THURSDAY, JULY 16, 1908.

EXPERIMENTAL ENTOMOLOGY.

Experimentelle Entomologische Studien vom physikalisch-chemischen Standpunkt aus. By Prof. P. Bachmetjew. Zweiter Band; mit 25 Tafeln. Pp. xvi+944+cviii. (Sophia: Staatsdruckerei, 1907.)

ALTHOUGH it is well known that many excellent observers have of late years devoted their attention to experimental work of which insects are the subject, it is probable that few students of entomology have realised hitherto how large is the mass of material that has now been accumulated in this department of research. The present work is somewhat of a revelation. Its tale of nearly a thousand pages consists almost entirely of a condensed account of the investigations conducted by various experimenters on the influence of external factors on the phenomena of insect life. Even so, the list is not quite complete, for, though the author, working under many difficulties, has displayed an amount of industry in collecting his material that is really astonishing, we could yet name more than one memoir bearing on the subject that seems to have escaped his vigilance. We note, for example, the omission of any reference to the striking experiments of Mr. G. A. K. Marshall on South African Lepidoptera. Nevertheless, the compilation has, on the whole, been admirably executed, and Prof. Bachmetjew's bulky volume will be indispensable to those workers in the subject who wish to have the results of nearly all previous investigations in a readily accessible form. The amount of labour saved to his colleagues in entomology by the author's determination to record every relevant fact hitherto ascertained by experiment is quite incalculable.

The work is divided into two parts, the first dealing with the actual results obtained by various investigators, the second giving the theoretical conclusions considered by these and other authorities to be warranted by the experiments in question. As might be expected, these speculative opinions are of very unequal value, and it is to be observed that the author makes little or no attempt to decide between them when they are contradictory, or to condemn them when erroneous. He has rather set before himself the task of recording without distinction, not only every fact relating to his subject, but also every conclusion at any time suggested, whether the latter be good or bad. His own views, save on a few points, are not much in evidence. It is clear from this that the book has serious limitations; these, however, do not prevent it from being extremely useful within the scope allowed it by its author. The insects dealt with naturally belong almost entirely to the order of Lepidoptera.

The effects of the various external factors are considered in their relation to the time occupied in development, to the size and form of the perfect insect, and to its ultimate colouring and pattern. Under each of these main heads the influence is considered of climate, moisture, temperature, light, the colouring of the surroundings, food, including chemical food-material artificially employed, electricity, magnetism, friction, artificial constriction, pressure, gravitation, and other factors.

The author defers to a future treatise the questions of seasonal dimorphism, protective resemblance, mimicry, and parthenogenesis. The omission of these subjects, especially of the first three, marks a further limitation of an important character, for they often have a special bearing on the interpretation of such facts as are here recorded. Indeed, inasmuch as an appreciation of the significance of the changes induced by the operation of external factors is often entirely dependent on a knowledge of the insect in question in its relation to seasonal, mimetic, and cryptic conditions, the present treatise, useful as it is, can only be considered as a partial introduction to the theory of the subject.

The book is fitly dedicated to Dr. Max Standfuss, of Zürich, whose experiments, conducted on a very large scale, have, perhaps, done more than those of any other investigator to establish our knowledge of the effects of temperature applied during the immature stages on the form and colouring of the perfect insect. His experiments in hybridisation, although carried out before attention had been generally directed to the epoch-making work of Mendel, are also very worthy of note. Next to Standfuss's experiments, perhaps the most important work of this nature is that conducted through many years by Mr. F. Merrifield at Brighton, and we are glad to see that due prominence is given to his admirable investigations in Prof. Bachmetjew's pages. Among other work carried out by English experimenters is that of Prof. Poulton, which also comes in for appreciative notice, but here we cannot fail to observe the somewhat unfortunate effect of the author's determination to reserve the question of protective coloration for future treatment. Much of the significance of Poulton's results on the effect of surrounding objects on the colouring of larvæ and pupæ is thus for present purposes lost. It is from their bearing on evolutionary problems that data of this kind derive their highest interest, and we must once more remark on the opportunities thus missed by the author. We may hope, however, that the omission is only of a temporary character, and that we shall yet see a treatise from his hand which will throw fresh light on many questions of primary importance in the study of evolution.

The plates consist for the most part of graphic representations of the statistical results furnished by the tables in the body of the work. They are useful as exhibiting series of facts in a form which by most people is more easily appreciated than a bare numerical statement.

It will have been gathered from the foregoing remarks that Prof. Bachmetjew's volume is mainly designed as a work of reference. In accordance with this plan, the literature of the subject has been very carefully catalogued, and the bibliography, which occupies seventy-seven pages at the end of the book, besides occasional lists given in the text, is of a very full description. It is true that there are omissions, but these do not appear to be numerous.

The author is already favourably known for his excellent *résumé* of observations and experiments relating to temperature in insects, this, with the present volume, constituting the first two instalments of his projected "Experimental Studies in Entomology." The production of the third volume of the series will be awaited with interest. F. A. D.

INFINITE SERIES.

An Introduction to the Theory of Infinite Series. By T. J. I'A. Bromwich. Pp. xvi+511. (London: Macmillan and Co., Ltd., 1908.) Price 15*s.* net.

THE first impression this book is likely to produce is that, considering its title, it is very big. However, it is not diffuseness that is to blame for this; the fact is that quite a third of the volume consists of matter that does not strictly come under the title, but is either introductory or supplemental. Thus we have an appendix dealing with irrational numbers and limits; another on logarithms and exponentials; a third on infinite integrals and gamma functions.

It is pleasant to find the author adopting Dedekind's definition of an irrational number, the only one which is really scientific. In the second appendix, the exponential function is introduced after the logarithm, but as the latter is defined by an integral, this does not matter much. There can be little doubt that for methodical treatment, the integral definition of log z, with the elements of the theory of complex integration, is by far the most satisfactory; and it does not introduce any gratuitous difficulties. The third appendix is interesting, because it introduces recent results obtained by the author, Mr. Hardy, and others, which illustrate very clearly how the problems of series are complicated when we pass to integrals over an infinite range. In passing, it may be observed that Mr. Bromwich refers with due appreciation to Mr. Gibson's excellent text-book on the calculus.

Passing on to the main subject of the book, it is curious to note how much there is that is comparatively recent. Of course, Abel and Cauchy were the great pioneers; but if we take, for instance, the distinction between uniform and non-uniform convergence, this does not seem to have been fully recognised before Stokes's paper of 1847 (see Mr. Bromwich's note, p. 115); and the new definitions of the "sum" of a divergent series are creations of yesterday.

The subject last mentioned is discussed in chapter xi., mainly after Borel and Cesàro, and is a good example of the extension of mathematical terms. Borel gives a process by which, from a divergent series (or sequence) Σ, we can in certain cases find an expression $S(\Sigma)$ which is finite. Moreover, if Σ is a convergent series, $S(\Sigma)$ is the sum in the ordinary sense, and if $S(\Sigma)$, $S(\Sigma')$ exist, then $S(\Sigma+\Sigma')=S(\Sigma)+S(\Sigma')$. Mr. Bromwich makes some very interesting comparisons between this recent theory and some of Euler's transformations of divergent or oscillating series. Like Fourier, Euler had a wonderful instinct, which led him right, even when his logic was defective.

It is fairly plain that, with the exception of convergent series, there is no one definition of the sum superior to all others; different definitions may be useful for different purposes. Again, with regard to ordinary series, there is no universal test for convergency, except, of course, the definition; and the same remark applies to integrals with infinite limits. Oddly enough, one of the most useful tests for the convergence of a series (p. 35) is practically due to Gauss.

One of Mr. Bromwich's great merits is that he constructs examples to show the fallacy of various plausible assumptions which have occasionally misled even the elect. For instance (p. 99), we have a product $\Pi(1+u_n)$ which is convergent, although Σu_n and Σu_n^2 both diverge. The discussion of double series is also very instructive. The fact is that any actual case of summation is the construction of a linear sequence s_1, s_2, s_3, &c.; so-called derangements or permutations of series are best regarded as constructions of new series, the terms of which have a one-one correspondence to those of the first. Two series thus related may, or may not, have the same sum.

Attention should be directed to the discussion (pp. 157–60) of certain Fourier series, especially as to the limiting form of the curve

$$y=\sin x+\tfrac{1}{2}\sin 2x+\ldots+n^{-1}\sin nx,$$

when n increases indefinitely. Reference might have been made to the correspondence in NATURE, vol. lix. (1898), in which Willard Gibbs and Prof. Michelson took part. The point is that the limiting form is not a mere zig-zag but a zigzag with projecting spines.

