made to the illustrations, which are all distinctly good. It would have been interesting if he had told us the method adopted of reproducing the picture of the frontispiece, "A Rainbow from an Autochrome," in more detail than he does. We can recommend the book to all, more especially to those who are not expert photographers.

The Botany of Iceland. Edited by Dr. L. Kolderup Rosenvinge and Dr. Eug. Warming. Part i. "The Marine Algal Vegetation." By Dr. Helgi Jónsson. Pp. vi+186. (Copenhagen: J. Frimodt; London: John Wheldon and Co., 1912.)

DANISH botanists are to be congratulated on the vigorous manner in which they attack the botany of the various dependencies of their kingdom. In the "Botany of the Faeröes" (1901–1908) the results of a systematic investigation of the flora and vegetation of those islands were presented, and with the completion of that work a similar survey of the botany of Iceland has been commenced.

The first part of the Iceland series, namely, the marine algæ, by Helgi Jónsson, has now appeared. It begins with the systematic list, which is concisely dealt with. An interesting account of the phytogeographic components of the flora follows, together with a comparison of the floristic features of neighbouring areas. The remaining pages are occupied with a detailed description of the algal communities, and notes on the biology of the species. A new method of classification is employed; three main vertical "zones" are recognised, and the communities of the littoral zone are subdivided according to their illumination requirements. It is open to question whether these divisions will meet with general approval, but all will agree that Dr. Jónsson has furnished a most valuable contribution to algological literature.

A. D. C.

A Medical and Surgical Help for Shipmasters and Officers in the Merchant Navy; including First Aid to the Injured. By W. Johnson Smith. Revised by Dr. Arnold Chaplin. Fourth edition, revised. Pp. xviii+355. (London: Charles Griffin and Co., Ltd., 1912.) Price 5*s.* net.

DR. CHAPLIN has re-written the portions of the work dealing with the causation of diseases, so as to incorporate the recent advances in our knowledge, especially of tropical diseases. The new scales of drugs and medical and surgical appliances, issued by the Board of Trade in January, 1912, have been included, and in other ways the volume has been brought into line with present-day requirements.

A Handbook of Wireless Telegraphy: its Theory and Practice. By Dr. J. Erskine-Murray. Pp. xvi+442. Fourth edition. (London: Crosby Lockwood and Son, 1913.) Price 10*s.* 6*d.* net.

A REVIEW of the third edition of Dr. Erskine-Murray's book will be found in the issue of NATURE for August 24, 1911 (vol. lxxxvii., p. 240). The additions to the present edition include a new chapter on the telegraphic efficiency of a wireless system; a theory of abnormal ranges, by night and by day, deduced directly from telegraphic observations, now included in the chapter on transmission; and new sections in other chapters on the Poulsen, Goldschmidt, and new Telefunken systems.

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.*]

On the Appearance of Helium and Neon in Vacuum Tubes.

AT the last meeting of the Chemical Society, Sir William Ramsay, Prof. Collie, and Mr. Patterson described some experiments which they regard as proving the transmutation of other elements into helium and neon. I have been making experiments of a somewhat similar character for some time, and though the investigation is not yet finished, the results I have obtained up to the present time seem to me in favour of a different explanation from that put forward at the Chemical Society. I described some of these experiments in a lecture at the Royal Institution on January 17, but as the separate copies of that lecture have not yet been issued, I will give here an account of some of the experiments which seem to me to have the most direct bearing on the phenomenon in question.

I used the method of positive rays to detect the gases; this method is more sensitive than spectrum analysis, and furnishes much more definite information. I may say that the primary object of my experiments was to investigate the origin and properties of a new gas of atomic weight 3, which I shall call X_3, which I discovered by the positive-ray method. This gas, as well as one with an atomic weight 20 (neon?), has appeared sporadically on the photographs taken in the course of the last two years; the discharge in the tube being the ordinary discharge produced by an induction coil through a large bulb furnished with aluminium terminals, and containing gas at a very low pressure. There seems to be no obvious connection between the appearance of either of these lines and the nature of the gas used to fill the tube; the 3 line has appeared when the bulb was filled with hydrogen, with nitrogen, with air, with helium, or with mixtures of hydrogen and oxygen in various proportions; the 20 line when the bulb contained hydrogen, nitrogen, air, hydrochloric acid gas, mixtures of hydrogen and oxygen.

The experiments I made had for their object the discovery of the circumstances which favour the production of X_3, and to test whether it was triatomic hydrogen produced by the discharge, as this is the alternative to its being a new element. I have found that the conditions which lead to a considerable production of X_3 generally give rise to the appearance of helium and neon. Indeed, in the great majority of cases in which I have observed the appearance of traces of helium and neon these gases have been accompanied by larger quantities of X_3; this gas seems to have escaped the notice of the readers of the paper at the Chemical Society. I may mention, too, that along with neon of atomic weight 20 there is a line in these circumstances corresponding to an atomic weight 10 or thereabouts. Though this is probably due to neon with two charges of electricity, it is generally brighter in comparison with the neon line than is usual for the lines corresponding to doubly and singly charged atoms, so that it is not impossible, though perhaps unlikely, that it may be due to a new gas.

The positive rays for the analysis of the gases were produced in a vessel containing gases at a low pressure. I shall call this the testing vessel; the vessel in which the various processes for generating X_3

were tried (the experimenting chamber) was sealed on to the testing vessel, but separated from it by a tap. Thus the pressure in the experimenting chamber was not restricted to being the same as that in the testing vessel, but might have the value which seemed most appropriate for any particular type of experiment. After these experiments were over, the tap was turned and some of the gases from the experimenting chamber let into the testing vessel; a photograph was then taken, and by comparing it with one taken before turning the tap the new gases present in the experiment chamber could be detected. The processes by which I have hitherto got the most plentiful supply of X_3 are :—

(1) By bombarding with kathode rays metals and other bodies.

(2) By the discharge from a Wehnelt kathode through a gas at a low pressure.

(3) By an arc discharge in a gas at a comparatively high pressure.

By far the larger number of the experiments were made by bombarding metals, but I will begin by describing an experiment with the arc, as it raises the question of the origin of these lines in a very direct way. An arc between iron wires passed through hydrogen at about 3 cm. pressure (in this case all the kathode rays would be absorbed quite close to the electrode) for an hour or so, and the gases liberated in the experimenting chamber tested; X_3, helium, and neon were found. The experiment, using the same wires for terminals, was repeated the next day; the three gases were again found. On the next day, still using the same wires, the arc was passed through oxygen; the X_3 line was still there, though much fainter than before; the helium and neon could not be detected with certainty. The next day, using the same terminals, the arc was again passed through oxygen; not one of the lines could be detected. This looks as if these substances were produced by the arc passing through hydrogen. It was found, however, that, still keeping to the same terminals, on pumping the oxygen carefully out and filling up again with hydrogen, the arc through the hydrogen now did not give even a trace of these lines. On replacing the old iron wires by new ones, and sending the arc through the hydrogen, the lines reappeared. This experiment seems to me to point very clearly to the conclusion that these gases were in the terminals to begin with, were removed from them by the long-continued sparking, and were not produced *de novo* by the arc.

In the experiments when the discharge was produced in a tube with a Wehnelt kathode, the potential difference between the terminals was only 220 volts, so that the kathode rays in the tube had only a fraction of the energy they had when the discharge was produced by an induction coil; X_3 and helium appeared when the discharge passed through this tube. I did not detect any neon.

The method which gave X_3 and also the other gases, in the greatest abundance, was to bombard metals, or indeed almost any substance, with kathode rays. The tube used for this purpose had a curved kathode, which focussed the rays on a table on which the substance to be bombarded was placed. The substance, round the spot struck by the rays, was generally raised to a bright red heat by the bombardment; the bombardment was as a rule continued for five or six hours at a time. I have got the X_3 line, as a rule, accompanied at first by the helium line, and somewhat less frequently by the neon line, when these following substances (which include nearly all I have tried) were bombarded: iron, nickel, oxide of nickel, zinc, copper, various samples of lead, platinum, two meteorites, and a specimen of black mica given me by Sir James Dewar, which was remarkable for the amount of neon it gave off.

The most abundant supply of X_3 came from platinum, and I will describe an experiment with this metal. A piece of platinum foil was bombarded on four days, and the gases produced each day examined. At the end of the first day's bombardment it was found that the line due to X_3 was very strong, those due to helium and neon weaker, but still quite conspicuous. The gases produced the first day were well washed out of the tube, and the foil bombarded for a second day. The gases formed proved to be much the same as on the first day; there was no appreciable diminution. The examination of the result of the third day's bombardment showed that the X_3 line had diminished considerably, the lines due to helium and neon perceptibly. When the gases produced on the fourth day's bombardment were examined it was found that the X_3 and helium had diminished to such an extent that the lines were barely visible. I could not see the neon line at all. In this case the helium was not eliminated until the fourth day. In general I have found that the helium disappeared long before the X_3 gas. Thus a piece of old lead I bombarded gave off appreciable quantities of helium from the first day's bombardment, very little on the second day, and none that I could detect on the third or subsequent days. The X_3, on the other hand, came off in considerable quantities up to the end of the experiment, which lasted for six days. I attribute the superior elimination of X_3 in the case of the platinum foil to the fact that during the whole time the bombardment was concentrated on a patch only about 2 mm. in diameter, while the lead melted under the bombardment, so that fresh portions were continually being exposed to the rays. A piece of Kahlbaum's chemically pure lead gave appreciable amounts of X_3 and helium, though not nearly so much as the old lead. I tried some lead which had just been precipitated, but could not detect either X_3 or helium.

In the course of the experiments with old lead I let hydrogen into the experimenting chamber to see if it would increase the amount of X_3, but could not detect any effect. On one occasion I let in oxygen when nickel was bombarded, also without any appreciable effect. I think these experiments are in favour of the view that these gases are present in the metal independently of the bombardment, and are liberated by the action of the kathode rays. They are surprisingly firmly held by the metal, and cannot, so far as my experience goes, be got rid of by heating. I kept a piece of lead in a quartz tube boiling in a vacuum for three or four hours, until all but a quarter of the lead had boiled away, and examined the gases given off during this process; neither X_3 nor helium could be detected. I then took the quarter that remained and bombarded it, and got appreciable amounts of X_3 and helium. On a second bombardment the X_3 was visible but the helium had disappeared. As an instance of the way these gases can stick to metals even when in solution or chemical combination, I may mention that though, as I have said, platinum foil after long exposure to kathode rays is freed from these gases, yet I got appreciable quantities of X_3 and helium, though no neon from platinum sponge freshly prepared from platinic chloride.

The reason helium is obtained by heating the glass of old Röntgen-ray bulbs is, I think, that after liberation by the kathode rays, the helium either adheres to the surface or is absorbed in a much looser way than before it was liberated. The question as to how these gases get into the metals is a most interesting one; are they absorbed in the process of manufacture?

In this connection it is interesting to note that X_3 does not appear to occur to any appreciable extent in the atmosphere. Sometimes when suffering from the difficulty of clearing out these gases I have been goaded into speculating whether they do not represent the partially abortive attempts of ordinary metals to imitate the behaviour of radio-active substance; but whereas in these substances the α particles and the like are emitted with such velocity that they get clear away from the atom, in ordinary metals they have not sufficient energy to get clear, but cling to the outer parts of the atom, and have to be helped by the kathode rays to escape.

I would like to direct attention to the analogy between the effects just described and an everyday experience with discharge tubes—I mean the difficulty of getting these tubes free from hydrogen when the test is made by a sensitive method like that of the positive rays. Though you may heat the glass of the tube to melting point, may dry the gases by liquid air or cooled charcoal, and free the gases you let into the tube as carefully as you will from hydrogen, you will still get the hydrogen lines by the positive-ray method, even when the bulb has been running several hours a day for nearly a year. The only exception is when oxygen is kept continuously running through the tube, and this, I think, is due, not to lack of liberation of hydrogen, but to the oxygen combining with the small quantity of hydrogen liberated, just as it combines with the mercury vapour and causes the disappearance of the mercury lines. I think this production of hydrogen in the tube is quite analogous to the production of X_3, of helium, and of neon. I have been greatly assisted in the experiments I have described by Mr. F. W. Aston, Trinity College, and Mr. E. Everett. J. J. THOMSON.

February 8.

The Water-surface "Halo."

THE "halo" which a happy memory of eighty years enables the Rev. O. Fisher to recall in NATURE of February 6 was probably one to which the explanation offered by Dr. Franklin Parsons does not apply.

There is a very striking phenomenon of separate rays or shafts of light converging on the shadow of the observer's head when this shadow is thrown on water. The phenomenon requires for its production certain conditions:—(1) A bright sun, high in a clear sky. For this reason in these latitudes the appearance is best seen about midday in summer. In winter it is scarcely noticeable. (2) The water must not be quite clear; on the other hand it must not be very turbid. (3) The surface must not be smooth, but may be fairly briskly agitated, but again not too briskly. (4) The water should be deep.

If any one of these conditions is absent the phenomenon is not seen, or is only imperfectly seen, as I was able to satisfy myself about twenty-five years ago by observations made, day after day, on the lake of Ullswater, where a stream discharged the muddy water of a mine far into the lake, and thus provided one of the necessary factors of variation. The necessity of these conditions, when once discovered, makes the explanation easy. The irregular convexities of the ruffled surface acting as condensing lenses separate the light penetrating the water into converging shafts. Along certain lengths of each or many of these shafts a sufficient condensation of light takes place to render them visible by means of the additional illumination of the slight turbidity. Thus the water is filled with luminous parallel shafts of varying lengths, which, seen in perspective, have their vanishing point in the shadow of the observer's head. I remember that it was long before I realised that the rays were *below* and not *on* the surface. When the observer's head is not many feet above the water the rays may be traced to great distances—50 or 60 degrees—from the shadow of the head.

The phenomenon, though often very brilliant, is often unnoticed, even by good observers—I think because it requires a certain comprehensive glance, no doubt in the first instance accidental, to recognise that the widely separated broken radiations belong to a single convergent system. But when this system has once been realised it becomes hauntingly present, and one glimpses portions of it at every glance at the water, even though the shadow of the head is cut off from the surface. A. M. WORTHINGTON.

Exmouth, February 9.

An X-Ray Fringe System.

BY allowing a diverging pencil of Röntgen radiation to fall at nearly grazing incidence on one of the sets of cleavage planes of a crystal of rock-salt, and observing the intensity of the reflected pencil by a photographic plate, we find a series of well-marked and equal-spaced maxima in positions corresponding to equal increments of $\cos\theta$, where θ is the angle of incidence of radiation on the cleavage planes. In the directly transmitted beam there is no indication of variation of intensity with angle of incidence. We thus have what *appears* to be a series of X-ray spectra of different orders, due to agreement in phase of waves from successive layers of molecules. Calculating on this assumption we get a wave-length of the order of magnitude in agreement with that calculated from the velocity of ejection of electrons by a substance exposed to this particular radiation—that is, assuming the results of the experiments of A. L. Hughes and others on ultra-violet light are equally applicable to Röntgen radiation. While only few experiments have yet been made on which to base any interpretation, this is in agreement with what we have already observed. Of the experimental results there is no doubt, and we cannot at present suggest any probable explanation except the very obvious one of interference. Further experiments are in progress.

C. G. BARKLA.
G. H. MARTYN.

King's College, London.
February 11.

Atmospheric Potential.

IN NATURE of December 12, 1912 (p. 411), Dr. George C. Simpson directs attention to several outstanding problems in atmospheric electricity. He says, *inter alia*: "Everywhere it has been found that the air is a conductor, and that the potential gradient is practically the same." It is not the object here to consider these statements, however questionable.

The potential gradient of the atmosphere is the difference of electric potential between two points in the same vertical one metre apart; which, for the first few kilometres above the earth's surface, is about 100 volts.

Now one problem which Dr. Simpson does not mention is the absence of current from the upper regions of the atmosphere to the lower corresponding to this difference of potential between them. It is a fundamental law of electricity that an electric current will flow in a conductor from a high potential to a lower one.

A conductor projecting vertically from the earth's

surface into the atmosphere for a distance of only ten metres would give for the first metre a voltage of 100, for the second 200, for the third 300, and so on, each voltage tending independently to send a current to the lower end of the conductor. So that a total voltage of 5500 would operate to send a current through the end of a conductor ten metres in height. By the same rule, a voltage mounting into the billions would operate to produce a current in a conductor reaching up to the top of a mountain two or three miles high. Yet there is no corresponding current, if indeed any at all. However poor the air may be as a conductor in transmitting the voltage, it would seem that winds would keep it stirred so as to have fresh portions of it continually in contact with the wire, and so cause a continuous current along it.

I know that others besides the writer would be grateful for some explanation of this apparent paradox.

EVAN M'LENNAN.

Corvallis, Oregon, U.S.A., January 14.

The Upper Trade and Antitrade Winds.

THE table published by Dr. van Bemmelen in NATURE of October 31, 1912 (p. 250), on an atmospheric sounding over Batavia up to a height of 30,800 metres, compared with Dr. A. Wegener's diagram of gases constituting the atmosphere, reveals a striking connection of the succession of the principal wind-drifts with the principal boundary-plains of the atmosphere.

(1) The surface of the pure nitrogen and oxygen atmosphere, almost free from hydrogen, is situated at a height of nearly 23 km.

(2) The surface of the troposphere is, between the tropics, situated at a height of nearly 17 km.

(3) The third principal surface is situated nearly at 0 km.

The table of the sounding of September 12, 1912, shows over each of these heights a succession of winds having a distinct trade and antitrade character.

Over surface (1), about 24 km., the direction from S_9E, above 25 km., the Krakatoa winds from $E_{21}E$ to $E_{81}N$. Over surface (2), about 18 km., the upper trade from E_8S to $E_{42}S$, above 19 km., the high westerly winds from $W_{17}S$ to $W_{30}N$. Over surface (3) the common trade from S to E_4N, above 4 km., the antitrade from E_{20} to $E_{54}N$.

The formal agreement is more perfect between the wind-directions over (1) and (3); but in any case, the directions over (2) confirm the German proverb: "Die Ausnahme bestätigt die Regel." For the directions from E_8S to $E_{..}S$ (average $E_{27}S$) are clearer trade-directions, and from $W_{17}S$ to $W_{30}N$ (average W_1N) are clearer antitrade-directions than the directions over surface (1) and surface (3).

This being so, it seems to be useful to compare the averages of these atmospheric layers in a table:—

Heights, km.	Averages: Of simple wind-directions	Of wind forces	Of air-transports	Wind-drifts of atmosphere	
25–30·5	$E_{18}N$	20	E_8N	Krakatoa winds	1
24	$E_{81}S$	8	$E_{81}S$	High trade-winds	1
19–23	W_1N	12	W_4N	High westerly winds	2
17·5–18	$E_{25}S$	4	$E_{46}S$	Upper trade-winds	2
4–17	$E_{24}N$	12	$E_{28}N$	Antitrade-winds	3
0–3	$E_{29}S$	4	$E_{34}S$	Trade-winds	3

There is a striking agreement of layers (1) and (2) as regards the averages of wind-forces, and a better agreement regarding the real air-transports (averages of directions × forces) than the simple wind-directions.

Here I should like to correct an erratum in the letter of Dr. van Bemmelen, vol. xc., p. 250. The antitrade is in the dry season situated *lower* instead of *higher* (compare vol. lxxxvii., p. 415).

WILHELM KREBS.

Holsteinische Wetter- und Sonnenwarte, Schnelsen, January 9.

Nomenclature at the Zoological Congress.

CERTAIN proposals regarding zoological nomenclature, circulated by Dr. Franz Poche, of Vienna, and supported by many zoologists, may be worth discussing in the columns of NATURE. An appeal has been made to zoologists in general, because it has proved difficult to get matters submitted to the Zoological Congress through the Commission on Nomenclature owing to the rule that permitted a single member of the commission to block progress in this direction if he so desired. It is therefore proposed that propositions for the amendment of the existing rules must be submitted to the congress if they have been approved by a majority of the commission. There can be little doubt that this plan will receive the support of the congress, and in the absence of anything better, I have willingly voted for it. It must be acknowledged, however, that the vote of the congress, in open session, may not always represent the best considered opinions. I was present when the proposals of the Commission on Nomenclature were submitted to the Zoological Congress at Boston, and it seemed evident that the time and place were ill-suited for the careful consideration of the subject. The commission had, indeed, held a special session during the congress, to which all zoologists were invited, but the attendance was sparse and not very representative.

At the coming congress at Monaco, owing to the change of date, it is probable that few Americans will be present, and probably many others, who are teachers, will be unable to leave their classes in the midst of the spring term. The plenum vote is therefore likely to be even less representative than usual; but, on the other hand, the active discussion of the last few years will undoubtedly stimulate more intelligent and widespread interest than was manifested at Boston. Is it not possible to adopt an entirely different and more representative plan, which will give all the results desired by Dr. Poche and his supporters? Why not circulate in advance the arguments for and against proposed amendments, prepared by prominent representatives of the two sides, and then reach a decision by votes received through the mails? Each country could be assigned a certain number of voters, according to its zoological strength; or it would perhaps be simpler to permit all those to vote whose works had been cited in as many as five different issues of *The Zoological Record*. In this way we should obtain a very accurate representation of zoological opinion throughout the world, every zoologist of any long standing having a vote, and all having plenty of time carefully to consider the questions involved. In the long run, the majority of working zoologists will have their way, and it will be a great saving of time and annoyance to permit them to do so as soon as possible. The same method could be adopted by the Botanical Congress, where it is perhaps even more needed, owing to the less settled state of botanical nomenclature.

A second of Dr. Poche's proposals relates to generic names published by authors who do not apply "the principles of binary nomenclature." Some of the decisions of the commission on this question have seemed to many of us contrary to the true meaning

of the rules as they now stand, and so as unnecessary as they are injurious.

A third proposal has to do with the method of determining generic types, and virtually substitutes elimination for type designation. This seems to me a backward step, and those who have used the "elimination" method know well how uncertain and difficult of application it is. On the other hand, the existing rule is not wholly satisfactory. I have elsewhere proposed that when, owing to the discovery of some long-forgotten type designation, a well-known generic name is in danger of being applied in an entirely unaccustomed way, the commission, with the approval of the congress, may arbitrarily designate a type from among the originally included species, in such a way as to retain the current usage of the generic name. It might further be recommended that no one should change the significance of a well-known generic name on account of some old designation of type, without first submitting the case to the commission.

The perplexities of nomenclature are many, doing the best we can, and they should not be needlessly increased. It is even a question whether the writer of these lines really belongs to the species *Homo sapiens*. The "typical" *sapiens*, as described by Linnæus and restricted by D. S. Jordan, is an imaginary being, "tetrapus, mutus, hirsutus," clearly not conspecific with our modern man. Possibly, according to strict nomenclatural rules, the present writer is *Homo americanus europaeus* (L.).

T. D. A. COCKERELL.

University of Colorado, Boulder.

The Discovery of a Human Tooth in the Cave Earth in Kent's Cavern.

IT will be remembered by those interested in the exploration of Kent's Cavern that during the course of the sixteen years' examination of the cavern-deposits, no vestige of the human skeleton was found under the upper stalagmite, though, as mentioned in your columns a few weeks ago, a portion of a human jaw was found *in* the upper or granular stalagmite.

On Saturday evening, February 1, I received the following communication from Mr. Charles Cox, who, with Mr. Powe, the owner of the cavern, has been making additional explorations:—

"Perhaps you will be interested to know that while digging inside arched entrance . . . on January 23 found *human* tooth, and a few minutes after a passage that proves to be the opposite end to the passage found on June 20 last. The above human tooth was 15 in. deep in undisturbed cave earth. Allowing 4 ft. previously excavated, it would be 5 ft. 3 in. below granular stalagmite floor.

"Faithfully yours,

"(Signed) CHARLES COX."

"A. R. Hunt, Esq."

On Monday, February 3, I went to the cavern and saw the spot where the tooth was found, and then went to Mr. Cox's residence, Cavern Villa, to see it. The tooth is an upper incisor, very much worn, and evidently sharpened on the under teeth to a chisel edge.

The points which struck me, as a non-expert, were the triangular shape and the convex front profile of the tooth. A medical friend points out that the triangular shape would be due to much wear on edible roots, &c.

It is to be regretted that the tooth is not a molar; but even as an incisor it seems to attest its own antiquity. It is a remarkable fact that the British Association Research Committee, by restricting its excavations to 4 ft., missed the tooth by 15 in., and the two ends of the passage referred to by Mr. Cox (one end in the sloping chamber and the other far away, near the arched entrance) by little if anything more!

I think it may be useful for me to make this statement (of course, with Messrs. Powe and Cox's consent) as one well acquainted with Kent's Cavern.

ARTHUR R. HUNT.

Southwood, Torquay, February 5.

THE BRITISH ANTARCTIC EXPEDITION.

THE British nation has been overwhelmed with grief by the news that when but a small fraction of their journey remained to accomplish, Captain Robert Falcon Scott and those who accompanied him to the south pole met their death. For the pole had been reached—the position doubly assured by the discovery of the marks left there by Amundsen—and it was only on the return journey, 155 miles from their headquarters, that nature turned relentless, and heaped such a load of difficulties upon the travellers that they finally perished.

Until the vessel *Terra Nova* came into touch with means of communication in New Zealand on Monday last, on her return from the Antarctic, we knew the story of the expedition only down to the early part of last year. The ship had left London on June 1, 1910, for her first outward voyage. The expedition, as perfect in organisation and equipment as not only Scott's former experience, but that of brother-explorers, willingly afforded, could make it, included a larger scientific staff than had ever before been taken south, for this was no mere polar dash. McMurdo Sound was reached, after a difficult voyage from New Zealand, in December, and the main party was landed, to establish headquarters at Cape Evans. A smaller party was placed on the west side of the Sound, and another, which had been destined for King Edward VII. Land, was prevented from landing there by the ice, and was put ashore at Cape Adare. This last party, by the way, must have had difficulties to face only less severe than those of the main body: they encountered heavy weather from the outset, and after being taken off by the ship early last year and landed again at Terra Nova Bay, Victoria Land, they had to be left there instead of being brought off before the ship returned to New Zealand; and it is only now that we learn that, under Lieutenant Campbell's leadership, they wintered in a snow-hut, living on seals and little in the way of imported provisions, were overtaken with sickness, and only regained headquarters in the early part of last November.

When the ship brought back the news of the party down to January, 1912, and it was learnt that Scott was to remain another year to complete his tasks, there was already ample evidence that the scientific workers had justified themselves

under the general direction of Dr. E. A. Wilson, whose loss, along with his leader, is now mourned. At headquarters regular temperature, pressure and wind observations had been kept up, and balloon work had been carried out for the study of the upper atmosphere—an investigation new in antarctic research. Magnetic, gravity and tidal observations, the study of the ice and biological and geological investigations had also been made. Wilson himself, desirous of studying the winter breeding of the emperor penguin, had led a short expedition to Cape Crozier, very noteworthy from the fact of its having been made in June, July and August (winter).

Meanwhile the work of laying depôts for the march to the pole had been carried out, and the march itself was begun on November 2, 1911. Scott had lost nearly half his ponies, and, anxious not to risk the remainder further than absolutely necessary, he delayed the start of the march for a month. In his last message he designates that as a contributory cause of the disaster. Almost from the outset the season appears to have been bitterly unfavourable. However, last year's last message showed the polar party going well, within 150 miles of the pole, where it was left by Commander Evans, Scott's second in command, who brought back the news.

And now the story is taken up by Scott himself, within a few hours of death. His diary is an imperishable memorial, not only of a struggle against overpowering odds at the moment, but of the foresight which was so essential a characteristic of his work. For in face of the foreknowledge of the inevitable end, he looked beyond it to the reception of the news by the world, nearly a year later; fighting against the last weakening, he set down a clearly reasoned statement of the causes which had led to the disaster—misfortunes, he calls them; he will not allow any charge of faulty organisation to be laid against himself and his helpers. Their thoughts turned at last to those dependent on them, and these Scott commended to the assistance of the nation in terms which will be forgotten by none who reads them.

The pole had been reached on January 18, 1912. Scott's companions were Dr. E. A. Wilson, Captain L. E. G. Oates, Lieutenant H. R. Bowers, and Petty Officer Edgar Evans. The last, who was believed to be the strongest man of the party, was the first to break down and delay the rest. The conditions of going on Beardmore Glacier were extremely severe, and here at last (February 17) Evans suffered concussion of the brain, which hastened his end. Then on the Barrier the weather conditions suddenly changed for the worse, with very low temperatures and high winds. Captain Oates fell gravely ill; Scott notes a shortage of fuel in the depôts. On March 16 Oates, feeling death upon him, and knowing that he held his companions back, went from them to meet it. Scott, Wilson, and Bowers pressed on, but within eleven miles of one of the depôts (which was afterwards found by the relief party in good order) a blizzard fell upon them. They had food for two days; Scott wrote his last message when they had been imprisoned for four. A relief party had been out for them; it appears to have been not very far, in either time or distance, from gaining its end. But the remains of Scott and his two companions were not found till after the ensuing winter, in November last.

This is the end of a great explorer: a man *omni consensu capax imperii,* and capable, moreover, of inspiring his followers with affection as well as enthusiasm, of judging the worth of men, and of making the best of their abilities. We find not only that men who accompanied him on his first journey to the south in 1901, as Wilson did, were ready to accompany him again on his second, but also that his inspiration helped others to enter the field independently, as Shackleton did, and already Dr. Charcot has placed it on record that it was Scott who "opened the road to the pole." Such honour, by itself, might have been held to be scientifically barren, but the gains to science of Scott's first journey, supplemented by what is known of the results of the second, refute any possible charge that he aimed merely at the breaking of a record. It has been said of him that he must have risen high in his profession, and indeed, considering how much of his life was devoted to the Antarctic, he did so. Born at Devonport in 1868, he was in the *Britannia* as a naval cadet in 1881, and afterward served successively on the Cape station, in the Channel and Training squadrons, and on the Pacific station, before specialising as a torpedo lieutenant. He was promoted commander in 1900. On his return from the Antarctic in 1904 he was promoted captain, besides receiving the C.V.O. and many other honours, including the Royal medal and a special medal from the Royal Geographical Society, the body which has throughout been most closely associated with his exploring work. In the course of naval service between his southern journeys, he was at the Admiralty as Naval Assistant to the Second Sea Lord.