Finally, a word may be said about the examples, which are very numerous and diversified. It is perhaps a trifling matter in itself, but to some minds it will give satisfaction, that as modern analysis is becoming assimilated, illustrations of it are being produced which have something of the elegance and individual beauty of the Cambridge or Oxford problem of years gone by. After all, a plant must grow before it flowers. G. B. M.

STUDIES IN EDUCATION.

The Demonstration Schools Record. Being Contributions to the Study of Education by the Department of Education in the University of Manchester. No. 1. Edited by Prof. J. J. Findlay. Pp. xvi+126. (Manchester: The University Press, 1908.) Price 1*s.* 6*d.* net.

THE work before us is to be regarded rather as an introduction to future issues of the "Record" than as an arranged and classified record of the results of educational observation and experiment. Here the authors take us into their confidence; we are told what their view of a demonstration school is, what questions they hope to solve, and on what principles they think the answers should be sought. When the future volumes are available the record will be one in which full confidence can be placed; it will not be a statement of partial facts selected consciously or unconsciously to fit a particular theory. For this

reason, as well as for the clear statement of some of the educational problems involved, those interested in educational progress will give the volume a cordial welcome. At the same time, it seems a little doubtful whether such facts should be published as that not only the mental achievements, but the "nature, instincts, experience, *and ideals*" of each child are noted and tabulated by the students in training. The files are no doubt kept with scrupulous privacy under lock and key. But if through parents buying the book and leaving it about, or talking about it, the children get to know of this dissection, the injury to character might be serious.

The general scheme of the school work will have the full approval of modern educationists, who will envy Prof. Findlay and his colleagues the opportunity of putting their theories into practice. Particularly valuable are Prof. Findlay's observations on the relation of the school to civic and corporate life, and especially his conviction that the parents are to be brought into the closest possible touch with the educational as well as the social aspects of the school work. It is indeed only when we have educated the parents that we can hope to have the full measure of success in educating the children.

As to details, the scheme of science teaching seems excellently conceived. That of French shows careful work in accordance with the direct method, the psychology of which is so well explained by Prof. Findlay's paper (reproduced p. 69). It is to be hoped that in future issues the relation of practice to theory will be dwelt on; for instance, one wants to know *how* "the general efficiency of the school *in other departments* affects vitally the success or failure" of the French teaching (p. 71). The scheme for history and handwork combined has at least the merit of boldness. With the object of increasing the sympathy with social rather than personal interests, biography has been discarded, and interest in the material world takes its place until the children are nine years old. From six to seven some elementary facts about the food, clothing, housing, &c., of present-day life are taught, with practical applications. From seven to nine the children are "prepared for more systematic study of the historical beginnings of the nation to which they belong" by being made to imagine themselves first as Tree-people, then as Cave-dwellers, then as Red Indians, then as pastoral tribes, and lastly as Saxons, and there is plenty of scope for handwork in reproducing the material conditions of the life of the different periods. Then, judging from the record, it would seem that at nine they are plunged straight into the *details* of the history and literature of the period from 1625–1660. For 1908 this was apparently the course for all children from nine to fourteen years of age.

The chapter on the social aspects of child study is not convincing, and scarcely seems to have been written in such close contact with the life of the school as the others. It shows a tendency to vague language and uncertain generalisations which seem out of place in the record of a demonstration school.

It is legitimate to hope that the future volumes will answer more of the questions they raise.

ELEMENTARY ELECTRICITY.

An Introduction to Electricity. Being a translation of the second edition of "Einfuhrung in die Elektrizitatslehre," with corrections and additions by author. By Bruno Kolbe. Translated by Joseph Skelton. Pp. xii+430. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1908.) Price 10*s.* 6*d.* net.

THE editor offers this volume as a satisfactory introduction to the science, both for students and for "the man in the street." So far as the former is concerned, the claim may be dismissed at once; the book is too inaccurate; and the "man in the street" must have a remarkable mind if he gets what he wants from Prof. Kolbe. We should have imagined that he required a clear statement of principles, and was not greatly concerned with experimental evidence. Prof. Kolbe gives him an overwhelming mass of experiment—(it is only fair to say that the experiments are often highly ingenious)—accompanied by confusing and misleading deductions.

Comprehension is rendered more difficult by the failure of the translator to eliminate the syntax of the original. We may be misrepresenting the author, but the following argument appears to be a simplified form of his treatment of the fundamental conceptions, charge, potential and capacity. Unit charge is defined as that on a certain proof ball after contact with a certain conductor charged to its spark potential. Successive charges are communicated to an electroscope, and a scale defining the magnitude of charges is graduated. The electroscope is then connected by a wire to various points of a charged conductor; the constant reading is defined as the "degree of electrification" (potential) of the conductor. It will be noted that in order that these definitions may agree with those used in stating the fundamental theorems, the capacity of the electroscope must be infinite in comparison with that of the proof ball, and infinitesimal in comparison with that of any conductor of which the potential is to be measured. After a long digression we come to capacity, for which two electroscopes measuring potential are required. The author appears to graduate the scales as before, and to assume that similar readings denote similar "degrees of electrification"; of course they will do so only if the capacities of the electroscopes are the same. After another chapter and a half we find the ordinary definitions of charge and potential; the former is shown experimentally to agree with that adopted previously (experimental complications are unknown to the fortunate author); but though the quantitative agreement of the latter with "degree of electrification" is asserted and assumed subsequently, no attempt is made to prove it. No indication is given of the connection of potential with field strength. In rejecting symbols, Prof. Kolbe appears to have rejected the whole of the logic of which those symbols are the ordinary expression.

Two glaring blunders should be noted in the same part of the book. The author tries to prove that there can be no charge inside a solid conductor without assuming the inverse square law; of course the proof is fallacious. He also states that the action of a flame

in discharging an insulator is similar to that of points on a conductor.

The remainder of the book is much better than the portion on electrostatics; but there are several errors, and, as usual, the author tries to cover too much ground. When will authors realise that there is no royal road to learning in science or elsewhere? If those who have special aptitude for these studies require years of work to grasp the fundamentals of electricity, is it likely that the "plain man" will get any good from reading 400 "elementary" pages attempting to deal with the whole subject? Such publications only increase the number of persons who talk and write about things of which they imagine themselves masters, but are in reality ignorant.

OUR BOOK SHELF.

Handbook of Flower Pollination, based upon Herman Müller's Work "The Fertilisation of Flowers by Insects." By Dr. P. Knuth. Translated by Prof. J. R. Ainsworth Davis. Vol. ii. Pp. viii+703. (Oxford: Clarendon Press, 1908.) Price 31*s.* 6*d.* net.

As stated in our review of the first volume (vol lxxiv., 1906, p. 605), Knuth's "Handbook of Flower Pollination" is an encyclopædic work, and the second volume, which is now before us, dealing as it does with the various methods of pollination in fifty-six families of dicotyledonous plants, is even more directly a book of reference than the first volume, which was of an introductory nature. In this second volume the author deals seriatim with all the genera and species in the natural orders under consideration, describes the structure of the flowers in so far as it affects directly or indirectly the mode of pollination, and cites the various direct observations on pollination made by himself or others. To each species of plant is appended a list of the insects which have been observed visiting the flowers, together with a statement as to whether the insects in question were devouring or collecting pollen or sucking nectar.

The translator has facilitated the use of the volume, which will be more frequently consulted than read through, by repeating more fully the titles of the books and papers referred to than is the case in the original. Few, if any, of these references are more recent than 1898, the date of publication of vol. ii. in the German edition, though the list of references in the first volume of the translation is brought up to 1904.

No doubt the labour involved in bringing up to date the various recorded visits of insects to flowers would have been very considerable, but on points of a more general character the translator might have added some additional information in the form of footnotes. Thus in dealing with those Papilionaceæ which have so far been recognised as self-sterile, the translator might have mentioned the more recent investigations of Kirchner, and might have referred to the illuminating generalisation of that author, who found that while so many perennial Leguminosæ are self-sterile, all the self-fertile forms of Papilionaceæ are annuals which are dependent for their continued existence on each year's successful crop of seeds, and cannot, therefore, afford to be self-sterile. Similarly, in dealing with the genus Alchemilla, mention might have been made of the recent investigations of Strasburger and others on the phenomenon of apogamy so characteristic of a certain section of this genus.

A useful improvement is the addition to the translation of a list of the natural orders dealt with in this volume, which will be as welcome to English readers as the more general introductory volume has proved itself to be.

The Theory of Ions: a Consideration of its Place in Biology and Therapeutics. By Dr. W. Tibbles. Pp. ix+131. (London: Rebman, Ltd., 1908.) Price 2*s.* 6*d.* net.

THIS is a bright little book written with the object of pointing out the bearings of physical chemistry on physiological processes. Dr. Tibbles, however, like Pauli, from whose book copious quotations are made, is rather inclined to make the phenomena of ionisation and the behaviour of colloids explain too much. There is no doubt that physical chemistry will in the future make clear a good deal of what is at present obscure in bio-chemistry; but a full appreciation of this effect cannot be gained until two things have occurred; one of these is a settling of the many vexed points of quite a fundamental nature between the physical chemists themselves, and the other is a fuller knowledge of the chemistry of protoplasm in general and of the protein constituents of protoplasm in particular.

At the present day there is probably only one sentence in the book with which all will be in agreement, and that is, "We are far from a satisfactory insight into the nature of the effect of ions."

The author gives a fairly accurate account of the advances recently made in physiological chemistry, although it will probably be found too compressed to appeal to any but those fully up in the subject. His nomenclature is not uniform, and is therefore confusing to the reader; thus he sometimes speaks of proteins, sometimes of proteids; in some places of amino- and in others of amido-acids; there are a number of uncorrected press errors, for instance, glycyl-glycyl for glycyl-glycine. The close similarity of the words absorption and adsorption should have rendered him especially careful in proof-correcting, especially where both are mentioned on the same page. He also gives us the rather startling information that choline is present in bile salts.

The work does not profess to contain anything original; it is rather a compilation from previous writers strung together with the object of emphasising the importance of a knowledge of solutions in the elucidation of physiological, pathological and therapeutical problems. Dr. Tibbles is not always judicious in his selections or judicial in their valuation. For instance, the old theories of Pflüger, Latham, Loew, and others on the distinction between living and dead proteins are all advanced as though they were still tenable and of equal value with the views of Fischer which depend on actual work and not on mere speculation.

Still, the book is interesting, and contains many suggestions of importance, but the author has not realised that it is not possible to write a complete text-book of organic chemistry, bio-chemistry, physical chemistry, therapeutics and immunity within the short compass of 130 small pages, or that the ionic theory or any other theory, however new and attractive, is sufficient to explain the universe.

The Libraries of London: A Guide for Students. Prepared by R. A. Rye. Pp. 90. (London: The University of London, 1908.) Price 6*d.* net, post free 9*d.*

THE libraries described in the book, with the exception of those of certain schools of the University, and

that of the Royal Botanic Gardens, Kew, lie within the London County boundary. The information about each of the very large number of London libraries is just what a student wants to assist him in his search for books on a particular subject. Few persons, unless they have made special inquiries, can have any idea of the immense number of books available in London for reference by the seeker after knowledge or recreation. Students owe a debt of gratitude to the Senate of the University of London for giving instructions for the preparation of this guide, and to Mr. Rye for his complete understanding of their needs.

LETTERS TO THE EDITOR.

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

The Spectrum of Radium Emanation.

IN NATURE of July 9 a letter from Prof. Rutherford appears giving an excellent corroboration of measurements of the spectrum of radium emanation which we communicated to the Royal Society on July 1. There can, therefore, be no doubt of the accuracy of Prof. Rutherford's measurements. When Mr. Watson, who is engaged in measuring accurately with a 10-foot grating the secondary spectrum of hydrogen, has finished his task, we shall be able to introduce some small corrections in our figures. WILLIAM RAMSAY.
A. T. CAMERON.

University College, Gower Street, London, W.C., July 9.

The Kinetic Energy of the Ions emitted by Hot Bodies.

IN a paper communicated to the American Physical Society at the New York meeting on February 29, the writer, in collaboration with Dr. F. C. Brown, showed that the part of the translational kinetic energy of the negative ions emitted by hot platinum, which depends on their component of velocity normal to the emitting surface, has the same mean value as the corresponding quantity for a molecule of gas at the temperature of the metal, and, further, that that component of the velocity is distributed among the different ions according to Maxwell's law of distribution of velocity among the molecules of a gas. Since then Dr. Brown has succeeded in showing that the same laws hold for the positive ions emitted by hot platinum.

Using a different method, the writer has succeeded in measuring the portion of the kinetic energy of the ions which depends on their component of velocity parallel to the emitting surface. Within the limits of experimental error, this quantity has the same mean value, for both positive and negative ions, as the corresponding quantity for a molecule of gas at the temperature of the metal, and is distributed among the different ions according to Maxwell's law.

Taken together, these investigations show that the ions emitted by hot platinum, under normal conditions, are identical, as regards their kinetic properties, with the molecules of a gas of the same molecular weight, at the temperature of the metal. It follows, by an application of the kinetic theory of gases, that the same thing holds for the free electrons inside the metal. This result has an important bearing on the electron theory of metallic conduction and of the emission of electromagnetic radiation by hot bodies.

This is the first direct experimental confirmation of Maxwell's laws relating to the distribution of velocity among a collection of moving particles in a state of statistical equilibrium.

The full account of these researches will shortly appear in the *Philosophical Magazine*. O. W. RICHARDSON.

Princeton, N.J., July 3.

Absorption of X-Rays.

SOME of the most interesting observations made in the investigation of the properties of homogeneous beams of Röntgen radiation are those exhibiting the connection between the absorption of X-rays and the emission of secondary X-rays from the absorbing substance. Many elements—probably all—when subject to a suitable primary beam, are the source of a homogeneous Röntgen radiation which is characteristic of the element emitting it. The following conclusions concerning the emission of this radiation have been found to be perfectly general, so far as experiments have been made.

When a very absorbable primary radiation is incident on a given element, the homogeneous radiation characteristic of that element is not emitted in appreciable intensity.

As the general penetrating power of the primary radiation is gradually increased, the absorption decreases only up to a certain point. When the penetrating power becomes greater than that of the radiation characteristic of the absorbing element, the absorption of that primary radiation begins to increase, and a secondary homogeneous radiation begins to be emitted. Then there is a rapid and considerable increase in both the absorption of the primary rays and in the emission of secondary rays. When the general penetrating power is increased still further, the absorption decreases again in the usual way, and the intensity of secondary radiation decreases at the same rate—in some cases at least—as the ionisation produced by the primary beam in air.

The special absorption of the primary rays thus connected with the emission of secondary rays is a considerable fraction of the total absorption—thus in iron the increase is about double the absorption previous to the emission of the rays.

Experiments have not been made to determine if all the extra energy absorbed appears as energy of secondary radiation, but from observations of the absorbability of the secondary radiation and of the ionisation it produces, it appears probable that a large proportion is re-emitted.

The energy re-emitted in the form of a radiation of more absorbable type is in some cases sufficient to make the total ionisation produced in an electroscope placed immediately behind a thin absorbing sheet of metal greater than that produced by the direct unabsorbed primary beam.

The emergent radiation is then a mixture of two homogeneous radiations, the proportions of which depend principally on the coefficients of absorption of the incident radiation, and of the radiation characteristic of the metal in the metal itself, the coefficient of transformation of one into the other type of radiation, and the thickness of the absorbing plate. A copper radiation may, by transmission through an iron plate, be transformed so completely as to be almost indistinguishable from pure iron radiation, but it does not then proceed in the direction of propagation of the incident radiation; it is emitted from the atoms in approximately equal intensity in all directions.

What has previously been described as the special power of a homogeneous radiation of penetrating the element emitting it and elements of neighbouring atomic weight (Phil. Mag., September, 1907, p. 408) may be more precisely stated thus:—A radiation which is more absorbable, equally absorbable, or only slightly more penetrating to most substances than the radiation characteristic of the element upon which it is incident, is absorbed much less than one of more penetrating type. It also produces little or none of the characteristic secondary radiation which is produced by the more penetrating radiation.

The special power of an ordinary heterogeneous primary radiation after transmission through an absorbing substance of penetrating further layers of that substance is due to two causes—(1) the special absorption of those radiations capable of stimulating a homogeneous secondary radiation, (2) the superposition on the primary radiation of that secondary radiation.

A full account of these experiments and a discussion of the results will be published shortly. C. G. BARKLA.

Liverpool, July 8. C. A. SADLER.

The Form of Birds' Eggs.