Dr. E. A. Wilson, as has been said, was chief of the scientific staff; in the former expedition he had served as artist and zoologist on vertebrates. He was an *alumnus* of Cheltenham College and Caius College, Cambridge. Captain Oates was of the 6th (Inniskilling) Dragoons; he served with distinction in the South African war, and on the present expedition his special charge was that of the ponies and mules. Lieutenant Bowers was commissariat officer of the southern party, and Evans was a tried antarctic traveller, having served on Scott's first expedition.

The nation has reason to be proud of these men, who have laid down their lives in the pursuit of geographical knowledge; and it will respond generously to Scott's last appeal: "Surely, surely a great, rich country like ours will see that those who are dependent upon us are properly provided for."

EYESIGHT AND TYPOGRAPHY.[1]

THIS report of the British Association Committee on the influence of school-books upon eyesight is full of interest. Its value depends chiefly upon the report of the oculist subcommittee, which was composed of Messrs. Priestley Smith, H. Eason and N. Bishop Harman. Advice upon the technical and trade aspects of printing was given by competent experts.

The subcommittee's report is valuable from the immediate point of view of school-books and also from the point of view of the reading of printed matter in general. Considering the enormous importance of reading and writing to the general public and the large place they occupy in daily life, it is remarkable that so little attention has hitherto been devoted to the physiological and hygienic features of the subject. It would have been a gracious act for the subcommittee to have expressed its indebtedness to the researches of Javal, an indebtedness which is unmistakable. With few exceptions the report recommends the principles advocated by Javal, and the authors have, perhaps wisely, refrained from any experimental researches on their own account. The subject is full of complications, physiological and psychological, and the recommendations made are as good as can be expected in the present state of knowledge.

At the outset of the section on the hygienic requirements the right note is struck in emphasising the fact that the reader recognises whole words and phrases at a glance. This statement expresses the essential difficulty of the scientific investigation and regulation of printing. Too much stress cannot be laid upon the fact that the canons of *visibility* of individual letters do not apply directly to the far more complex problem of the *legibility* of letter groups in words and phrases. It is rightly pointed out that the upper half of a word or letter is usually more important for perception than the lower half. We would emphasise the point more strongly. It is the fundamental factor in legibility, as is easily proved by reading with the lower half of the line covered by a card. Hence we think that the suggestion made to give more distinctive character to the lower half of a larger proportion of letters is unsound.

The general evolution in the shapes of printed letters has been in the direction of increasing the predominant features of the upper halves, so that more letters extend above the line than below, the extension above the line has increased, whilst that below has been curtailed, and so on. These tendencies are in favour of legibility and should not in our opinion be tampered with. For the same reason we are astonished at the statement that "uncial Greek may be recommended as being easy to read (see supplement)." The supplement gives two examples, one in 12-point Porson Greek, the other in uncial Greek on long primer body. A glance suffices to show that the former is much more legible.

Owing to the complexity of the correlation of the physiological and psychological factors in reading, such details as the best dimensions of letters and spacing, length of lines and their separation, and so on, are at present matters of compromise. The committee does not give any explicit scientific reasons for the faith that it has, but the typographical table and the rules laid down are eminently sensible. The small type used in Bibles and prayer-books is more than a matter of regret; we should like to have seen it more severely condemned. The remarks on the thorny question of atlases are very good.

We hope that this report will have a widespread influence. It contains much sound advice not only for those who deal in school-books but for all authors and publishers.

[1] Report on the Influence of School-books upon Eyesight by a Committee of the British Association, presented at the Dundee Meeting, 1912. Copies obtainable from the British Association, Burlington House, London, W. Price 4*d*.

INVESTIGATION OF ATMOSPHERIC POLLUTION.

THE Committee for the Investigation of Atmospheric Pollution, appointed at the International Smoke Abatement Conference and Exhibition held in London last March, has held three meetings in London and has just published what may be regarded as an interim report.

This report states that after careful consideration of all the various methods that have been suggested or tried for measurement of the impurities of the atmosphere, that employed for *The Lancet* investigation of the soot and dust-fall of London in 1910 has been selected as the simplest, and the one most likely to yield satisfactory results under the conditions which will govern the observations that are to be made. The method is based upon the use of an apparatus resembling an enlarged rain-gauge, with a catchment area of 4 sq. ft. This gauge receives all the dust and soot that falls by its own weight or is carried down by the rainfall during the period of its exposure, and on examination of the water which collects in the bottle attached to the apparatus, the amount of total suspended matter, tarry oils, soot, &c., can be determined.

A circular letter has been sent out by the committee to all the more important city and local authorities in the United Kingdom, asking for their cooperation in the application of this method of observation in the districts over which they have administrative powers. This circular has met with a most gratifying response. The authorities of a large number of important cities have already signified their intention of commencing observations on the lines suggested by the committee, and many other authorities are only waiting for further details before promising their support to the movement and cooperation in the work. Birmingham, Bradford, Leicester and Newcastle are the most important of the cities that have definitely promised their support; but there is no doubt that Glasgow, Liverpool,

Manchester and London will join in these observations.

The new movement initiated by the committee for studying and recording the character of the soot-fall in various industrial centres of the United Kingdom is, therefore, meeting with considerable support; and there is little doubt that the observations and records will prove of decided value to all interested in the progress of smoke abatement.

Dr. W. N. Shaw, F.R.S., director of the Meteorological Office, is chairman of the committee; and its hon. secretary is Dr. J. S. Owens, 47 Victoria Street, S.W., from whom any further particulars regarding the work of the committee can be obtained.

LORD CRAWFORD, F.R.S.

AS announced with regret last week, James Ludovic Lindsay, the twenty-sixth Earl of Crawford, died on January 31. Born at St. Germain-en-Laye on July 28, 1847, he was educated at Eton and Trinity College, Cambridge, and for a short time served as lieutenant in the Grenadier Guards, but his early developed scientific tastes led him to resign the service and devote himself to astronomy and bibliography.

As Lord Lindsay he first became known to readers of NATURE by his organisation of an expedition to observe the total eclipse of the sun near Cadiz on December 21, 1870, and by the establishment, soon afterwards, of his observatory at Dun Echt, Aberdeenshire. Its astronomical equipment was far in advance of any other observatory in Scotland and second only to that of Greenwich in the United Kingdom, for it contained a fine 15-inch equatorial refractor by Grubb with many improvements on former designs, a transit circle of 8-in. aperture by Troughton and Simms, a fine heliometer by Repsold of 4-in. aperture, a 6-in. equatorial refractor by T. Cooke and Sons of York, two reflecting telescopes with silver-on-glass mirrors of 12-in. aperture, both equatorially mounted, a Foucault siderostat by Eichens of Paris, with 16-in. mirror by M. Martin, a 40-ft. photographic lens by Dallmeyer (to be used to photograph the transit of Venus), a 12-in. altazimuth by Troughton and Simms, and a large collection of smaller astronomical and physical apparatus, including the largest electro-magnet then in existence.

Simultaneously with the erection of this observatory (1871–1874) Lord Lindsay was organising an expedition to Mauritius for the purpose of observing the transit of Venus in December, 1874, and there are those who remember the astonishment and interest with which astronomers first read in the Monthly Notices of the Royal Astronomical Society for November, 1873, of the scope and extent of these preparations. The very important results of that expedition are published by him in vols. ii. and iii. of the Dun Echt Observatory Publications. They not only include determinations of the longitudes of Alexandria, Suez, Aden, Seychelles, Réunion and Mauritius, but also an experimental determination of the solar parallax by heliometer observations of the minor planet Juno. This latter series of observations was probably the most important result of all the many costly transit of Venus expeditions, for it proved conclusively that the heliometer method of observing minor planets was capable of determining the solar parallax with a precision and certainty that is unattainable by the historic method of the transit of Venus.

On his return to England Lord Lindsay, in addition to his duties as Member of Parliament for Wigan, continued to perfect the equipment of his observatory, and made researches on the spectra of stars, planets and comets—adding at the same time continually new treasures to his splendid astronomical library.

He also instituted, under the able editorship of Dr. Ralph Copeland (who was in charge of his observatory from 1876 to 1889), the valuable series of Dun Echt circulars, by which early intimation of astronomical discoveries was communicated to astronomers.

On the death, in 1880, of his generous and highly cultured father, the twenty-fifth Earl of Crawford, he succeeded to the earldom. The many responsibilities and occupations which then crowded upon him prevented him from taking much farther part in active astronomical research, and although his interest in it never abated, he thereafter left the work of the observatory almost entirely in the hands of Dr. Copeland.

For some years previous to the retirement of Prof. Piazzi Smyth, in 1888, from the post of Astronomer Royal for Scotland, the question of reorganising the Edinburgh Observatory had been under consideration—and it had even been proposed to hand it over to the University. But this was prevented by Lord Crawford's timely action and noble generosity. He offered the whole of the beautiful instrumental equipment of his observatory and its splendid astronomical library to the nation on the sole condition that the Edinburgh Observatory, thus enriched, should be maintained as a royal observatory. This offer was finally accepted and Dr. Copeland was appointed to the vacant offices of Astronomer Royal for Scotland and professor of astronomy in the University of Edinburgh in January, 1889. The great national observatory on Blackford Hill, which owes its existence to the generous action above described, was formally opened in April, 1896, by Lord Balfour of Burleigh in the presence of Lord Crawford.

Our limits of space render it impossible to do justice to the varied activities of Lord Crawford's life; we have therefore confined attention to the side of his career by which his name will chiefly be remembered in the scientific world, although the narrative conveys but little idea of his mental grasp and breadth of view. He had an inborn genius for mechanics and engineering, a love of science in every form, and a passion for travel; and he inherited from his father the love of all things

rare and beautiful, together with the instinct of the antiquarian, the bibliophile and the collector. His generous and sympathetic nature endeared him to all who were his fellow-workers, and more than one man has to thank him for scientific opportunity that would otherwise have been denied him.

Lord Crawford's health in his later years was far from good. He once wrote: "It has been my lot to live in close communication with two inseparable hangers-on, the one rheumatism, the other asthma. I found relief by going to sea, provided it was towards the Sunny South. The cold damp of a home winter I have not faced for many years." During these voyages he made important collections of birds, fishes, insects and plants (many of them previously unknown to science), which were presented to the National History Department of the British Museum, or, in the case of live specimens, to the Zoological Society. The story of his last cruise in his yacht, the *Valhalla*, among the little-known islands of the Pacific is told by Mr. M. J. Nicoll in his "Three Voyages of a Naturalist."

During the last four years of his life Lord Crawford was almost a prisoner in his house, Cavendish Square, London, where he occupied a suite of rooms that was maintained at nearly uniform temperature. But his mental activity was unabated, and almost to the last he was closely occupied in preparing a catalogue of a vast number of documents he had gathered together relating to the French Revolution—a collection that includes more than 600 original letters of Napoleon the First.

Lord Crawford joined the Royal Astronomical Society in 1871, and became its president in 1878 and 1879. In recognition of his services to astronomy he was elected a fellow of the Royal Society in 1878. He was a trustee of the British Museum, a Knight of the Thistle, a Knight of Grace of St. John of Jerusalem, a Commander of the Legion of Honour of France and of the Rose of Brazil.

ORIGINS OF HELIUM AND NEON.

AT the meeting of the Chemical Society on Thursday last, February 6, two papers were read which have attracted great public attention. One was by Sir William Ramsay, on the presence of helium in an X-ray tube, and the other, on the presence of neon in hydrogen after the passage of the electric discharge through hydrogen at low pressure, was by Prof. Norman Collie and Mr. H. Patterson. An excellent account of the meeting appeared in *The Morning Post* of February 7, and upon it the subjoined revised report is based. Elsewhere in the present issue will be found a communication from Sir J. J. Thomson describing recent experiments of a somewhat similar character made by him, and his interpretation of them.

In the absence of the president of the Chemical Society, Prof. A. Smithells presided at the meeting of the Chemical Society at Burlington House on February 6. Sir William Ramsay, in his paper on the presence of helium in the gas from the interior of an X-ray tube, reminded the fellows that some years ago he and Mr. Cameron had obtained lithium from copper, though people were mildly incredulous. He had also published a statement to the effect that under the influence of radium emanation silicon gave some carbon dioxide, while with thorium a respectable quantity of carbon dioxide was obtained, the inference being that the element tended to break down to carbon, which in the presence of oxygen became carbon dioxide. When the time came for him to have to return the radium that had been lent to him he had looked about for some other substance with which to continue his experiments. Radium gave helium and niton, or radium emanation, and also heat and α rays. Niton was extraordinarily energetic, more so than any other known substance, so that a cubic centimetre of it gave more than three and a half million times the energy of a cubic centimetre of explosive gas. During the decomposition of the emanation α rays were given off and β rays with even greater velocity. The question to determine was whether it was possible to find signs of chemical transformation through the β rays, a difficult one when it was remembered that only 6 per cent. of the energy of emanation appeared in the form of β rays. He had made the attempt, however, with old X-ray bulbs. In the first instance his method had been to break the bulbs, and on analysing the gases contained in the glass by means of the combustion tube, he had found as the only gases helium, neon, and argon. Last November, instead of breaking the bulbs, he had heated them to three hundred degrees, and collected the gases, finding the spectrum of helium and also a small quantity of neon. As a result of these experiments there was no question that the bulbs contained helium. The problem was what was the source of this helium. It might have been derived from the electrons, or from contact with the kathode or anti-kathode, or from the contact of the kathodic rays with the glass. Last summer he had informed the society that on treating water with radium emanation, instead of getting helium, neon was got, the equation suggesting itself that helium (4) plus oxygen (16) equals neon (20). Thus at Bath, when the waters were charged with radium, great quantities of both neon and helium were produced.

Prof. N. J. Collie and Mr. H. Patterson read their paper on the presence of neon in hydrogen after the passage of the electric discharge through hydrogen at low pressures. Prof. Collie directed attention to the fact that he and Mr. Patterson had done the early portion of the work of their joint paper independently and from different points of view, and that it was only in the later stages of the work, when they had learnt that they were getting the same results independently, that they had collaborated. He described his early experiments, which had been undertaken on fluorspar with the hope of decomposing the fluorine by means of the electric discharge. On testing some fluorspar that Sir William Ramsay had received from Iceland last summer he had found that helium was given off. Further investigation showed that the spar gave off carbon monoxide and other gases, and when the problem had been investigated with one of Sir William Ramsay's ingenious pieces of apparatus it had been determined that on treating the spar neon was produced. Further investigation showed that the same result was obtained by using artificial calcium fluoride, and again by using glass wool, and then again by carrying out the discharge in the bare glass tube. What was the origin of the neon? Had air leaked in through the taps of the apparatus? Was it due to impurities in the hydrogen placed in the tube to con-

duct the current, or to the oxygen used in the later stages to get rid of the hydrogen, or to neon being dissolved in the glass? Prof. Collie described the experiments undertaken to exclude the possibility of there being any such origin for the gas, and also the attempt made with a negative result to see whether the neon could have leaked through the heated glass tube.

At this stage, Mr. Patterson continued the paper, showing the point of view from which he had undertaken the research. He had been interested, he said, in the pure physics of the electron. He described the formulæ on which he had built up a hypothesis, and announced that he had thought it conceivable that by doubling the electrical charge on the hydrogen atom it might be possible to convert this into an α particle, and so into helium. He did not, he said, regard the result of the experiment as proving the hypothesis, but he thought that perhaps his hypothesis provided an explanation.