IN NATURE of June 4 (pp. 111–3), in a paper by Prof. D'Arcy Wentworth Thompson read before the Zoological Society, April 28, the way in which form in birds' eggs is to be accounted for is discussed. Referring to the accepted causes of variation in form of eggs, Prof. Thompson says:—"Whatever truth there be in these apparent adaptations to existing circumstances, it is only by a very hasty logic that we can accept them as a *vera causa* or adequate explanation of the facts; and it is obvious to my mind that in attempting to deal with the forms assumed by matter, whether in the organic or the inorganic world, we ought first to attempt to deal on simple physical lines with the forces to which it has been subjected, that is to say, the intrinsic forces of growth acting from within, and the forces of tension and pressure that may have acted from without."

In other words, for the antecedent cause (adaptation to surroundings) is substituted modification resulting therefrom or the consequential cause; and far from it being "very hasty logic" to assume the former, it is, to my mind, hasty logic to rule it out and to substitute for it an *effect*. In any case, the consequent is not a "*vera causa* or adequate explanation," as must at once be apparent. Again, force or energy determines the "forms assumed by matter"; and in a question of this kind we cannot compare the inorganic and organic worlds, since in the latter we find conscious effort and thought an attribute, so far as we know, not applicable to the former, and in causation either can play a very effective part. In regard to adaptation to surroundings or influence of external conditions, which to all is not meaningless, we may state the following premises:—

(1) There is a distinct evolution in form from a spherical, through various forms of ellipse, to the elongated conical egg-shell of the guillemot cited.

(2) In abnormal and embryonic eggs, normally non-spherical, there is often a reversion to the spherical form.

(3) Certain types of eggs characterise birds morphologically allied, addicted to the same mode of life, and subject to the same incident physical surroundings.

(4) Correlated with identity of form is unity of type in coloration, and it seems reasonable to suppose that this is due also to influence of surroundings—arising from which adaptations, protective resemblance, &c., may become necessary.

(5) When an egg retains permanently a form that it appears reasonable to regard as suited to environment, the same type of egg is not usually found to characterise other birds habituated to a different environment.

From (5) and the preceding premises, even though partly inferential, we may logically conclude that the form of eggs is connected with environment, for experiment, indeed, shows that all types of egg but that of the guillemot will roll off a table more readily than the latter, to instance one case alone; and it is generally admitted that the most potent factor in the production of modifications is the influence of environment. Furthermore, the egg-shell is not an indispensable product of reproduction, but has become necessary as a result of the acquired characters of different species of terrestrial organisms, so that we may regard this as further evidence of the influence of surroundings upon the bird and its egg; and thus variation in nesting-site, contributing to variation in form of egg, appears to follow by means of modifications arising from the causes indicated.

The determination of a force, in fact, is antecedent to its consequential mode of action. The latter is surely not an efficient cause, but an effect of an antecedent which we *may* call an efficient cause if we like. The one is subjective, the other objective, in nature, and these cannot be substituted. Function in an organ, or mode in which an organ performs its function, is not equivalent to cause. On this and the influence of surroundings reference may be made to the writings of Sir Ray Lankester ("Embryology and Classification," pp. 36–9), on the influence of memory and energy in evolution, Prof. Cope (*Amer. Nat.*, 1882, pp. 454–69), Ribot ("Heredity"), Hyatt ("Bioplastology," pp. 60–87), Herbert Spencer ("Principles of Biology").

Whether we regard the corpuscular or germ-plasm theory as the only tenable one, or whether we favour the dynamical theory, we can, I think, in either case allow that memory persists; and if it persists can it not recall in answer to stimulus a response given by the ancestor of a species? Cells may contain or retain by virtue of memory the characters of the species, but effort or energy is no doubt the means by which a response to stimuli, causing new characters to arise (and become fixed), may be conveyed. We may regard it as feasible that modifications are indirectly due to the influence of energy and memory on the germ-plasm, the specific type preserver, and that heredity or variation may be influenced in nature by the characters acquired by incidence of physical surroundings, whilst a response in an organism to outside stimuli creates a response from within, stimuli acting from within and without reacting upon one another. An organism being "a combination of rhythmically acting parts in moving equilibrium," it follows that "a change to a new state of equilibrium" will bring "the actions of all organs, reproductive included, into harmony with these actions," and the fact that "the units and the aggregate must act and react upon each other" (Herbert Spencer) more or less illustrates the view adopted. When the influence of memory and energy, and the reactions they give rise to, are duly appreciated, the recurrence during successive generations of identical characteristics is more readily understood, and the action of pangenesis becomes obscure if this excludes the perpetuation of all characters arising during the phylogeny of the group or the history of the individual.

The validity of the mode in which eggs assume different forms described by Prof. Thompson I freely admit, but in claiming it, as he does, as a cause of their variation I cannot agree with him, since mode of action follows determining cause, and, as Hyatt says, "The action of physical causes takes effect upon an irritable plastic organism which necessarily responds to external stimulant by an internal reaction or effort."

A. R. HORWOOD.

Leicester Corporation Museum, June 17.

Lord Kelvin's Philosophy.

THERE is one word in Sir Oliver Lodge's interesting article, under the above heading, published in NATURE of July 2, to which I think some exception may reasonably be taken. In speaking of explanation in terms of force and action-at-a-distance, or in terms of motion and a continuous medium, Sir Oliver says that "To Lord Kelvin it would appear that both solutions were equally satisfactory, and that it was only a question of which was the most tractable." It is the word "equally" which is rather strong. He might indeed, as Sir Oliver says, prefer "to resort to the Boscovich doctrine"; but he would only do so in virtue of the tractability of the process, leaving aside for the time the question of the greater fundamentals. It was not at all a question of philosophy. It was a question only of the desirability of partial progress in place of no progress. His philosophy was Newtonian, postulating forces but reserving a medium.

In attempted explanation of certain elastic qualities in matter, he postulated a "simplest" Boscovichian system. That failing, he adopted a "second-simplest" system. Similarly, in attempted explanation of matter and energy, he postulated a simplest foundation in his vortex theory. That failing, he would doubtless have gladly framed a second-simplest foundation had he seen it to be possible. He was content to wait, meanwhile continuing his attack on the unknown along more presently promising lines.

In a letter of date December 1, 1905, referring to the molecular (Boscovichian) theory of magnetism and the "interesting truth" which it represents, he said "which will be added to when we know the physical quality of a molecular magnet and its relation to ether and to torrents of electrions through ether." In this spirit he was willing to wait for a knowledge of the physical quality underlying any other Boscovichian figuration.

W. PEDDIE.

University College, Dundee, July 8.

The Magnetic Separation of Heavy Minerals in the Field.

FOR some time I have been trying to find a simple and rapid field method of separating the magnetic and faintly magnetic from the non-magnetic minerals in the residue obtained by panning a river sand or gravel. In the laboratory this is usually done by means of the electromagnet. I have experimented in the field with a portable electromagnet, but, apart from the disadvantages of weight, bulk, and clumsiness of manipulation, the dynamo is readily liable to go out of order and render the whole apparatus useless. My colleague, Mr. Longbottom, has experimented with a compound magnet composed of three or four simple horseshoe magnets bound together and fitted with adjustable poles. This gives admirable results, and is to be recommended for fractional separations, but the constant adjusting and re-adjusting of the poles becomes tedious in actual practice.

I find, however, that all the advantages of the electromagnet can be obtained in the field by the combined use of an ordinary large (8-inch) horseshoe magnet and a penknife. A small quantity of the residue to be examined is taken, and the magnetite removed in the usual way. The magnet is then held vertically over the sample, and the bright steel blade of a penknife laid flat across one of the poles with the back of the blade downwards. By gradually approximating the point of the blade to the other pole, and thus narrowing the space between the poles themselves, the power of the magnet is increased, and not only iron ores, but all the dark-coloured silicates and garnets can be rapidly and completely removed from the sample. The residue may then contain such valuable minerals as tinstone and monazite, which when in small quantity are frequently masked by the other minerals present. This method has the further advantage that any single grain can be rapidly tested by turning the point of the blade slightly down below the level of the poles and bringing it close to the grain in question.

As an invaluable field method, as a useful laboratory method where an electromagnet is not available, and as an actual working method for teachers of practical geology, I can recommend the one above described for simplicity, inexpensiveness, and trustworthiness.

J. D. FALCONER.

Zaria, Northern Nigeria, May 24.

The Sky Glows.

THESE phenomena on about June 30 and July 1, referred to in my letter (NATURE, July 9, p. 221), I termed displays of Auroræ, and was prompted to apply that title by the descriptions given in some of the London newspapers, which stated that well-defined streamers had been observed from the metropolis.

But certain features of the glows struck me as being essentially different from exhibitions of normal Auroræ Boreales. No streamers whatever were seen here, but my view is somewhat restricted at low altitudes, and I thought they might have evaded recognition. The clouds observed were of peculiar character, and some of them showed traces of spiral formation. Though thin, they were strongly illuminative, and stars shone through them with surprising distinctness.

Here the display ranged over four nights, for on June 29 the sky was very light, and stars and Milky Way extremely faint, but clouds were very prevalent. On July 2 some attractive, coloured-cloud scenery was presented in the north-west and north, but the sky had not the bright, weird aspect it wore on preceding nights, and after midnight I saw nothing unusual.

Sounds proceeding from the north were strikingly audible in the still air, and I never remember to have heard the noise from distant railway trains in north-east so loudly before.

Whatever the true nature of the recent exhibition may have been, it is certain that something in the air exercised the capacity of reflection in a very high degree. The period was one of great heat and thunderstorms.

During past years, while engaged in meteoric or telescopic observation, I have occasionally noticed great differences in the transparency of the air. Occasionally the lightness of the firmament has struck me as being due to influences beyond local atmospheric causes. The variations have been great without palpable reasons, but no doubt there are different explanations applicable, though the observer finds it difficult to assign satisfactory ones in all cases.

W. F. DENNING.

A Remarkable Solar Halo.

ON July 2, one of the days on which Miss Stevens saw a halo at Oxford (NATURE, July 9, p. 221), a very bright halo was visible in the neighbourhood of Torbay. I first noticed it about 9 a.m., and it remained visible well into the afternoon. It attained its greatest brightness from 11 a.m. until noon. On looking at it through dark glasses it exhibited a somewhat remarkable form; the main halo had the usual radius of about 22°, but east and west were arcs of which the greatest distance from the sun was about 25°; these arcs gradually ran into the 22° halo. The effect was somewhat as though an elliptical halo were superposed on a circular one, the parts where the two coincided being of enhanced brightness. Below the sun there were at times fragments of halo at 44°. Masses of cirrus drifting from an easterly direction passed across the halo at times and partially obscured it, but probably had no part in its formation; it could be seen shining through the thinner parts of these clouds, and it regained its brightness as soon as they passed over. The halo was evidently formed by thin clouds above the ordinary cirrus, but no definite structure was visible to enable one to determine which way this layer was moving.

CHARLES J. P. CAVE.

Brunhilda, R.Y.S., Fowey, July 12.

Proposed Admission of Women to the Fellowship of the Chemical Society.

As president of the Chemical Society, I shall be glad if you will publish the accompanying letter referring to the correspondence as to the admission of women to the Fellowship of the Chemical Society which appeared in NATURE of July 9.

W. RAMSAY.

You have doubtless received a letter emanating from Oxford dated July 1 enclosing a circular and copy of the petition recently presented to the Council of the Chemical Society requesting the Council "to take such steps as may appear desirable to ascertain the wishes of the Society as a whole in regard to this question."

The envelope enclosing the above communications bore the familiar printed address-slips which might well lead Fellows to conclude that they were issued by authority of the Council. This is not the case.

The Council resolved that the statement of arguments on both sides which was issued to Fellows on June 23 was better calculated to elicit an unbiassed opinion of all Fellows if sent alone.

The course adopted by the signatories of the Oxford circular of July 1 is, therefore, not only unauthorised, but is in direct opposition to a resolution of the Council of which the signatories are members.

W. RAMSAY (*President*).
HORACE T. BROWN (*Foreign Secretary*).
ALEX. SCOTT (*Treasurer*).
M. O. FORSTER, ARTHUR W. CROSSLEY } (*Secretaries*).

Linnæus's Authorities.

I SHOULD be very much obliged if any of your readers could supply me with the full titles of the works cited by Linnæus as follows in the twelfth edition (1766) of the "Systema Naturæ," p. 33:—

"Bont. jav. 84 *t.* 84; Koep. itin. *c.* 86; Dalin. Orat. 5."

I have looked up the works of Bontius in the British Museum, but they are not *ad hoc*. Also where, if anywhere, did D. Braad publish an account of his journeys to India?

KARL PEARSON.

Biometric Laboratory, University College, London.

THE MINES OF THE BRITISH EMPIRE.[1]

THE aim of Mr. Stokes's work on the mines of the Empire is to supply the non-technical reader with a description of the historical, physical, and industrial features of the principal centres of mineral production in the British Dominions beyond the seas. The bulk of the volume is based upon information collected during a tour of the Empire extending from January, 1906, to the beginning of 1908; and the author, who is an experienced technical journalist, has produced a book of conspicuous literary merit that cannot fail to prove of service as a work of reference. The illustrations, sixty-eight in number, are excellent reproductions of photographs, and have been carefully chosen to illustrate the importance of the mineral industry of the Empire.

The value of the annual mineral yield of the Empire now exceeds 200,708,000*l*. The quantity and value of the mineral products form a good barometer of industrial prosperity, and such statistics bear expressive testimony to the influence of the Empire as a factor in the mineral industry. Statistics for 1906 show that the Empire produced of the world's total yield the following percentages:—Gold, 60; silver, 12; tin, 73; copper, 9; lead, 15; iron, 18; nickel 60; manganese, 40; coal, 30; asbestos, 90; graphite, 45; mica, 90; and diamonds, 98. Similarly the influence of the mining industry upon the growth and welfare of the Empire is exhibited by the statistical history of the several colonial mineral territories. Thus the aggregate yield to the end of 1906 of Ballarat and Bendigo, Australia, discovered 1851, was 276,500,000*l*.; of the Witwatersrand, since 1885, was 162,000,000*l*.; of Kimberley, since 1869, was 85,000,000*l*.; of Broken Hill, New South Wales, since 1883, was 42,000,000*l*.; of Kalgoorlie, Australia, since 1893, was 37,000,000*l*.; of Mysore, India, since 1880, was 26,000,000*l*.; of Klondike, Canada, since 1896, was 24,500,000*l*.; of Charters Towers, Australia, since 1872, was 23,000,000*l*.; and of Mount Morgan, Australia, since 1882, was 13,000,000*l*.

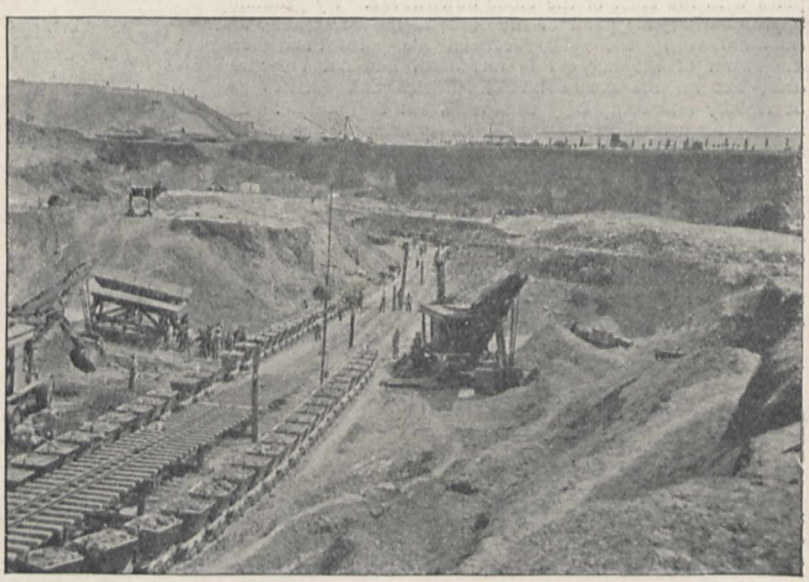

FIG. 1.—Premier (Transvaal) Mine in 1905. From "Mines and Minerals of the British Empire."