Prof. Collie then resumed his reading of the paper. He had, he said, criticised Mr. Patterson's method of preparing hydrogen by electrolysis of barium hydrate solution, and to avoid this possibility of error Mr. Patterson had filled his barium hydrate apparatus with pure oxygen, so as to avoid the presence of dissolved air in the barium hydrate solution, but he still obtained neon. Another possibility had then suggested itself. While neon did not enter glass under ordinary conditions, might it not do so under the influence of the X-ray discharge? To make certain on this point the experiment tube was surrounded with another tube containing neon, and about the same result was obtained as before. Several experiments were made with helium in the outer tube; in the inner tube neon was found. Lastly, since sending in his paper the previous week, he had used the outside vessel as a vacuum (a higher than an X-ray vacuum), and still the neon appeared, the quantity thus obtained being comparable with that present in about two cubic centimetres of air. The previous Friday and Saturday he had performed the experiment twice with the experiment tube surrounded by a vacuum. He had then asked himself whether there was anything else he could test. He decided to try whether there was anything in the outer chamber. He let a cubic centimetre of pure oxygen into the outer chamber; having pumped out this oxygen he passed a spark through it, and there was a slight explosion, due to hydrogen. He absorbed the oxygen in the usual way with carbon cooled with liquid air, but there was still some gas left, which he regarded as rather a nuisance. He repeated the process of absorption, but the gas still remained, in relatively large amount. He decided to test it and turned on the coil. The sight he then saw astounded him, for the tube was a blaze of helium, with some neon mixed. He communicated with Mr. Patterson, who repeated the experiment. Mr. Patterson at first found the same. Then he put oxygen into the outer tube, and he found, instead of helium in excess, what appeared to be the neon in excess, the equation being suggested that helium (4) plus oxygen (16) equals neon (20). If the helium had sufficient velocity, when produced in the inner tube, to traverse it, it was quite possible for a new element to be produced. For his own part he was quite satisfied provided neon and helium had been produced from substances in which they were previously not present. There were various possibilities. It might be that the elements of the tube or the electrodes gave neon or helium under the influence of the discharge. This gave them ten or a dozen elements to choose from as the source. Again, there was the chance that the hydrogen was the source or mercury vapour. Or it was possible that they were dealing with a primordial form of matter, the primordial atom which, when produced, had all the energy necessary for forming the universe. By the combination of these "atoms" the atoms of the elements would be formed. Helium, and possibly hydrogen, were present in the hottest stars, and they were present in the experimental tube. Perhaps the electric current was a directed flow of these atoms, and with the phenomena of heat and light the elements came into existence. At any rate one thing seemed certain. The elements could be changed, and they could be changed in a way very different from the way that radium was changed. In its case the process could neither be hastened nor retarded. But the present phenomenon was artificial, and, further, the process was occurring at the other end of the system of the atoms, producing elements of low atomic weight. The old idea of the transmutation of elements had to be altered. We were coming now to know more of subatomic matter, and it had to be realised that—

> The old order changeth, yielding place to new,
> And God fulfils Himself in many ways
> Lest one good custom should corrupt the world.

Prof. Collie then showed two illustrations of the effect of sparking neon, the gas when absolutely pure blazing out into a pillar of perfect flame-red. He added, in conclusion, that he had broken the experiment tube, heated it, and found under the microscope that it was full of bubbles of gas that had been caught in their passage through the tube.

Prof. Smithells, in opening the discussion, said that, without venturing to express any opinion upon the facts or the hypothesis brought forward, it was evident that if the conclusions were substantiated it would be difficult to speak of their importance in language of exaggeration.

Sir William Ramsay expressed his great gratification at other researchers having taken up the investigation. With radium there had been no chance of repetition, but the present experiments on transmutation could be reproduced by anyone with a coil and a battery. He was extremely gratified that the theory of transmutation now no longer rested on his *ipsissima verba*.

Various expressions of opinion by men of science upon the experiments and conclusions described above have been published in the daily papers. Mr. F. Soddy has, we learn from *The Westminster Gazette*, given his views as follows:

The results as regards the apparent formation of helium and neon in vacuum tubes under the influence of the kathode rays have been noticed by previous investigators. A paper published by myself in the Proceedings of the Royal Society, 1908 (p. 94), states that the source of what might be termed the miraculous appearance of helium in a vacuum tube was traced to the power of aluminium electrodes of absorbing these gases during previous use. Baron von Hirsch, of Munich, in 1907 came to this laboratory to investigate a case he had noticed in which he supposed that helium was produced by the kathode ray discharge in a vacuum tube. This we succeeded in completely disproving. These observations show that other workers have investigated the kathode rays in vacuum tubes, and have even thought that helium and other rare gases were produced. It is impossible to say anything about the new experiments of Sir William Ramsay, Prof. Collie, and Mr. Patterson until full publication is available. There is nothing in the paper which leads one to suppose that there is any special new condition to which the production could be ascribed, and, of course, some such condition may account for the results. All that can be said is that other workers have not got helium in experiments which seem to be similar.

NOTES.

MR. R. LYDEKKER writes to say that his letter to *The Times* of February 6 in regard to the supposed cuckoo heard by himself at Harpenden on February 4 is based on an exceedingly clever imitation of the bird's note by a bricklayer's labourer working in a new house in the neighbourhood. Mr. Lydekker has interviewed the man, who states that he produces the sound with his lips alone, and that in the season he is able to attract all the cuckoos in his vicinity to the spot where he utters the call.

MR. W. R. OGILVIE GRANT has been appointed assistant keeper of the department of zoology at the Natural History Museum, South Kensington, in succession to Mr. Edgar Smith, who will retire, by reason of age, on March 31.

THE Friday evening discourse at the Royal Institution on February 28 will be delivered by the Hon. R. J. Strutt on active nitrogen, instead of Mr. C. T. R. Wilson, who will deliver his discourse on the photography of the paths of particles ejected by atoms on March 7.

WE regret to announce the death, on February 8, at sixty years of age, of Prof. M. M. McHardy, late professor of ophthalmology in King's College, London, and the inventor of the registering perimeter which bears his name, for mapping out the field of vision.

THE Helmholtz medal of the Berlin Academy of Sciences has been awarded to Prof. S. Schwendener, of the Berlin University, for his researches in vegetable physiology. Prof. Emil Abderhalden, of the University of Halle, has also received a prize for his researches on egg albumin.

WRITING from Launceston, Tasmania, a correspondent states that the belief that exposure to the rays of the moon has a poisonous effect on fish is very prevalent among the older people in Tasmania. The belief appears to have been taken out by the early settlers, and has become firmly rooted. Communications upon the same subject will be found in NATURE of November 14 (p. 305), December 5 (p. 382), and December 12, 1912 (p. 417).

SIR CECIL H. SMITH, director of the Victoria and Albert Museum, and Dr. E. H. Starling, F.R.S., professor of physiology in the University of London, have been elected members of the Athenæum Club under the provisions of the rule which empowers the annual election by the committee of three persons "of distinguished eminence in science, literature, the arts, or for public service."

DR. W. C. FARABEE, instructor in anthropology at Harvard, has resigned that post in order to accept the leadership of an expedition that the University of Pennsylvania is sending to South America, to remain in the field three years. Its main object will be ethnological research, but representatives of other departments of science will accompany the expedition. Dr. Farabee has previous experience of this region, having conducted a South American expedition for the Harvard Peabody Museum from 1906 to 1909.

AN account of the work of Dr. C. G. P. de Laval, whose death on February 2 was announced in last week's NATURE, is given in *Engineering* for February 7. Dr. de Laval was born on May 9, 1845, and was educated at the Upsala University. His name will be associated with the cream-separator, a machine developed by his ingenuity and application, and also with the well-known steam turbine which bears his name. The latter machine is notable as embodying the first application of Napier's diverging nozzle for expanding steam, and for the principle of mounting the turbine wheels on long flexible shafts; these shafts are run at speeds much higher than the critical speed, and under such conditions remarkable steadiness is secured in the rotor. Dr. de Laval's work in the development of high-speed gearing is well known. He also experimented with steam at exceptionally high pressures, and exhibited turbines in 1897 running with steam at 1500 to 1700 lb. per sq. in. pressure. He was a member of the Swedish House of Representatives.

INTERESTING details of the life and work of the Right Hon. Lord Ilkeston, better known in the world of medical science as Sir Walter Foster, who died on January 31, are given in a long obituary notice in *The British Medical Journal* of February 8. B. Walter Foster was born in 1840, and was therefore in his seventy-third year when he died. Before he had completed his twenty-first year he was appointed professor of practical anatomy and medical tutor at Queen's College, Birmingham. He gave special attention to diseases of the heart, and his best-known contribution to medical literature was a book on the sphygmograph which appeared in 1866. Among his other publications are:—"The Use of Ether and Etherised Cod-liver oil in the Treatment of Phthisis," "Method and Medicine," "The Prince's Illness: its Lessons—a Lecture on the Prevention of Disease," and "The Therapeutics of Diabetes Mellitus." He delivered the address in medicine at the annual meeting of the British Medical Association held in Birmingham in 1890, taking as his subject the public aspects of medicine. He was president of the section of public medicine at the annual meeting held at Nottingham in 1892, and of the section of State medicine at the London meeting in 1910. At a comparatively early period of his career Foster had begun to take an active part in public affairs outside his profession. In Parliament he took a prominent part in the discussion of all questions affecting directly or indirectly the interests of medical practitioners. He became Parliamentary secretary to the Local Government Board in 1892, and held the office until 1895. In 1910 he accepted a peerage, taking the title of Lord Ilkeston at the expressed wish of the constituency he had represented for twenty-three years. He had been a Privy Councillor since 1906. In addition to the distinctions already mentioned, he received the honorary degree of D.C.L. from the University of Durham in 1893, and that of LL.D. from the University of Montreal in 1897.

THE Transactions of the Edinburgh Field Naturalists' Club and Microscopical Society for 1911–12

(vol. vi., part 5) contain a portrait and memoir of the late Dr. William Watson, Indian Medical Service, who was president of the society from 1888 to 1891, and died on June 16, 1912, at the age of eighty. Dr. Watson was stationed for many years at Naini Tal, where he saw the disastrous landslip of 1880, acquired special knowledge of Indian botany, and in 1875 was commissioned by Government to furnish a report on the flora of Kumaon.

THE London County Council has issued a handbook to the special series of cases in the Horniman Museum illustrating animal locomotion. The exhibit appears to be of considerable extent, displaying adaptations to swimming, creeping, burrowing, running, leaping, climbing, "parachuting," and flying in various classes of animals, these adaptations being explained in the handbook, which has been compiled by Mr. H. N. Milligan, under the supervision of Dr. Haddon. A plate illustrates the convergence of type presented by various groups of swimming vertebrates, as exemplified by fishes, ichthyosaurs, cetaceans, and sirenians. We believe a special exhibition illustrative of flying is shortly to be opened in the Natural History Museum.

UNDER the title, "Die Mutationen in der Erblichkeitlehre," a lecture delivered by Prof. Hugo de Vries in October, 1912, at the inauguration of the Rice University, Texas, the largest scientific institution in the southern States, for the building and equipment of which the founder, Mr. W. M. Rice, bequeathed ten millions of dollars, has now been published (Berlin: Borntraeger). In this lecture Prof. de Vries reviews the relations between his well-known mutation theory and other theories of evolution—natural selection, orthogenesis, and neo-Lamarckism—replies to various criticisms of the mutation theory, and summarises the chief advances made during recent years in the study of mutation, including the important cytological results obtained by Gates and other investigators. This brochure, presenting the author's latest views, and recounting the progress made during the ten years that have elapsed since the publication of his "Mutationstheorie," will be useful to students of evolutionary biology; numerous references to the recent literature of the subject are included within the comparatively small compass of forty-two pages.

THE Cambridge University Press has published Prof. J. Ward's Henry Sidgwick memorial lecture for 1912, "Heredity and Memory" (1*s.* 6*d.* net). The lecture deals in an interesting manner with the hypothesis that heredity is a form of memory. The author differs from some who accept Semon's mnemic hypothesis in believing that it is useless to seek a physical explanation of "engrams," for memory is essentially a psychical process, and heredity, being fundamentally racial experience, is also psychical rather than physical. The general position adopted is thus frankly vitalistic or animistic, and this is justified on the ground that since we know psychical phenomena (mind and purpose) in ourselves, the principle of continuity demands that they must exist also in the lower organisms. It is not justifiable to ascribe the vital phenomena of the lowest organisms to purely physical causes when we have no conception of how such causes could produce the mental phenomena which are characteristic of the highest. A considerable portion of the lecture is devoted to a criticism of Weismann, but a good deal of recent work, some of which might have been used in support of the author's thesis, and some which tells against it, is not mentioned.

MR. R. L. DITMARS, the curator of reptiles of the New York Zoological Society, contributes to a recent number of *Zoologica* (published November, 1912) an interesting paper upon the feeding habits of snakes, based in the main upon observations of specimens in captivity. For the purpose of systematising his subject-matter, the author divides these reptiles according to their method of taking food into two main groups, the non-venomous and the venomous. The non-venomous group contains: (*a*) constricting species, like the Boidæ and some Colubridæ, which coil round their prey and squeeze it to death; (*b*) semi-constrictors, like the Colubrine genera Zamenis and Spilotes, which overcome their prey by holding it in a single coil or by pressing it to the ground, and swallow it alive; (*c*) non-constricting species, like the Colubrine genera Tropidonotus and Heterodon, and the insectivorous Typhlopidæ and Glauconiidæ. The venomous group contains: (*a*) the poisonous Colubridæ, like the sea-snakes (Hydrophis) and the cobras (Naia), which seize their prey and hold it until dead, when swallowing begins; (*b*) the vipers, which stab their prey and immediately release it, awaiting its rapid death by poisoning before attempting to swallow it. This classification is not claimed to be in any sense absolute, but is adopted to indicate the principal methods of overcoming prey practised by snakes. Some very interesting observations are recorded, especially those relating to an example of the king cobra, or Hamadryad (*Naia bungarus*), an example of which showed by its behaviour that it knew the difference between a water viper (*Ancistrodon piscivorus*), a poisonous Crotaline, and a harmless water snake (*Tropidonotus taxispilotis*), although to the human observer the two matched one another closely. The viper it refused to touch, but the innocuous specimen it seized at once. This experiment gains in interest from the fact that the two species offered for food to the cobra are foreign to its native country.

ALTHOUGH the study of plant geography dates back at least as far as Humboldt's time, plant ecology, which is concerned with the detailed and systematic study of plant communities—the groupings of plants found associated together under definite conditions of life—is one of the youngest branches of botany. One of the requirements of a young but progressive subject is a suitable nomenclature, and this Dr. H. Brockmann-Jerosch and Dr. E. Rübel have attempted to supply in their recently published work, "Die Einteilung der Pflanzengesellschaften" (Engelmann, Leipzig, price 2.50 marks). They divide plant communities into four main types—"Lignosa" (woodland and scrub), "Prata" (meadow and marsh), "Deserta," and "Phytoplankton." Each of these is divided into a number of classes of formations, and these again into groups of formations, and these are

discussed in some detail, with examples drawn from the rapidly growing literature of phytogeography. Though it is doubtful whether ecologists will accept this scheme in all its details, it will be welcomed as an important contribution to plant ecology from a broad philosophic point of view.