Although the mines of the United Kingdom are excluded from the scope of the volume, the vast field covered will be evident from the following enumeration of the thirty-six chapters into which the work is divided:—Mine labour; mica and manganese in India; Burma rubies and petroleum; the Kolar goldfield; gems and graphite in Ceylon; industrial and geological conditions of the Malay States; Chinese and European mining methods in the Malay States; Bendigo and Ballarat, Victoria; gold and copper in Queensland; New South Wales mineral production; silver, lead, and zinc at Broken Hill, New South Wales; methods of extraction at Broken Hill; Mount Lyell copper mine, Tasmania; Mount Bischoff tin mine, Tasmania; gold, silver, and lead in Tasmania; north-eastern tinfields, Tasmania; growth of the gold industry of Western Australia; ore treatment at Kalgoorlie, Western Australia; Wallaroo and Moonta copper mines, South Australia; chief mineral localities of New Zealand; Waihi gold mine, New Zealand; mineral production of South Africa; Cape Colony, Orange River Colony, and Transvaal diamonds; mining in Rhodesia; Transvaal gold; Rand ore extraction and treatment; administration, labour, and working costs in the Transvaal; progress of the mineral industry of Canada; silver at Cobalt, Ontario; nickel at Sudbury, Canada; asbestos fields of Quebec; gold and copper at Rossland, British Columbia; Boundary copper district, British Columbia; Klondike alluvial gold; West Africa and the Sudan; and other British dependencies (British North Borneo, Labuan, and Sarawak, Fiji Islands, British New Guinea, Cyprus, Nigeria, British Central Africa, Uganda Protectorate, Newfoundland, British Honduras, Leeward Islands, Barbados, British Guiana, and Trinidad). From this enumeration it will be gathered that the chief mineral products of the Empire dealt with include gold, tin, copper, silver, lead, zinc, nickel, manganese, iron, antimony, bismuth, molybdenum, tungsten, coal, oil shale, petroleum, mica, graphite, asbestos, diamonds and other precious stones. So vast is the subject as a whole that congratulations are due to the author for the able and concise manner in which he has described the manifold characteristics of mineral occurrence and of methods of working in a form as lightly technical as is consistent with accuracy.

A perusal of the author's well-filled pages shows that the old established mining fields are constantly presenting fresh features, but that new discoveries attracting universal attention can be recorded but twice or thrice in a decade. Compared with preceding periods, and notably with the decade 1882–1891, which saw the discovery of the Witwatersrand, Mount Morgan, Sudbury, Waihi, and Broken Hill, the past ten years have not been marked by many new discoveries, the Premier diamond deposit in the Transvaal, which since 1902 has yielded 3,300,000*l*., and the silver veins of Cobalt, Ontario, which since 1903 have yielded 1,100,000*l*., having been the most brilliant discoveries. The Premier mine, which produced the diamond weighing 3025 carats now in the King's possession, is shown in the accompanying illustration (Fig. 1); and the character of the narrow rich veins, averaging 4 inches in width, at Cobalt is shown in

[1] "Mines and Minerals of the British Empire." By Ralph S. G. Stokes. Pp. xx+403. (London: Edward Arnold, 1908.) Price 15*s*. net.

Fig. 2. At surface, where the veins have been affected by atmospheric agencies, there is a high proportion of metallic silver. Much of the ore shipped in 1904 was largely composed of native silver. The discovery at Cobalt is an indication of Canada's bright prospects of becoming a more important mineral-producing country. In North America the territory controlled by Great Britain exceeds that of the United States. But of this immense area of 3,600,000 square

FIG. 2.—Metallic Outcrop of Silver Ore, Cobalt. From "Mines and Minerals of the British Empire."

miles only a very narrow fringe has even been explored, and yet the rocks of which a very large proportion of the unexplored area is in all probability composed are those which in the United States carry the most valuable mineral deposits. Here, and in other parts of the Empire, the world awaits the establishment of new mining regions to compensate for the steady impoverishment of the old.

THE SECONDARY OSCILLATIONS OF OCEANIC TIDES.[1]

TIDAL observers have long known that at certain stations, mostly situated on bays or indentations of the coast, the simple curve of the tide-gauge is complicated by oscillations of level, often of considerable range and regularity of period. At first sight nothing could be further removed from the study of earthquakes than these irregularities of the tidal oscillation, but a connection has been discovered by the Japanese Earthquake Investigation Committee, whose diverse activity leads it to the study, not only of everything directly or indirectly connected with earthquakes, but also of everything which resembles their effect. The discovery, by Prof. Omori, that the periods of the earthquake-produced sea-waves were not uniform at neighbouring stations, but in each case agreed with those of the secondary oscillations of the tidal curve, naturally led to an investigation of this phenomenon, which has been noticed and made the subject of speculation by various observers. The investigation was carried out under the direction of Prof. H. Nagaoka, and has been published in a bulky and profusely illustrated quarto volume.

After a description of the improved and portable form of tide-gauge which was invented for the investigation, the ordinary limnograph being unsuitable and the ordinary tide-gauge too cumbrous, we have a detailed account, illustrated by reproductions of the tide curves and charts, of the records from fifty-one stations on the Japanese coasts. A general summary of the results is given, from which it appears that on the open Pacific coast, or in a bay of considerable area communicating with the sea by a narrow outlet, the tide curve is of a simple character, the secondary oscillations being small and irregular; but in more open bays, the breadth of which is not too large in comparison with their length, secondary oscillations are conspicuous, and often show great regularity of period. Simultaneous observations at different places along the shore-line showed that the phase of oscillation was usually the same throughout the bay, and that the oscillations which were conspicuous within the bay could be detected, with the same phase, but much reduced amplitude, at its mouth. From this it appeared that the whole mass of water in the bay was in simultaneous oscillation in a stationary wave, analogous to the sound-wave in an open organ pipe, and that the bay selected from the multitudinous ocean waves of various period the particular one to which it was able to respond, and, like a resonator with sound-waves, magnified and made it conspicuous.

This conclusion was verified by experimental investigation. Models, to scale, of the bays were made and sunk to the appropriate level in a large tank of water; in this tank was immersed a leaden ball which, being attached to a simple or a horizontal pendulum, could be set in oscillation with any desired period, and by its movement communicate to the water in the tank a periodic oscillation, unaccompanied by any appreciable surface-wave; reflection from the walls of the tank being checked by a thick layer of damping material—wood-shavings, to wit. By exciting waves with this arrangement the water in the model of the bay was put into standing oscillation, the amplitude of which was generally small; as the period of the pendulum approached the proper period of the bay, the amplitude of oscillation gradually increased, and, when the period exactly coincided with that of the model, the amplitude reached its maximum, continuing, with a regular period, after the pendulum was stopped. The phase of the water particles was the same for all parts of the bay when the oscillation was a fundamental one, but a binodal or trinodal oscillation was easily produced in an elongated bay.

An ingenious development of the experiment consisted in sprinkling aluminium powder on the surface of the water and photographing the model with a camera suspended vertically above it; by giving an appropriate length of exposure, the movement of the particles reproduced the course of the stream-lines on the resulting photograph. In Fig. 1 we reproduce one of these photographs, showing the motion where the induced wave is the fundamental oscillation, in which the mouth of the bay is a node for

[1] "An Investigation on the Secondary Undulations of Oceanic Tides, carried out by the Order of the Earthquake Investigation Committee during 1903-6." By Drs. K. Honda, T. Terada, Y. Yoshida and D. Isitani. Preface by Prof. H. Nagaoka. Pp. viii+113; 95 plates, 2 frontispieces. Published as No. 26 of Publications of the Earthquake Investigation Committee in Foreign Languages, and as vol. xxiv. of the Journal of the College of Science, Imperial University of Tokyo. (Tokyo, 1908.)

vertical and a loop for horizontal motion, while the head is a loop for vertical and a node for horizontal

FIG. 1.—Model of Aomori Bay, showing stream lines of fundamental oscillation: period 4·453 in model, representing 303 m. in the bay itself.

motion. The period of this oscillation in the model was 4·45 seconds; the factor, corresponding to the scale adopted, being 4090, this represents a period of

FIG. 2.—Model of Aomori Bay, showing stream lines of lateral oscillation: period 1·63 in model, representing 108 m. in the bay itself.

303 m. in the actual bay, in which a periodic oscillation of 300 m. was observed. Besides this fundamental wave, the water within the bay could be set into lateral oscillation, as shown in Fig. 2, with a period of 1·60 s. in the model, representing 108 m. in the actual bay, where a well-marked regular undulation of 103 m. was observed.

The account of the experiments is followed by a mathematical treatment of the subject, and a calculation of the periods of the stationary waves for each of the bays investigated, a calculation which gave results in general, and sometimes in close, accordance with the observed periods. Finally, there is a suggestion that the great increase in the range of tides near the head of large bays may be partly due to this cause. The Bay of Fundy is celebrated for the great range of the tide near its head, where the difference between high and low water is from 50 to 70 feet, while near the mouth the range is not more than 7 to 10 feet; the difference is partly attributable to the banking of the tidal wave as it travels up a narrowing channel, but, the fundamental period of oscillation of the bay being about twelve hours, it is by no means improbable that this has a material effect in increasing the range of the semi-diurnal tide, with which it approximately agrees in period.

We have indicated sufficiently the scope of this important memoir, the unseismological interest of which has been recognised by its simultaneous appearance as one of the publications of the Earthquake Investigation Committee and as a volume of the Journal of the College of Science of Tokyo.