THE Meteorological Chart of the North Atlantic and Mediterranean for February (first issue), published by the Meteorological Office, exhibits a cyclonic storm of exceptional intensity over the central portions of the Atlantic in the weekly period commencing with January 9; the storm region occupied practically the whole breadth of the ocean, while anticyclones lay over the United States and northern Europe. At 7h. a.m. on January 10 the ss. *Celtic*, in lat. 49° N., long. 29° W., reported a reading of the barometer so low as 27·44 in., one of the lowest ever recorded over the North Atlantic; on February 5, 1870, the R.M.S. *Tarifa*, in lat 51° 3′ N., long. 23° 39′ W., reported a reading of 27·33 in. It will probably be remembered that at False Point, Orissa (India), the low reading of 27·12 in. was recorded in the cyclone of September 22, 1885; but such extreme values are very rare.

DR. RUDOLF SPITALEN, in "Die Eiszeiten und Polschwankungen der Erde" (*Sitzungsb. d. k. Akad. d. Wiss. in Wien*, November, 1912), discusses two distinct problems. He gives a negative answer to the question whether the heaping up of ice over the northern continents in the glacial periods would have been accompanied necessarily by large displacements of the axis of rotation in the earth, and he forms his conclusions after a very considerable amount of careful computation based on very reasonable assumptions. He develops Schiaparelli's discussion of the motion of the earth's axis under the influence of geological changes, and confirms the suggestion that the shifting of the pole may cause displacements of the faulty portions of the earth's crust in a way that would lead to wide wanderings of the pole. The conclusion that the Ice age is to be associated with a considerable shifting of the earth's axis of rotation is necessarily a speculative one, but Dr. Spitalen brings in numerous facts (or perhaps rather theories) from the writings of geologists and geodesists to support his views. It is scarcely possible in the nature of things to prove his case, but he gives a good account of it, which will bear careful study.

NOT the least interesting of the many engineering problems presented by the Panama Canal is that of the stability of the sides of the deep cuts. This question is discussed by Dr. Vaughan Cornish in *The Edinburgh Review* for January—"The Panama Canal and the Philosophy of Landslides." The earlier landslides, *e.g.* the big one at Cucuracha, were caused by the top residual clay sliding into the cut upon a lubricated sole; this was dealt with by the removal of practically the whole deposit where slipping appeared probable. Later, in 1910, and again in 1912, when the deepening of the cut was particularly rapid, the movements took the shape of a sudden uplift of the floor, together with bulging of the lower part of the bank. This movement of the earth—incorrectly described as a landslide by Dr. Cornish—is called a "break" by the canal engineers; it is similar in cause and effect to the well-known "creep" of miners. The sudden removal of support produced by the rapid deepening of the cut caused certain weak beds of argillaceous sandstone, and in other cases beds of lignite, to fail beneath the vertical pressure on the sides. The weakness of the rocks was no doubt increased by the access of rain water. The difficulty is serious, as may be seen by the fact that on account of the "breaks" alone more than 16½ million cubic yards of material beyond that in the original estimates have had to be removed. The trouble is being overcome by increasing the batter of the sides and by introducing broad "berms" or benches in them.

THE *Verhandlungen* of the German Physical Society for December 30 last include an abstract of a memoir on the expansion with rise of temperature of quartz, various steels, including nickel steels, and a number of bronzes and brasses, by Dr. W. Bein. The complete paper appears in vol. viii. of the *Abhandlungen* of the German Committee of Standards. The method is that of Fizeau, with the improvements introduced by Abbé and by the author. The material tested is in the form of a cylinder one centimetre high, and is placed between horizontal glass plates, kept apart by a quartz ring, as in Reimerde's experiments. The expansion of the quartz is investigated by the interference bands formed by light reflected at the bottom surface of the top, and the top surface of the bottom glass plate. Three lines of the mercury spectrum were used. The following values of the coefficients of t and t^2 respectively were found to hold between 0° and 100° C.:—Quartz, $7{\cdot}15\times10^{-6}$ and $0{\cdot}0081\times10^{-6}$, steels, 10 to $11{\cdot}5\times10^{-6}$ and $0{\cdot}0045$ to $0{\cdot}0075\times10^{-6}$; nickel steels, $0{\cdot}59$ to $1{\cdot}48\times10^{-6}$ and $0{\cdot}0018$ to $0{\cdot}0045\times10^{-6}$; bronzes and brasses, 16·8 to $19{\cdot}1\times10^{-6}$ and $0{\cdot}0036$ to $0{\cdot}0052\times10^{-6}$. The results for quartz agree with those of Benoit and Scheel. All the metal specimens showed signs of internal stress when first tested.

THE Transactions of the Concrete Institute (vol. iv., part iii.) contain an interesting lecture on fireproofing, delivered by Mr. R. L. Humphrey, who is the president of the National Association of Cement Users, Philadelphia, Pa. The conditions in America regarding this subject are notoriously bad, and give the unenviable distinction of having the greatest fire losses in the world, and each succeeding year shows no appreciable decrease. Mr. Humphrey deals, among many other matters, with safety appliances and facilities for the escape of the occupants of a building in the case of fire. Much greater regard is had for life in Britain and on the Continent than in America. Steep iron ladders passing unprotected plain glass windows are common. The Asch building fire provides an example of such a structure, and the consequent loss of life. It is a significant fact that, standing on the pavement of the ill-fated Asch building, one can see within a stone's throw many more buildings that are infinitely worse as regards construction and provisions for safety. Public opinion and continual ridicule of such ill-conceived contrivances is having its effect in that

they are rapidly becoming obsolete, and it is hoped that shortly retroactive laws will make such contrivances criminal.

THE tenth of the "Technologic Papers of the Bureau of Standards" issued by the U.S. Department of Commerce and Labour deals with the melting points of fire bricks, and is by Mr. C. W. Kanolt, assistant physicist to the Bureau of Standards. Mr. Kanolt has taken as the melting point the lowest temperature at which a small piece of the brick could be distinctly seen to flow. The experiments were conducted in an Arsem graphite resistance vacuum furnace, the temperatures being determined by means of a Morse optical pyrometer of the Holborn-Kurlbaum type, an improved method of calibrating, which is described. The melting points of fifty-four samples of fire brick, including fire clay, bauxite, silica, magnesia, and chromite brick, have been determined. The following melting points of materials important in the manufacture of fire brick have been obtained by Mr. Kanolt:—Kaolin, 1740° C.; pure alumina, 2010° C.; pure silica, 1750° C.; bauxite, 1820° C.; bauxite clay, 1795° C.; chromite, 2180° C. It is pointed out that the value given for silica is not the true melting point, but represents approximately the temperature at which silica flows distinctly.

FURTHER additions have been made by Messrs. T. C. and E. C. Jack to their series of "People's Books," which, it will be remembered, are sold at 6*d.* net each. Among the new volumes may be mentioned "Zoology, the Study of Animal Life," by Prof. E. W. MacBride, which provides a popular introduction to the science, with chapters on such interesting subjects as the origin of species, the consequences of Darwin's theory, and the bearing of zoology on the questions of human origin and the future destiny of the race. Dr. H. J. Watt's "Psychology" directs attention mainly towards the study of experiences—their analysis, description, classification, and connections. Mr. P. E. B. Jourdain, in "The Nature of Mathematics," endeavours to make the ordinary person understand "speaking broadly, what mathematicians do, why they do it, and what, so far as we know at present, mathematics is." In the volume on "Friedrich Nietzsche," Mr. M. A. Mügge gives a sympathetic account of the life of the philosopher. Another volume takes the form of an atlas by Mr. J Bartholomew, which contains fifty-six plates, and is a marvel of cheapness.

MESSRS. WITHERBY AND CO. are publishing photographic enlargements of six of the principal plates from "The Home-life of a Golden Eagle," by Mr. H. B. Macpherson, which contains some of the most striking pictures of bird-life ever secured. The enlargements measure 9½ by 11½ in., and that of "The Mother Eagle and her Child," which has been submitted to us, is a most successful example of avian portraiture. The price of each enlargement is 7*s.* 6*d.*

MESSRS. J. AND A. CHURCHILL are the publishers of "Notes on Chemical Research," by Mr. W. P. Dreaper, a notice of which appeared in last week's NATURE. Their name should have been given at the head of the notice.

OUR ASTRONOMICAL COLUMN.

LATITUDE DISTRIBUTION OF ABSORPTION MARKINGS ON Hα SPECTROHELIOGRAMS.—In an interesting note appearing in No. 2, vol. lxxiii., of *The Monthly Notices*, Dr. Royds analyses the latitude distribution of the dark absorption markings found on spectroheliograms taken in Hα light at the Kodaikanal Observatory during the period April, 1911–June, 1912. Seventy-four per cent. of the total areas of absorption markings occurred in the southern hemisphere, and there was a slight preponderance in favour of the western side of the central meridian. The latitude-distribution curve for these markings agrees with that for the limb prominences in showing a striking maximum near latitude 50° S., which is almost absent from the corresponding northern latitude; in the northern hemisphere the maximum is in the zone 25° to 30°. The association of Hα markings with sun-spots is shown by the correspondence of their two latitude curves between the equator and 20° N. and S. It is suggested that maxima in the Hα curve in the higher sun-spot latitudes may denote activity in those regions presignifying the commencement of a new sun-spot cycle.

THE SPECTRUM OF THE CORONA.—The interdependence of physics and astrophysics is emphasised by an article appearing in No. 458 of *The Observatory*, in which Prof. J. W. Nicholson suggests that the spectrum of the corona may be given a physical interpretation, based on the assumption that the "coronium" atom is a simple one, in which the actions of the component electrons may be theoretically determined. The majority of terrestrial atoms are too complicated thus to be analysed, with our present knowledge of mathematics, but among celestial atoms Prof. Nicholson suggests there may be some of sufficiently simple construction to enable the mathematician to determine their structure, and so deduce, from first principles, the nature of the spectrum emitted by them; in "nebulium" and "coronium" he believes such simple atomic structures are to be found.

If, according to theory, the model, simple atom consists of a number of negative electrons revolving about a positive nucleus, it can be deduced that the wave-lengths of the radiations emitted can have a series of values of which the cube roots are in arithmetical progression. Such series are found in the spectrum of the corona, and the theory allows an interpretation of nearly all the lines in this spectrum to be set up.

THE TEMPERATURES OF STARS.—By comparing quantitatively the differences of intensity in various sections of the spectrum, Dr. H. Rosenberg has educed temperatures for seventy stars, and publishes his results in No. 4628 of the *Astronomische Nachrichten*, where he also describes his methods. The temperatures determined range from more than 400,000° C. for γ Pegasi to 2150° for α Tauri, but the former is exceptional, the next lower temperature being 50,000° for γ Cassiopeiæ. The temperature of the sun, the intensity-difference of the spectrum of which forms the basis of the calculations, is, on this scale, 4950°. In the lower temperatures Dr. Rosenberg's results agree fairly well with those of Wilsing and Scheiner, but higher up the scale the values are much greater. The general concordance is shown when the intensity-differences are plotted on a curve having for its abcissæ the various spectral types of Miss Maury's classification, the highest temperatures being exhibited in both cases for the helium stars and those showing bright hydrogen lines in their spectra.

ONE HUNDRED NEW DOUBLE STARS.—Dr. Aitken continues his publication of newly discovered double stars in No. 223 of the Lick Observatory Bulletins. The present list contains the data for 100 objects, all measured with the 36-in. refractor, and brings the total now discovered up to 2500; of these only seventeen have distances greater than 5·0″, while in 1847 the components were separated by less than 2·0″. The original programme included the examination of all stars down to the ninth magnitude, given in the B.D., from the north pole to −22° declination, and 95 per cent. of the area to −14° has now been surveyed; of the remaining area, −14° to −22°, only about one-quarter remains to be examined.

CONTRIBUTIONS TO AMERICAN ECONOMIC GEOLOGY.[1]

THE State of Texas consists mainly of plains of Cretaceous and Cainozoic rocks which slope gradually eastward to the Gulf of Mexico. They are interrupted to the north-west of the city of Austin by an outcrop of pre-Cambrian rocks composed of granite, gneiss, and schist, and of some early Palæozoic sediments, including Cambrian and Ordovician. These older rocks of Texas have been described in a bulletin by Mr. Paige, who has proved that they have been faulted up into their present position. These old rocks contain some iron ores, of which the Survey during its work in the region discovered thirty-two occurrences. Only three are sufficiently large to be of economic importance, and their value is still unproved. The ores are masses of magnetite; they occur in the schists and usually along the contact with the granites or in bands of rock crushed between parallel faults. The iron was originally deposited in marine sediments, and has been concentrated in consequence of the intrusion of the granites and diabases and of the faulting. The author, in concluding his discussion, quotes a passage from Van Hise attributing the origin of many ores to the materials of igneous rocks, and he inserts iron in the list given by Van Hise; but the case of iron is so different from the others that this addition is scarcely justified.

The existence of a tar spring associated with some hot springs near Lander, in Fremont County, Wyoming, was sufficient indication of petroleum to justify the search. A report by Mr. E. G. Woodruff describes the geology of the district and the evidence as to its supplies of oil. The neighbourhood consists of a series of rocks ranging from the Carboniferous to Eocene, and including a long series of the Mesozoic. There are two oil-bearing horizons, of which the most prolific is the Embar formation, belonging to the Carboniferous; there is a smaller supply in the Upper Cretaceous. The thirteen existing wells yield a supply of 330 barrels a day. The field is one of those in which the productive positions occur along an anticlinal axis.

The Salt Creek oilfield in Natrona County, also in Wyoming, is described by Mr. C. H. Wegemann. The country consists of Cretaceous rocks, lying between some Eocene beds and one which may be Jurassic. The oil-bearing horizons are the Upper Cretaceous Shannon "Sands," some 8 ft. of sandstone saturated with oil. The oil from a lower bed, the Wall Creek "Sand," rises in intermittent flows like a geyser, and Mr. Wegemann attributes the ascents to the same cause as geyser eruptions. A small quantity of oil also comes from a sandstone at the base of the Cretaceous series, which is regarded as possibly the equivalent of the Dakota Sandstone. This oil is associated with water, which in this case is fresh. Mr. Wegemann briefly discusses the origin of the oil; he regards it as derived from organic matter, and especially fossil fish in the adjacent shales, from which it passed into the sandstones. Mr. Wegemann regards this view as supported by the presence of sulphur in the oil.

The Seward Peninsula, the most western part of the mainland of America, projects into the Bering Sea between Norton Sound and Kotzebue Sound. A reconnaissance geological survey has been in progress for ten years, and has been completed by the work of Messrs. P. S. Smith and H. M. Eakin on two sheets, which include the country extending from the north of Norton Bay eastward to the Lower Yukon Valley. The country is geologically complex. It has a base of Archæan rocks covered by a varied series of Palæozoic sediments. In Middle Mesozoic times the region was occupied by land which was submerged in the Cretaceous, though the evidence as to the exact horizon of the marine Cretaceous beds is still indefinite. Great post-Cretaceous earth movements, accompanied by some igneous intrusions, folded and faulted all the lower rocks; as some of the dykes have been faulted, the movements continued later, but the post-Cretaceous faults had no direct influence on the topography. The country was subsequently dissected by river erosion. The country was never covered by an ice sheet, in spite of its high northern latitude and its proximity to the sea; but the authors discovered traces of small glaciers in some of the valleys. The country has shared in the post-Glacial oscillations which are so conspicuous along the Alaskan coasts. The economic minerals of this district include alluvial gold, silver, lead, and copper, and some Cretaceous coal.

The chief copper mines of Alaska are situated among the Wrangell Mountains at the head of the Copper River. Some of the most promising ore bodies occur in the valley of the Chitistone River, a little to the west of the Canadian frontier. The rocks of this district are all Mesozoic, and include the Upper Triassic Chitistone Limestone and Macarthy Shales. The age of the Kennicott formation is still somewhat doubtful; it has been often referred to the Lower Cretaceous, but in the view of the authors is probably Upper Jurassic. Unlike the Seward Peninsula, the country has a comparatively simple geological sequence, and has been strongly glaciated. It shared in the great Cretaceous uplift, which led to its dissection by stream erosion. The valleys were moulded by ice, which, according to the authors, not only gave them their trough-shaped form, but deepened them by from 1000 to 1500 ft., an estimate based on the height of the hanging valleys. The dissection of the country was aided by two series of faults which intersect at right angles and divide the country into blocks, some of which have been lifted and others lowered. The country was thus disturbed by displacements which, though small, had an important indirect effect. One exceptional geographical feature is described by Moffit and Capps as "rock glaciers." They consist

[1] "Mineral Resources of the Llano-Burnet Region, Texas, with an Account of the Pre-Cambrian Geology." By S. Paige. Bulletin 450, U.S. Geological Survey, Washington, 1911. Pp. 103+v plates+22 figs.

"The Lander and Salt Creek Oil Fields, Wyoming." The Lander Oil Field, Fremont County. By E. G. Woodruff. The Salt Creek Oil Field, Natrona County. By C. H. Wegemann. Bulletin 452, U.S. Geological Survey, Washington, 1911. Pp. 87+xii plates+1 fig.

"A Geologic Reconnaissance in South-eastern Seward Peninsula and the Norton Bay—Nulato Region, Alaska." By P. S. Smith and H. M. Eakin. Bulletin 449, U.S. Geological Survey, Washington, 1911. Pp. 146+xiii plates+15 figs.

"Geology and Mineral Resources of the Nizina District, Alaska." By F. H. Moffit and S. R. Capps. Bulletin 448, U.S. Geological Survey, Washington, 1911. Pp. 111+xii plates+11 figs.

"Contributions to Economic Geology." (Short Papers and Preliminary Reports, 1909.) Part ii., Mineral Fuels. [M. R. Campbell, Geologist in Charge]. Bulletin 431, Washington, 1911. Pp. 254+xii plates+4 figs.

of streams of rock talus with the interstices filled by ice, so that the whole mass can move like a glacier. They therefore resemble the stone rivers of the Falkland Islands, in which the flow was due to interstitial mud.

Bulletin 431 contains a series of short papers and preliminary reports dealing with mineral fuels, including petroleum, natural gas in North Dakota, and the coals and lignites of Alabama and various western States. J. W. G.

RECENT WORK ON INVERTEBRATES.

NO. 3 of vol iv. of "Memoirs of the Department of Agriculture of India" is devoted to the life-history and habits of the big brown Indian cricket (*Brachytrypes achatinus*), the various stages of development being illustrated by a coloured plate. According to the author, Mr. C. C. Ghosh, these insects, which measure nearly two inches in length, and are burrowing and nocturnal in habit, have recently been the cause of considerable injury to various crops, such as jute, rice, and tea.

The parasites of the hymenopterous family Dryinidæ form the subject of Bulletin No. 11 of the Entomological Reports of the Experiment Station of the Hawaiian Sugar-planters' Association. After a review of the classification of the group, Dr. R. C. L. Perkins, the entomologist to the association, describes a number of new species from various parts of the tropics.

To the fourth part of vol. cxxi. of the *Sitzber. K. Akad. Wiss. (Math.-Naturwiss. Klasse)* several specialists contribute further accounts of the organisms collected during Dr. Werner's recent zoological expedition to the Egyptian Sudan and northern Uganda, Prof. F. Klapálek describing the Neuroptera, Dr. F. Ris the Libellulæ, the Rev. E. Wasmann the Termites, Dr. Werner the genus Embidaria, and Prof. O. Fuhrmann the cestodes of birds.

Students of distribution, as well as specialists in this particular group, will be interested in Mr. M. Connolly's list of the South African land and freshwater molluscs in the South African Museum, published in vol. xi., part 3, of the Annals of that institution. The total number of species recorded is 596, of which no fewer than forty-one are included in the characteristically Ethiopian genus Achatina.

In part 4 of the same volume Messrs. Goddard and Malan commence a descriptive account of South African leeches (Hirudinea), so far as they are at present known. Although all the families of the group are represented in South Africa, land-leeches have not hitherto been detected, this being due, no doubt, to the unsuitability of the zoologically explored portions of the country to their existence.

The nets of trawlers returning to Hull from the North Sea and the neighbourhood of Iceland have yielded to the search of Mr. John Thompson a rich harvest of the hydroid zoophytes of those waters. These have been studied by Mr. James Ritchies, the results of whose investigations are published in vol. xviii., No. 4, of the Proceedings of the Royal Physical Society of Edinburgh. A considerable increase in our knowledge of certain species has been made, and one form is described as new.

In *The Entomologist's Monthly Magazine* for November Mr. Claude Morley discusses a certain mysterious sibilant humming in the air said to be not uncommonly heard during the summer in this country. That the sound is due to insects there can be no reasonable doubt, and Mr. Morley considers himself justified in attributing it to two species of Chironomids, *Chironomus dorsalis* and *Tanypus varius*, both of which normally fly at a high elevation. The ground for this identification is that during a bout of the humming gusts of wind arose which drove specimens of these insects within reach. That Chironomidæ are capable of producing sounds has been previously recorded in America.

To the *Sitzungsberichte der Kgl. Böhm. Ges. Wiss.* for 1911 Dr. E. Schera communicates the first two parts of a study of Turbellarians, mainly based on specimens collected in various parts of Bohemia. Such a critical study, it is claimed, was urgently needed, since many of the genera and species have been named on insufficient materials, and synonyms are consequently rife, and even now certain forms cannot, for the same cause, be properly described. In the first part of his memoir the author describes certain new genera and species, while in the second he monographs the group Olisthanellini.

To Records of the Indian Museum, vol. vii., part 4, Messrs. F. H. Gravely and S. P. Agharkar communicate notes on the habits of the Indian fresh-water jellyfish (*Limnocnida indica*), the discovery of which was recorded in NATURE, vol. lxxxvii., p. 144, 1911. The species occurs in western Indian in the Yenna and Koyna, tributaries of the Krishna, and it is believed also in the Krishna itself near Dhom. It has been observed in April and May, and is well known to the natives, by whom it is called *chakraphul* (wheel-flower), deep pools forming its favourite haunts. From the lack of any evidence of the occurrence of special resting eggs, it is inferred that there must be a fixed hydroid generation. R. L.

MIGRATIONS BETWEEN AUSTRALIA AND AMERICA.

A PAPER by Mr. Hans Hallier on former land-bridges, and plant and human migrations between Australia and America, appears in *Mededeelingen van's Rijks Herbarium*, Leyden, for 1912, No. 13. At the outset the author refers to earlier conclusions, based on botanical evidence, that Indonesia, Australia, and Polynesia at one time formed a great Australian peninsula, most of which subsequently sank, either wholly or in part, leaving the mountains of Tasmania, New Zealand, New Caledonia, the Louisiades, New Guinea, the Moluccas, Celebes, the Philippines, Formosa, &c., to serve as centres of plant-dispersal between China and Polynesia, these being separated by deep sea from the mountains of eastern Australia. In earlier times the peninsula was connected by land with America, the northern boundary of this bridge extending from southern Japan through the Sandwich and Revilla-Gigedo Islands to Lower California, while the southern limit seems to have passed by way of the Society and Paumotu Islands from Tasmania through the Auckland, Campbell, Antipodes, and Chatham groups, and thence through Easter Island, Sala-y-Gomez, and Juan Fernandez to the south of Chile. To summarise the evidence of community of origin of the flora of this area, and of the relationships of language-roots, is here impossible, but reference may be made to certain American designs, considered by Wiener to represent lamas, but, according to the author, intended for kangaroos. After stating that, from linguistic evidence, southern Asia should be regarded as the dispersal-centre for the life of Indonesia and Polynesia, and referring to the community of type between ancient Egyptian, American, and south Asiatic art, the author expresses the opinion that Egyptian and American culture travelled from a south Asiatic source by two routes, one to Africa, and the other by way of Indonesia and Polynesia to America.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Board of Anthropological Studies has recommended to the Senate the establishment of a tripos examination in anthropology, which shall rank as equivalent to the second part of any of the existing triposes and be open to candidates on the same conditions. The board feels strongly that familiarity with the material of modern anthropology and with the scientific methods which it employs must prove of great value to those students who have received a training in theology, law, history, linguistics, economics, and kindred subjects, and more especially to those who intend to undertake research. From all candidates for such a tripos the board considers that a general knowledge of anthropology as well as a more detailed knowledge of a selected geographical area should be required. In order to meet the varying interests of candidates, the board is of opinion that in each year two areas should be prescribed by the board, and that candidates should be allowed the option of making a detailed study of the anthropology of one of these areas.

Mr. Rudolf Albert Peters, of Gonville and Caius College, has been elected to the Benn W. Levy studentship. The appointment is for one year.

The Vice-Chancellor has appointed the Right Hon. the Earl Curzon of Kedleston, Chancellor of the University of Oxford, to the office of reader on Sir Robert Rede's foundation for the present year. The lecture will be delivered in the Easter term, and its subject will be "Modern Parliamentary Eloquence."

Sir Dorabji J. Tata has announced his intention of giving to the Forestry School 100*l*. a year for five years, from March, 1913, for instruction in forestry which will be of benefit to India.

AT a special Convocation of the University of Calcutta, held on January 25, the honorary degree of doctor of science was conferred upon Dr. A. R. Forsyth, F.R.S.

THE governors of the Wye Agricultural College have approved of the purchase of twenty-two acres of land situated at Malling for a fruit research station, and have also decided to institute during the summer a course of specialised instruction in entomology and mycology for county instructors of horticulture, towards the cost of which the Board of Agriculture will be prepared to make a grant.

WE learn from *Science* that the will of Alfred Samson, who died recently at Brussels, provides for an endowment of 100,000*l*. for the Prussian Academy of Sciences, and 20,000*l*. for the Bavarian Academy of Sciences, at Berlin and Munich. The endowments are stated to be for investigations which afford a prospect of raising the morality and well-being of the individual and of social life, including the history and prehistory of ethics, and anthropological, ethnological, geographical, geological, and meteorological influences as they have affected the mode of life, character, and morals of man.

ON Tuesday, February 11, Mr. D. M. S. Watson began a course of twenty lectures on the morphogenesis of the mammalia from a palæontological point of view, to be delivered at University College, London, on Tuesdays and Thursdays, at 5 p.m. Dr. F. W. Edridge-Green will deliver a course of four lectures at the college on the physiology of vision and colour vision, on Wednesdays, at 5 p.m., beginning on February 19. The lectures will be illustrated by numerous experiments and demonstrations. Application for admission to both courses of lectures should be made to the secretary of the college.

THE Mansion House Committee of Associations for Boys met at the Mansion House on February 5 to confer with representatives of various Government Departments on the advisability of forming an inter-departmental committee to deal with questions concerning the training and care of boyhood. The following resolution was passed:—"This conference would welcome the formation of an inter-departmental committee of the State Departments concerned with the welfare of boys, which should consider questions regarding moral, physical, and industrial education, and also work in closer cooperation with the voluntary associations in the United Kingdom, now numbering 280,000 boys, while leaving them free to pursue the ends for which they were established."

A EUGENICS Education Conference is to be held at the University of London, South Kensington, on March 1. Major L. Darwin, president of the Eugenics Education Society, will deliver his presidential address, taking for his subject, "The Eugenic Ideal." During the meeting Canon Lyttelton, headmaster of Eton College, will speak on racial responsibility as a factor in the formation of character, and Prof. J. Arthur Thomson, professor of natural history in Aberdeen University, will open a discussion on the method of introducing the eugenic ideal into schools. At the close of the meeting, should it appear to be in accordance with the general feeling of the meeting, Major Darwin will propose, "That the Minister of Education be asked to receive a deputation requesting an inquiry as to the advisability of encouraging the presentation of the idea of racial responsibility to students in training, and children at school."

MR. G. A. WILLS and his brother, Mr. H. W. Wills, have offered to the council of Bristol University the sum of 150,000*l*. for the extension of the University buildings. Their proposal is to erect a building that shall not only include a large hall, libraries, council chamber, offices for the registrar and staff, lecture-rooms, and a main entrance, but also present to the chief thoroughfare an architectural elevation at once worthy of the University and an ornament to the city. The donors also suggest a small committee to act with them in carrying out the scheme, and lay down the following conditions:—Not less than 20,000*l*. is to be set aside for an endowment for the expenses of lighting and heating and the other establishment charges it will entail. The work is to begin not later than the spring of next year, and to be completed not later than 1917. The whole sum is to be paid when the building contract is signed. In addition to this generous offer, the council has received a letter from Mr. W. Melville Wills, of the same family, offering the sum of 20,000*l*. in memory of his father, Mr. H. Overton Wills, in augmentation of the general endowment fund of the University. The council has accepted the offers gratefully.

PROF. E. A. SCHÄFER was entertained at dinner by the Edinburgh University Club in Sheffield on February 8. During the course of a speech, we learn from *The Times*, he complained of the lack of State help for universities in this country. Great Britain does not recognise its responsibilities in this respect. Prof. Schäfer said the State makes miserable grants and attaches conditions sometimes which cannot be fulfilled. We ought to take a lesson from other nations. Some towns support their universities, but the University of Edinburgh has no support from its city, although the University is the mainstay of Edinburgh's prosperity. Speaking of the training of doctors, he remarked that the tenure given to the medical curriculum is all too short to obtain the

necessary knowledge of the sciences upon which medicine and surgery are based. It is absurd that anybody should attempt to learn medicine, surgery, pathology, and pharmacology unless he has already a fair knowledge of anatomy and physiology. We shall have to get rid of some of the subjects of the curriculum to the extent that is necessary for an understanding of physiology. Biology, physics, and chemistry can be taught just as well, Prof. Schäfer thinks, at school as at the university.

AT the end of last month the president and fellows of Harvard College voted to establish the Harvard University Press, for the publication of works of a high scholarly character. For some years the University Publication Office, besides printing the catalogues, department pamphlets, and other official documents, has found it possible, in spite of its limited resources, to issue from time to time a few special works, until it now publishes seven periodicals and more than eighty books, ranging from treatises on Indic philology to practical directions for American lumbermen. To organise and extend this activity, so as to make the University properly effective as a publishing centre for scholarly books, is the object of the new foundation. The agent of the Press in England will be Mr. Henry Frowde. The function of a university press should be to publish works of prime importance and distinctive merit which can rarely be profitable undertakings, but are nevertheless of high value to students in various departments of intellectual activity. This appears to be the aim of the Harvard syndics, as it is of like boards of other universities in the United States. When a university press concerns itself largely with the issue of textbooks for schools and college, considerations of commercial profit tend to predominate over those relating to the advancement of learning, with which purpose alone a university should be associated.