VESTIGES OF SCALES IN THE FOX.

IN the case of such a familiar animal as the fox it might well have been supposed that everything worth knowing in the matter of its bodily structure had already been recorded. That this is not so is demonstrated in an article by Mr. K. Toldt, of Vienna, published in the April number of the *Zoologischer Anzeiger*, where it is shown, on what appears to be practically conclusive evidence, that the fox is descended from ancestors the bodies of which appear to have been clothed with horny scales like those of the pangolins, or scaly ant-eaters. Although these scaly ant-eaters are the only living mammals the bodies of which are completely covered with overlapping scales, armadillos furnish us with an example of another type of armour in the same class; while there are several groups of mammals in which some portion of the body is scaly. In the rat, for example, the whole tail is scaled, and more or less distinctly scaled areas are met with in several porcupines and certain other rodents, as well as on the tail of the great South American ant-eater. In all cases where hairs grow from the body between the scales (as they almost invariably do), such hairs, in place of being scattered about in an irregular manner, have a certain definite arrangement. They grow, for instance, in isolated bundles, arranged in some cases in groups of three or four, and placed at regular intervals from one another.

From the fact that the hairs are arranged in this peculiar and definite fashion in a number of species which show no traces of scales, it has been suggested that such mammals trace their descent from scale-clad ancestors.

Careful examination of the skins of young foxes has enabled Mr. Toldt to announce, not only that the hairs are arranged in this peculiar fashion, namely, in groups of three bundles, each containing some fourteen or fifteen hairs, but likewise that the skin itself actually exhibits a structure such as would be presented by that of a pangolin after the scales had been pulled out. Viewed through a microscope, the skin presents,

in fact, the appearance of a roof covered with overlapping rounded tiles, with the triply-arranged bundles of hair growing between each "tile." Moreover, when seen in cross-section, the skin is observed to be thrown into a series of ridges or steps, each of which represents the free edge of one of the "tiles." To explain such a structure otherwise than as representing the bed of a scaly armour seems impossible, or at all events illogical, and we are accordingly compelled to accept the author's view that the fox is descended from scale-clad ancestors. No actual traces of scales have been observed in any of the skins yet examined, but Dr. Toldt suggests that such might be detected if a large series of skins of young fox-cubs were examined under proper conditions.

Although no mention of this point is made by the author of the paper referred to, the fox is just one of those animals which might naturally be expected to retain traces of its descent from reptilian ancestors. There is good reason to believe that the extinct mammal-like reptiles of South Africa were the immediate forerunners of the primitive carnivora or creodonts of the Tertiary period; while it is certain that from these latter are descended the modern carnivora, among which the fox, in common with the other members of the dog tribe, is one of the most primitive and least specialised representatives.

NOTES.

A STATUE to Bunsen, raised by public subscription, will be unveiled at Heidelberg on August 1.

WE regret to see the announcement of the death of Lord Blythswood, F.R.S., at seventy-one years of age.

SIR WILLIAM H. WHITE, K.C.B., F.R.S., has been elected chairman of the council of the Royal Society of Arts for the ensuing year.

PROF. GEORGE HALE, director of the Mount Wilson Observatory, California, has been elected a foreign correspondant in the astronomical section of the Paris Academy of Sciences in succession to the late Prof. Asaph Hall.

DR. BOUCHARD has been elected president of the Paris Academy of Sciences in succession to M. H. Becquerel, who was recently appointed permanent secretary of the academy. Prof. Émile Picard succeeds Dr. Bouchard as vice-president.

THE congress of meteorologists representative of the United Kingdom and of the British colonies and dependencies, which it was proposed to hold in Quebec in the last week of this month, has been postponed until next year.

THE well-known expert on turbines and hydraulic engineering, Prof. A. Stodola, of the Zürich Polytechnic College, has been awarded the Grashof gold medal of the Society of German Engineers.

THE council of the Society of Engineers and the council of the Civil and Mechanical Engineers' Society have approved a scheme of amalgamation which is expected to meet with the cordial support of the members of both bodies. This is a welcome innovation in the policy of technical societies, as of late years there has been a growing tendency to form new societies, and the consequent overlapping of work has rendered bibliographical research increasingly difficult.

A THOROUGHLY representative exhibition of mining machinery was opened at Olympia by Lord Strathcona on July 11. An interesting popular feature of the exhibition, which will remain open until July 31, is a series of realistic scenes giving an excellent idea of the practical working side of the Empire's mining industries. These scenes represent prospecting for diamonds in South Africa, gold mining in the Transvaal, alluvial gold mining in the Klondyke, hydraulic gold mining in New Zealand, tin mining, coal mining, granite quarrying, and Bath-stone mining.

IN the House of Commons on July 8, Mr. Dundas White asked the Prime Minister whether the Government would give facilities for the passing this session of the Daylight Saving Bill, now entitled the Local Time (Great Britain and Ireland) Bill; and, if so, whether the Government would propose amendments making clear that the adoption of the proposed modification of time was not compulsory, and substituting for the term local time some less ambiguous term. In reply, Mr. Asquith said:—"The Government have no intention of giving facilities for the passing of the Daylight Saving Bill."

IN the Chancery Division of the High Court, Mr. Justice Eve has just decided that china clay is a mineral within the meaning of the Railway Clauses Consolidation Act, 1845. The right to work china clay in some land purchased by the Great Western Railway Co. was claimed by the vendor to the company and owner of the adjoining land. Notice of this claim was given to the railway company, which brought the action for an injunction to restrain the owner from excavating the land near and under their line in Cornwall to get china clay, on the ground that the product obtained was not a mineral in the sense of the Act of 1845. Mr. Justice Eve, however, decided against this view, and gave judgment for the defendents. A full report of the judgment appears in Wednesday's *Times*.

WITH a view to obtain accurate information regarding the nature and extent of the damage done by rats in the United Kingdom, the committee of the Society for the Destruction of Vermin has prepared a schedule of questions for wide distribution. It is desired to obtain information from all persons who are in a position from their own experience to give particulars concerning temporary or permanent rat plagues, the damage done by rats, the steps taken to prevent such damage, and the results obtained. The secretary of the society, Mr. A. E. Moore, 95 Wigmore Street, London, W., will be glad to send a copy of the schedule of questions to any person who is able and willing to send information.

THE Paris correspondent of the *Times* announces that M. Henri Deutsch de la Meurthe has offered a new prize of 1000*l*. for the first aërial automobile apparatus, either lighter or heavier than air, which will transport Commandant Renard to England. If he is conveyed by an automobile balloon, the descent must be made at Aldershot Camp. If he goes on an aëroplane, however, it will only be necessary to reach the English coast. From the same source we learn that Commandant Renard, in some comments on the recent exploits of Mr. Henry Farman at Issy les Moulineaux and of M. Delagrange in Rome, referred to the fact that both aëronauts have remained more than fifteen minutes in the air, and remarked, "In less than two years the distance traversed by an aëroplane has passed from twenty-five mètres—the famous preliminary bound of M. Santos Dumont in October, 1906—to nearly twenty kilomètres, a proportion of 1 to 800." At that rate, within two years it will be possible to make journeys of twenty days without stopping. At all events, there is

nothing extraordinary, says Commandant Renard, in thinking that journeys of several hours, and even of an entire day, will soon become quite normal.

THE *Comptes rendus* of the Paris Academy of Sciences for June 29 contains the report of the committee appointed to consider the distribution of the Bonaparte fund for 1908. The committee has considered 107 applications for assistance from this research fund. Some of these, it is mentioned, do not comply with the conditions laid down by the founder, Prince Roland Bonaparte, and others are for work entirely outside the field of the Academy of Sciences. The committee excludes also demands for assistance in researches in medicine, surgery, and general biology, since the funds of the *Caisse des Recherches scientifiques* are exclusively reserved for biological studies. Ten grants are recommended as follows:—(1) 2000 francs to L. Blaringhem for a continuation of his important studies on the variation of species and the experimental methods for the creation of new species of plants; (2) 2000 francs to Dr. Billard to enable him to pursue his studies on the hydroïds; (3) 2000 francs to Dr. Estanave to furnish him with the means of continuing his researches on direct vision projection in relief, with special reference to radiography; (4) 2500 francs to MM. Fabry and Buisson for a continuation of their work on the establishment of a system of standard wave-lengths. The grant is to be applied to the purchase of a plane grating, a metal concave mirror of large diameter, and two plane mirrors required for a study of the differences between the lines of the solar spectrum and those of the electric arc; (5) 5000 francs to M. Gonnessiat for the purchase of astronomical instruments for the observatory of Algiers; (6) 2000 francs to Dr. Loisel for the continuation of his actinometric observations at the Observatory of Juvisy; (7) 2000 francs to M. Dongier for the establishment of apparatus for the simultaneous study of the rainfall and atmospheric potential; (8) 2500 francs to M. Perot for the spectroscopic study of the light from the sun by interferential methods; (9) 2000 francs to M. Matignon for the determination of specific heats at high temperatures; (10) 3000 francs to P. Colin for the publication of a map of South Imerina. These recommendations were adopted by the academy.