A LETTER to *The Times* of February 10, signed by Mr. A. C. Benson and three other distinguished Cambridge men, says it is proposed to present to the council of the Senate of the University of Cambridge a memorial suggesting that a syndicate should be appointed to review the whole question of examinations conducted by the University, for which preparation normally takes place at school. It is pointed out that Greek cannot much longer be retained as a compulsory subject in the previous examination. But merely to abolish one compulsory subject, without at the same time carefully devising an examination suitable to the curricula of efficient English secondary schools, would, in the opinion of the memorialists, be harmful to the best interests of English education. An effort should be made, they think, to coordinate the various preliminary examinations which are conducted by university bodies. They desire also to simplify the examinations conducted by Cambridge so that they should practically be reduced to two in number, suited respectively to candidates of sixteen and eighteen years of age. The whole subject will demand the most careful consideration from the syndicate, which is asked for, and it will be desirable that its members should have an intimate knowledge of the relations of secondary and university education. The hope is expressed that experienced teachers will be placed on the syndicate. The text of the memorial is given in *The Times* of the date mentioned. Signatures of those who desire to see consideration given to the feasibility of the changes should be sent to Mr. A. C. Benson, The Old Lodge, Magdalene College, or to the Rev. Dr. Barnes, Trinity College, Cambridge, from whom copies of the memorial can be obtained.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 6.—Sir Archibald Geikie, K.C.B., president, in the chair.—S. R. **Wells** and Leonard **Hill**: The influence of the resilience of the arterial wall on blood pressure and on the pulse curve. The form of the pulse curve and the systolic and diastolic pressure (measured by the sphygmomanometer in the case of man) are modified very greatly by the conduction of the pulse along any particular artery. The conduction varies with the resilience of the arterial wall. An artery which is contracted, and therefore more rigid, conducts the systolic crest almost with undiminished amplitude from the heart to the peripheral vessels, and there is in such an artery a wide difference between the systolic and diastolic pressure. In a relaxed, resilient artery, on the other hand, the systolic wave expands the wall of the artery, and part of its energy is stored up as potential energy in the wall. As this comes into play during diastole and the systolic wave reaches the peripheral vessels in diminished form, the height of the diastolic wave is approximated to that of the systolic. The arteries are controlled so as to bring about one or other of these conditions at the periphery—a hammer-like pulse with big difference between systole and diastole, or a pulse with small difference and a more uniform mean pressure. The evidence for these conclusions has been drawn both from the investigation of thin-walled rubber tubes (specially made) and of arteries.—A. A. **Gray**: The occurrence of a ganglion in the human temporal bone, not hitherto described. The ganglion referred to in the title was found in the human temporal bone, below and in front of the stapedius muscle. In the specimen in which it was discovered the ganglion was comparatively large, but it is probable that considerable variations in this respect occur in individuals. So far as present investigations show the ganglion is associated with two nerves—the facial nerve and Arnold's nerve—but it is possible that fibres from other nerves may enter the ganglion.—J. A. **Gunn** and F. B. **Chavasse**: The action of adrenin on veins. (1) The action of adrenin upon ring preparations of veins remote from the heart is to diminish their calibre, as in the case of arteries. They, therefore, probably contain veno-constrictor nerve fibres from the thoracico-lumbar sympathetic system. (2) The action of adrenin on quiescent rings from the superior vena cava near the heart is to cause them to beat rhythmically and powerfully. (3) (*a*) The accelerator-augmentor nerve supply of the heart, and (*b*) the rhythmically contractile tissue, extend up the superior vena cava for at least 6 to 8 mm. from the veno-auricular junction in the heart of the sheep. (4) The induction by adrenin of rhythmic contraction in the quiescent superior vena cava seems, on the whole, in accordance with the myogenic theory of mammalian heart rhythmicity.—Capt. H. S. **Ranken**: A preliminary report on the treatment of human trypanosomiasis, and yaws, with metallic antimony. The object of this preliminary report is to demonstrate that intravenous injection of metallic antimony in a fine state of division is a therapeutic measure applicable on a large scale to the treatment of human trypanosomiasis. A considerable number of cases have been treated by this method, and in a further series combined treatment was employed, salvarsan or atoxyl being given in addition to the antimony. As a routine dose, one grain of antimony was given in four to six ounces of physiological salt solution. Summaries of results of the various series are given. In the great majority of cases treatment brought about considerable improvement, as evidenced by disappearance of

trypanosomes from the blood and lymphatic glands, improvement in nutrition, mental state, &c.—Major W. B. **Fry** and Capt. H. S. **Ranken**: Further researches on the extrusion of granules by trypanosomes and on their further development. With a note by H. G. **Plimmer** on a new method of blood fixation. Following a short description of methods used in these investigations, the paper deals with the subject of granules in general in trypanosomes. Two classes of granules are referred to:—(*a*) Those representing probably stored food material, and (*b*) those of nuclear origin and character, with which latter only the paper is concerned. Descriptions of the mechanism of extrusion are detailed as observed to take place in human and animal varieties, and the influence of drugs and other effects are discussed in this connection. A description of the free granule and its after-development and fate is given. A section on fixed and stained specimens follows, the earlier sections of the paper dealing in general with observations made of the parasite in the living state.

Geological Society, January 22.—Dr. Aubrey Strahan, F.R.S., president, in the chair.—H. H. **Thomas**: The fossil flora of the Cleveland district of Yorkshire. I., The flora of the Marske Quarry. With notes on the stratigraphy, by the Rev. G. J. Lane. Several plants collected in the Cleveland district of Yorkshire are described. Other specimens dealt with were obtained from the Marske Quarry. The Marske flora, which includes several types not hitherto recorded from the Jurassic plant-beds of Yorkshire, is believed to be of Middle Jurassic age. A note is appended on the stratigraphy of the Marske Quarry, situated on the northern face of the Upleatham outlier, about a mile distant from Marske-by-the-Sea. The Marske beds are assigned to the Lower Estuarine Series.—C. **Thompson**: The derived Cephalopoda of the Holderness Drift. It is claimed that about 180 species of ammonites are already in hand from the Glacial Drift. A large number are new to Yorkshire lists hitherto published, and the matrix of many of them cannot be matched now by our land exposures. The whole of the Lower Lias is represented by all its genera, and the rocky matrices are characteristic, and it is urged that the ice plucked them from outcrops in the bed of a former North Sea; also these outcrops show the continuity of the North Yorkshire Basin with that of north-western Germany. The Middle and the Upper Lias afford much material, but the types are closer to those of North Yorkshire. The Oolites are scantily represented, although the Lower Cretaceous is abundantly represented both by ammonites and by belemnites. The Chalk belemnites belong to a zone higher than any known in Yorkshire; therefore, they probably came from the sea-bed.

CAMBRIDGE.

Philosophical Society, January 27.—Mr. J. E. Purvis in the chair.—Sir J. J. **Thomson**: Further applications of positive rays to the study of chemical problems. The author described the application of positive rays to the detection of the rare gases in the atmosphere. Sir James Dewar supplied two samples of gases obtained from the residues of liquid air. One sample which had been treated so as to contain the heavier gases was found on analysis to contain xenon, krypton, argon. There were no lines on the photograph unaccounted for, hence there are no unknown heavy gases in the atmosphere in quantities comparable with the known gases. The other sample, which had been heated so as to contain the lighter gases, was found to contain helium and neon, and, in addition, a new gas with the atomic weight 22. The relative brightness of the lines for this gas and for neon shows that the amount of the new gas is much smaller than that of neon. The second part of the paper contained an investigation of a new gas of atomic weight 3 which this method of analysis had shown to be present in the tube under certain conditions. The gas had occurred sporadically in the tube from the time of the earliest experiments, but its appearance could not be controlled. After a long investigation into the source of this gas, it was found that it always occurred in the gases given out by metals when bombarded by kathode rays; a trace of helium was also usually found on the first bombardment. The metals used were iron, nickel, zinc, copper, lead, and platinum; the gas was also given off by calcium carbide. Various experiments were described which illustrated the stability of the gas (see also p. 645).—R. D. **Kleeman**: The atomic constants and the properties of substances. Formulæ are developed by means of which the critical quantities of a substance can be calculated in terms of atomic constants, given the nature of a molecule. These constants are the atomic volumes and the atomic attraction constants obtained in a previous paper. Knowing the critical constants, the pressure of the saturated vapour, its density, the internal heat of evaporation, &c., can be obtained from the law of corresponding states. Applications in chemistry are given.—H. C. **Pocklington**: Some diophantine impossibilities.—A. E. **Oxley**: The variation of magnetic susceptibility with temperature. Part ii., Aqueous solutions. Starting from Curie's laws and taking into consideration the various complexes which exist in solution, and the way in which these complexes dissociate with rise of temperature, the formula $\chi = A/\theta + B + C.\theta$ is deduced; where χ is the susceptibility, θ the absolute temperature, and A, B, and C are functions of the concentration. This formula represents the results of observation accurately.—R. D. **Kleeman**: The properties of a substance connected with its surface tension. Deductions are made from fundamental formulæ developed in previous papers in connection with surface tension. It is shown that the various relations that have been found connecting surface tension with other quantities have as foundation certain fundamental relations. A new method of obtaining the absolute mass of the hydrogen atom was developed. It gave for the quantity in question $1{\cdot}56 \times 10^{-24}$ grams.

MANCHESTER.

Literary and Philosophical Society, January 21.—Prof. F. E. Weiss, president, in the chair.—Prof H. B. **Dixon** and H. M. **Lowe**: Experiments on Abel's theory that incombustible dusts act catalytically on igniting weak mixtures of methane and air. The use of fine incombustible dusts as a means of preventing explosions of coal dust in mines has brought into prominence the conclusions arrived at by the late Sir Frederick Abel, viz., that the presence of such incombustible dusts in a mine may bring about the explosion of small percentages of fire-damp in air which would not otherwise be inflammable. While Abel's experiments have been repeated on a similar scale at the Home Office Experimental Station at Eskmeals during the past year with negative results, the explanation advanced by Abel has also been examined experimentally in the Manchester University chemical laboratories. Abel's explanation is that the finely divided dust, heated up by the lamp flame, allows chemical action to take place on its surface—just as platinum brings about the combination of hydrogen and oxygen—and that the oxidation of the fire-damp proceeds with increased rapidity as the dust becomes more highly heated. The dust particles are thus

raised to incandescence and fire the gas mixture around them. This involves the assumption that an amount of combustible gas, which is insufficient to propagate flame in the mixture, can by suffering partial combustion bring the remainder into an explosive state. The heating up of a gas mixture by an external source of heat increases its explosive power; but this is not found to be true if the heat is derived from the burning of the gas itself. The authors have heated up mixtures of coal gas and air and mixtures of methane and air by means of a long platinum spiral through which an electric current was passed. After chemical combustion is started the mixtures become *less* and not more explosive, although only a portion of the heat is derived from combustion of the gas itself. Even if the incombustible dusts acted like platinum it would be difficult to explain Abel's results as being due to a catalytic action. Experiments carried out at Eskmeals show that the presence of fine incombustible dusts does not increase, but retards, the rate of explosion of gaseous mixtures.

EDINBURGH.

Royal Society, January 20.—Dr. B. N. Peach, F.R.S., vice-president, in the chair.—J. M'Lean **Thompson**: Studies in floral zygomorphy. I., The initiation of staminal zygomorphy. A study of the very young buds and expanded flowers of *Gregia Sutherlandii* showed that in all the parts of the flower zygomorphy was initiated, but it was not maintained. In the case of the stamens the filaments did not attain the maximum length simultaneously; but sooner or later they all attained the maximum length, and when this stage was reached the anthers dehisced. It was shown that the lengthening of the filaments was due to the elongation of the cells, the number of which remained the same from an early development stage up to the perfected condition.—Dr. C. G. **Knott**: Change of electrical resistance of nickel subjected to cross-magnetic fields. The nickel was in the form of tape-like strips, which could be rolled into compact coils and set in the air-gap of an electromagnet. Moderate fields were in these circumstances sufficient to produce easily measurable changes of resistance in transverse fields. The nickel coils were made the cores of transformer-wound anchor-ring electromagnets, and by passing a current through the enveloping wire longitudinal fields of sufficient strength were obtained. The most curious facts established were these:—(1) Although, as is well known, longitudinal magnetisation is accompanied by increase of resistance, yet when the nickel is maintained in a steady state of transverse magnetisation the effect of the same longitudinal field superposed upon the transversely magnetised state is in most cases to diminish the resistance. (2) When a transverse field is superposed upon a steadily maintained longitudinal field the decrease of resistance is numerically greater than when the transverse field acts alone, and this in spite of the fact that a longitudinal field acting alone produces an increase of resistance.

PARIS.

Academy of Sciences, February 3.—M. F. Guyon in the chair.—L. **Lecornu**: The security of aëroplanes. For the study of the important question of safety in aëroplanes a society has been formed called the "Union pour la sécurité en aéroplane." From its funds it proposes to award a prize of 400,000 francs in connection with this question. Neither plans, memoirs, nor reduced models will be considered; only full-size working machines will be admitted to the competition.—A. **Müntz**: Luminosity and plant assimilation. Although in experiments carried out in confined atmospheres the amount of assimilation has been found to depend largely on the intensity of the light to which the plant has been submitted, data are given to show that this is not the case with plants growing in the open air. The probable reason for this is that the carbon dioxide is present in a much higher proportion in the confined air, and even a dull diffused light is sufficient to take full advantage of the small proportion of carbon dioxide present in outside air.—A. **Blondel**: The origin of wireless telegraphy by means of musical sparks. A claim for priority; the author's first use of this method dates back to 1898.—G. **Tzitzéica**: Derived networks.—D. **Pompéiu**: An application of the functional calculus to the theory of functions.—Joseph **Pérès**: The determination of all the permutable functions of the first species with a given function.—A. **Bilimovitch**: The equations of motion of non-holonomial conservative systems.—Paul **Jégou**: The phenomena occurring in the electrolytic detector not provided with an auxiliary electromotive force and theoretical considerations on the working of electrolytic detectors.—C. **Gutton**: The duration of the establishment of electrical double refraction. A description of experiments showing that in a field of force of variable intensity the variations of the electrical double refraction of bromonaphthalene and carbon bisulphide do not follow exactly those of the electric force. The results of these experiments are in accord with the theory of the orientation of the molecules developed by Langevin.—H. **Buisson** and Ch. **Fabry**: A microphotometer designed to measure the opacity of photographic plates.—Jean **Meunier**: The spectra of nebulæ. In addition to hydrogen, the author identifies some of the lines with iron and titanium. The possibility of the existence of iron and titanium in absolutely gaseous flames is discussed.—G. **Charpy** and S. **Bonnerot**: The reactions which accompany the osmosis of hydrogen through iron. The passage of hydrogen through iron at 600° C. is shown to result in the elimination of some of the impurities of the metal, phosphorus, sulphur, and carbon being removed. The conclusion is drawn from these results that iron and steel, manipulated without special precautions in contact with air, are generally saturated with hydrogen.—J. **Bougault** and M. **Mouchel-la-Fosse**: The action of the alkaline sulphites on the ethylenic acids. Certain unsaturated acids instantaneously fix a molecule of sodium bisulphite, and this reaction can be applied to the separation of unsaturated and saturated acids. 1 cg. or 2 cg. of benzoic acid has been easily separated in this way from 1 gram of cinnamic acid.—Paul **Guérin**: The seminal tegument in the Thymeleaceæ.—A. **Pinard** and A. **Magnan**: The fragility of the male sex. In 52,689 accouchements there were 7056 deaths before or after birth. An analysis of the data, collected over twenty years, shows that before birth the mortality was the same for both sexes; the increased male mortality during and immediately after birth is attributed by the authors to the mechanical effects of the greater weight and size of the male infants and not to any inherent delicacy in the male.—J. G. de **Man**: A new observation of *Menippe convexa* inhabiting the empty shells of Balanus.—M. **Javillier**: The substitution of glucinium for magnesium or zinc in the culture of *Sterigmatocystis nigra*. Experiments are quoted showing that glucinium cannot replace magnesium or zinc as a catalytic agent in the growth of this mould.—Charles **Lepierre**: The replacement of zinc by glucinium in the culture of *Aspergillus niger*. The results obtained are opposed to those given in the previous paper.—Louis **Duparc**: The origin of the platinum in the alluvial deposits of certain lateral affluents of the Koswa, North Urals.—De Montessus de **Ballore**: Destructive earthquakes and the seasons.

NEW SOUTH WALES.

Linnean Society, November 27, 1912.—Mr. W. W. Froggatt, president, in the chair.—Dr. H. L. **Kesteven**: A new endoparasitic Copepod: morphology and development.—D. **McAlpine**: The fibro-vascular system of the quince fruit, compared with that of the apple.—Dr. R. Greig **Smith**: Contributions to our knowledge of soil-fertility. No. 6, the inactivity of soil-protozoa. When suspensions of soil-protozoa containing *Colpoda cucullus* were added to soils previously treated with chloroform, &c., it was found that the numbers of bacteria were not decreased, and further examination showed that the cysts of Colpoda were not destroyed by the volatile disinfectant. Suspensions of amœbæ did not induce a diminution of the bacterial increase, and the great augmentation of the bacteria that occurs during the first few days was shown to occur also when pure cultures of rapidly growing bacteria, such as *Bact. putidum*, which accompany the amœbæ, were added. Experiments with unfiltered and cotton-wool-filtered suspensions of soil did not show any indication of the activity of the soil-protozoa, from which it is to be inferred that the toxins and nutrients of the soil are alone concerned in the changes that occur in the numbers of bacteria in soils which have been heated or treated with volatile disinfectants.—A. A. **Hamilton**: A new species of Eriochloa (Gramineæ) from the Hawkesbury River.—R. J. **Tillyard**: Description and life-history of a new species of Nannophlebia (Neuroptera: Odonata). The larva and imago were discovered on the Bellinger River, N.S.W., in November last. The discovery is important, because no other larva belonging to Ris's group i. of the Libellulinæ has so far been found. As this group contains all the supposedly archaic remnants of the subfamily, it was expected that the larva would throw some light on the phylogeny of the groups of the Libellulinæ in general.—L. A. **Cotton** and A. B. **Walkom**: Note on the relation of the Devonian and Carboniferous formations west of Tamworth, N.S.W.—G. A. **Waterhouse**: Notes on Australian Lycænidæ. Part v.—Dr. S. J. **Johnston**: Some trematode parasites of marsupials, and of a monotreme. Two species of Harmostomum, parasites from the marsupial "cat" *Dasyurus viverrinus*, and the bandicoot, *Perameles obesula*, respectively, are described as new.

CALCUTTA.

Asiatic Society of Bengal, January 8.—Rasik Lāl **Datta** and Haridās **Sen**: A new series of double sulphates of barium and hetero-cyclic ammonium bases. Part i.—J. Coggin **Brown**: The A-ch'ang (Maingtha) tribe of Hohsa-Lahsa, Yunnan. The A-ch'angs are one of the smaller groups of the lesser-known tribes of the Burma-China frontier. Their headquarters are in the twin States of Ho-hsa and La-hsa in the western part of the province of Yunnan, China. The exact position of the A-ch'angs in the generally accepted scheme of racial classification is a matter of controversy amongst Indo-Chinese anthropologists, and the whole question is reviewed in this paper in the light of further evidence obtained by the author during a short residence in their country. It is concluded that the grouping of the A-ch'ang with the Maru, Zi, Lashi, and Hpon tribes is correct.—E. **Brunetti**: House-flies and blood-sucking Diptera taken in Galilee in October, 1912, by Dr. N. Annandale.—Dr. N. **Annandale**: Papers on the biology of the Lake of Tiberias. No. II., Notes on the fish, batrachia, and reptiles. The fish fall into four geographical groups as follows:—(1) Palestinian species; (2) African species; (3) Asiatic species; and (4) Mediterranean species. The first group is the largest and the last the smallest; the African group forms an important element in the fauna. The Palestinian race (*rufus*, Heckel) of *Discognathus lamta* (H.B.) differs in minor characters from the typical race from Bihar. The batrachian and reptilian fauna of the lake is a poor one, including only five species.

BOOKS RECEIVED.

Notes on Sampling and Testing. The Handbook of the Manchester Chamber of Commerce Testing House and Laboratory. Second edition. Revised and enlarged. Pp. 96+4 plates. (Manchester: Marsden and Co., Ltd.) Paper, 1*s*.; cloth, 1*s*. 6*d*.

Royal Botanic Gardens, Kew. Bulletin of Miscellaneous Information, 1912. (London: H.M.S.O.; Wyman and Sons, Ltd.) 4*s*. 6*d*.

Aus Natur und Geisteswelt: Experimentelle Abstammungs- und Vererbungslehre. By E. Lehmann. Pp. viii+104. Die Funkentelegraphie. By H. Thurn. Zweite Auflage. Pp. vi+128. Grundlagen der Elektrotechnik. By A. Rotth. Pp. 126. Masze und Messen. By Dr. W. Block. Pp. 111. Das astronomische Weltbild im Wandel der Zeit. By Prof. S. Oppenheim. Zweite Auflage. Pp. 134. (Leipzig: B. G. Teubner.) Each 1.25 marks.

Department of Agriculture and Technical Instruction for Ireland. Fisheries Branch. Scientific Investigations, 1911. No. 1, Report of a Survey of Trawling grounds on the Coasts of Counties Down, Louth, Meath, and Dublin. Part iii., Invertebrate Fauna. By A. L. Massy. Pp. 225+ii plates. (Dublin: H.M.S.O.; E. Ponsonby, Ltd.; London: Wyman and Sons, Ltd.) 2*s*.

Transactions of the Royal Society of South Africa. Vol. iii., part 1, 1913. Pp. 185+plates. (Cape Town: Royal Society of South Africa.) 17*s*.

Transactions of the Linnean Society of London. Second Series. Botany. Vol. viii., part i.: A Contribution to a Knowledge of the Mutating Oenotheras. By Dr. R. R. Gates. Pp. 67+6 plates. (London: Linnean Society; Longmans and Co.)

A First Book of Rural Science. By J. J. Green. Pp. viii+146. (London: Macmillan and Co., Ltd.) 1*s*. 6*d*.

Board of Agriculture and Fisheries. Agricultural Statistics, 1911. Vol. xlvi., part 5: Colonial and Foreign Statistics, with Index to vol. xlvi. Pp. 379–521. (London: H.M.S.O.; Wyman and Sons, Ltd.) 7½*d*.

Experimental Mechanics and Physics. By A. H. E. Norris. Pp. viii+176. (London: Mills and Boon, Ltd.) 1*s*. 6*d*.

Tamango, José Maria le Brigand. By Prosper Mérimée. Edited by R. R. N. Baron. Pp. vi+92. (London: Mills and Boon, Ltd.) 1*s*.

The People's Books:—Atlas of the World. By J. Bartholomew. Pp. viii+56. The Nature of Mathematics. By P. E. B. Jourdain. Pp. iv+92. Friedrich Nietzsche. By M. A. Mügge. Pp. 94. Psychology. By Dr. H. J. Watt. Pp. 90. Zoology. By Prof. E. W. MacBride. Pp. iv+92. (London and Edinburgh: T. C. and E. C. Jack.) Each 6*d*. net.

Bartholomew's New Reduced Survey Maps for Tourists and Cyclists. Sheet 3: Cumberland. New and revised edition. (Edinburgh: J. Bartholomew and Co.) Paper, 1*s*. 6*d*. net; cloth, 2*s*. net; cloth, dissected, 2*s*. 6*d*. net.

Elementary Biology, Animal and Human. By J. E. Peabody and A. E. Hunt. Pp. xiv+212. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd.) 4*s*. 6*d*. net.

The Chemical Constitution of the Proteins. By Dr. R. H. A. Plimmer. Part 2. Second edition.

Pp. xii+107. (London: Longmans and Co.) 3s. 6d. net.

A Study of Metabolism in Severe Diabetes. By F. G. Benedict and E. P. Joslin. Pp. vi+135. (Washington: Carnegie Institution.)

Pierre du Ryer, Dramatist. By Prof. H. C. Lancaster. Pp. v+182. (Washington: Carnegie Institution.)

Guide to the Materials for American History to 1783, in the Public Record Office of Great Britain. Vol. i., The State Papers. By Prof. C. M. Andrews. Pp. xi+346. (Washington: Carnegie Institution.)

The Classics of International Law. Edited by J. B. Scott. De Jure et Officiis Bellicis et Disciplina Militari Libri III. Vol i., Reproduction of the First Edition. With introduction by Dr. J. Westlake. Pp. xxvii+227. Vol. ii., Translation. By Dr. J. P. Bate. Pp. xii+250. (Washington: Carnegie Institution.)

Scientific Papers. By J. Y. Buchanan. Vol. i. Pp. xii+15 papers. (Cambridge: University Press.) 10s. 6d. net.

Klimatographie von Salzburg. By Dr. A. Fessler. Pp. 87+map. (Vienna: Gerold and Co.)

Report of the Conference on the Education of the Domiciled Community in India, Simla, July, 1912. Pp. iv+202. (Calcutta: Superintendent Government Printing, India.) 1s. 6d.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 13.

ROYAL SOCIETY, at 4.30.—A Cassegrain Reflector with Corrected Field: Prof. R. A. Sampson.—Studies of the Processes Operative in Solutions. XXV. The Influence of Non-electrolytes on Solubility. The Nature of the Processes of Dissolution and Precipitation: Prof. H. E. Armstrong and Dr. J. V. Eyre.—Studies of the Processes Operative in Solutions. XXVI. The Disturbance of the Equilibrium in Solutions of Fructose by Salts and by Non-electrolytes: E. E. Walker.—The Excitation of γ Rays by the α Rays of Ionium and Radiothorium: J. Chadwick and A. S. Russell.—Load Extension Diagrams taken with the Optical Load Extension Indicator: Prof. W. E. Dalby.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Some Factors in Parallel Operation: A. R. Everest.

CONCRETE INSTITUTE, at 7.30.—Three Steel-frame Structures in London: S. Bylander.

ROYAL SOCIETY OF ARTS, at 4.30.—Kathiawar: Sir W. Lee-Warner.

MATHEMATICAL SOCIETY, at 8.—Figures in n-Dimensional Space analogous to Orthocentric Tetrahedra: T. C. Lewis.—A Property of the ζ-Function: J. E. Littlewood.—The Summability of a Fourier's Series: G. H. Hardy.—Trigonometrical Series which Converge Nowhere or almost Nowhere: G. H. Hardy and J. E. Littlewood.—A Theorem Concerning Power Series: H. Bohr.—The Theorem of Quadratic Reciprocity: P. J. Heawood.—The Irreducibility of Legendre's Polynomials: J. B. Holt.

FRIDAY, FEBRUARY 14.

ROYAL INSTITUTION, at 9.—New Gyroscopes and their Applications: Prof. Andrew Gray.

PHYSICAL SOCIETY, at 8.—Annual General Meeting.—The Dynamics of Pianoforte Touch: Prof. G. H. Bryan.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Annual General Meeting.—Modern Condensing Systems: A. E. Leigh Scanes.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

MALACOLOGICAL SOCIETY, at 8.—Annual Meeting.

SATURDAY, FEBRUARY 15.

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

MONDAY, FEBRUARY 17.

ROYAL SOCIETY OF ARTS, at 8.—The Art of Miniature Painting: C. Davenport.

ARISTOTELIAN SOCIETY, at 8.—The Analysis of Volition, treated as a Study of Psychological Methods and Principles: Prof. R. F. A. Hoernle.

VICTORIA INSTITUTE, at 4.30.—The Antecedent Probability of a Revelation: Ven. Archdeacon Sinclair.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Canals and Canalised Rivers: J. A. Saner.

TUESDAY, FEBRUARY 18.

ROYAL INSTITUTION, at 3.—The Heredity of Sex and some Cognate Problems: Prof. W. Bateson.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—Some Aspects of Palæolithic Relics in North Britain and Ireland: Rev. S. Smith.

ROYAL STATISTICAL SOCIETY, at 5.—The Panama Canal and Competition for Trade in Latin America, the Orient and Australasia: Prof. Lincoln Hutchinson.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further Discussion:* Durban Harbour, South Africa: C. W. Methven.—Natal Harbour Works: C. J. Crofts.

ZOOLOGICAL SOCIETY, at 8.30.—Diagnoses of New Species and Varieties of Agnathous Mollusca from Equatorial Africa: H. B. Preston.—The Dwarf Buffalo of Southern Nigeria, with a Revision of the Dwarf Buffaloes of Western Africa: R. Lydekker.—Notes on the Habits of Certain Reptiles in the Lagos District: W. A. Lamborn.—Two British Entomostraca belonging to the Orders Copepoda and Ostracoda: Dr. G. Stewardson Brady.—The Gorgonopsia, a Suborder of the Mammal-like Reptiles: Dr. R. Broom.

WEDNESDAY, FEBRUARY 19.

ROYAL SOCIETY OF ARTS, at 8.—The Adulteration of Jam: E. Marriage.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Report upon the Lenses of the late Joseph Jackson Lister: E. J. Spitta.—Demonstration on the Use of the Centrifuge in Pond-life Work: D. J. Scourfield.—Slides showing the Development of the Fairy Shrimp (*Chirocephalus diaphanus*): C. Lees Curties.

ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Periodical Variations of the Velocity of the Wind at Oxford: W. H. Robinson.—Rate of Ascent of Pilot Balloons: J. S. Dines.—Meteorological Conditions in a Field Crop: W. L. Balls.

THURSDAY, FEBRUARY 20.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Studies on Enzyme Action. XIX. Urease, a Selective Enzyme. II. Observations on Accelerative and Inhibitive Agents: Prof. H. E. Armstrong, M. S. Benjamin, and E. Horton.—Nervous Rhythm arising from Rivalry of Antagonistic Reflexes; Reflex Stepping as Outcome of Double Reciprocal Innervation: Prof. C. S. Sherrington.—The Liberation of Ions and the Oxygen Tension of Tissues during Activity: Dr. H. E. Roaf.—Contributions to the Bio-chemistry of Growth. The Glycogen Content of the Liver of Rats Bearing Malignant Growths: W. Cramer and J. Lochhead.—Changes in the Glomeruli and Tubules of the Kidney accompanying Activity: Prof. T. G. Brodie and J. J. Mackenzie.

INSTITUTION OF MINING AND METALLURGY, at 8.

FRIDAY, FEBRUARY 21.

ROYAL INSTITUTION, at 9.—Horticultural Investigations at the Woburn Experimental Fruit Farm: Spencer U. Pickering.

SATURDAY, FEBRUARY 22.

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

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