THE "Brisbane beds" of Queensland, at one time supposed to be of Jurassic age, form the subject of an article by Mr. S. B. J. Skertchly in the first number of a new serial, the *Queensland Naturalist*. Their plant-remains prove them to be of early Tertiary age—perhaps equivalent in time to the Laramie beds of the United States.

AMONG other American papers, we have to acknowledge the receipt of one by Mr. C. S. Townsend on the taxonomy of the more typical flies, with descriptions of new genera and species, forming part of vol. li. of Smithsonian Miscellaneous Contributions; also one by Alice Robinson, issued as No. 5 of vol. iv. of the Zoological Publications of California, on the incrusting chilostomatous bryozoans of the Pacific coast of North America.

IN an article communicated to the current volume of the Journal of the Asiatic Society of Bengal, Mr. R. B. Sanyal urges the importance of establishing an aquarium for scientific research in Bengal. The author quotes Lieut.-Colonel Alcock to the effect that the ideal situation for such an establishment would be the Orissa coast, in the immediate neighbourhood of the sanatorium at Puri. With some modification of the salt-excise, it is believed that a fishing and dredging station on this coast would yield a large revenue from dried fish, fish-oil, isinglass, &c., while from the scientific point of view such an establishment would almost certainly result in discoveries of profound interest and importance.

WE have to acknowledge the receipt of four parts (vol. xxiii., Nos. 5–8) of the Journal of the College of Science, Imperial University of Tokyo. No. 5 is devoted to the appendicularians (such as Kowalevskia, Fritillaria, and Oikopleura) met with in Japanese waters in the Noctiluca-plankton, the author, Mr. T. Aida, giving elaborate details of their anatomy. New cicadas from Europe and the Mediterranean region generally are described by Dr. S. Matsumura in No. 6, while in No. 7 Mr. S. Tanaka gives descriptions of fourteen Japanese fishes regarded as new. Finally, in No. 8, Mr. I. Ikeda gives full details of the structure of three remarkable forms of Japanese echiurid gephyrean worms of which preliminary descriptions have appeared elsewhere. The paper is illustrated by four plates, of which the first is coloured.

THE first article, comprising 360 pages, of vol. viii. of the Bulletin of the Illinois State Laboratory is devoted to the organisms and their seasonal distribution of the plankton of the Illinois River, based on the results of observations and collections made from 1894–9. The plankton of fresh waters, observes the author, Dr. C. A. Kofoid, differs from that of the sea in the almost universal absence of larval forms of life, in the smaller number of invertebrate groups represented, and in the smaller size of the species. Notwithstanding this lack of the larger forms, the Illinois plankton represents a larger quantitative amount of organic matter per cubic metre of water than is the case with marine plankton. The relative abundance of diatoms, of green and blue-green algas, and of chlorophyll-bearing flagellates, apparently affords abundant sustenance for the animal section of the plankton.

IT has long been a puzzle how the "oystercatcher" opens the shells of the mussels which form its main diet. The question has been set at rest by an article contributed by Mr. J. M. Dewar to the June number of the *Zoologist*. The great majority of the molluscs are opened from the dorsal border, when the valves are gaping, by the bird thrusting its beak into the aperture and then using it as a lever, at the same time severing the adductor muscles. If one of the valves be fractured in the process, the lever-action becomes unnecessary. About 9 per cent. of the mussels are opened on the ventral border, where the aperture for the byssus renders them as vulnerable when the valves are closed as when open. Mussels presenting this aspect are carefully searched for by the birds. Finally, about 13 per cent. of the mussels are attacked at the posterior extremity of the shell.

IN a special report issued by the Government of Egypt, Captain Stanley Flower has published an account of his round of visits to the menageries, aquariums, and museums of Europe in 1907 for the purpose of acquiring information which might prove advantageous to the establishment under his care at Giza. Much of the interest of the report is centred on the notices of local and private collections of which the general public knows but little. Among the latter, special reference may be made to the wonderful collection of living fresh-water fishes maintained by Captain J. A. M. Vipan in two special buildings in the garden at Stiblington Hall, near Peterborough. Among the rarities in this collection may be mentioned specimens of the bichir (Polypterus) from the Gambia, and Russian sterlets presented by H.I.M. the Czar of Russia. Mr. F. E. Blaauw's collection of mammals and birds at Gooliust,

near Hilversham, also comes in for commendation. The report concludes with a list of the antelopes seen by the author in the course of his tour and one of those now living in the Giza Gardens. Captain Flower, we notice, uses the name *Portax picta* for the nilgai and *Oreas canna* for the eland, thereby demonstrating that modern emendations in nomenclature are still by no means universally accepted.

WE have also received a copy of the report of the Giza Zoological Gardens for 1907, illustrated with a coloured plan. The year appears to have been an unusually successful one, the number of visitors and the amount of money taken at the gates being in excess of any previous season. Captain Flower directs special attention to the circumstance that both kudu and addax have bred in the menagerie.

A FLORA of the Austrian Duchy of Styria, "Flora von Steiermark," prepared by Dr. A. von Hayek, is announced by the publishing firm of Gebrüder Borntraeger. To the special section consisting of an enumeration of the plants will be added a general survey of plant distribution in the duchy and in neighbouring countries. The work is to appear in about eighteen monthly parts, each costing three marks. The first part contains the pteridophytes and a few pages of the gymnosperms. The features of the work are the analytical keys to the orders, genera and species, brief diagnoses and localities for each genus and species, and references to literature. Considerable interest attaches to the flora, as certain ranges of the eastern Alps lie within the province, and the vegetation in the lowlands shows affinities with the flora of Illyria.

A SHORT account—accompanied by excellent illustrations—of the anatomical features of the extranuptial nectaries of certain plants is contributed by Mr. K. Ono to the Journal of the Royal College of Science, Tokyo (vol. xxiii., article 3). On the ground of development, the writer distinguishes two types of nectaries, those derived from epidermal cells only, as in species of Polygonum, and those derived from both hypodermal and epidermal cells. It is stated that in some cases the secretion from the glandular cells is forced into a space between them and the cuticle, until finally the liquid escapes by rupture of the cuticle; in other cases it is believed that the secretion permeates the cuticle. Physiological experiments indicated that the secretion is mainly controlled by internal conditions, and that of external factors moisture is the most important.

THE idea has been mooted, and has met with some measure of acceptance, that as agricultural land after a repetition of crops of any given species becomes unsuited to the requirements of that species, so, after a proportionately long period, on land bearing pure forest, the seedlings of the crop may eventually fail owing to changes in the properties of the soil. In this connection, Mr. B. O. Coventry contributes an article on alternation of forest crops to the June number of the *Indian Forester*. He instances the observed failure of natural reproduction of the blue pine, *Pinus excelsa*, under its own cover with the incursion of deodar, also the gradual extension of mulberry into a Punjab plantation where originally "shisham," *Dalbergia sissoo*, was dominant. In the North-West Provinces, at a high level, it has been noted that *Quercus incana* is invading the domain of *Pinus longifolia*, and blue pine is advancing into the oak; at another level, *Quercus semicarpifolia* is losing ground to spruce and silver fir. The subject is one that deserves the attention of foresters.

THE attention of geologists may be profitably directed to two important papers on the submarine stratigraphy of the English Channel, published in the Journal of the Marine Biological Association of the United Kingdom, vol. viii., No. 2, in May of the present year. Mr. L. R. Crawshay (p. 99) discusses the conditions under which the stones and gravel on the Channel floor become exposed by a constant drift of the fine material towards the English coast. Mr. R. Hansford Worth contributes (pp. 118–188) a critical review of a large number of specimens dredged up by Mr. Crawshay on the S.S. *Oithona* in 1906, and also describes those collected by previous observers, including his own published work of 1899. The greatest interest centres in the discovery of true chalk, in addition to numerous flints, in the region south of the Eddystone. Flints occur, indeed, in practically all the dredgings. One block of foraminiferal limestone, with Miliolinas, clearly of Eocene age, was found in mid-channel off the Lizard, providing a valuable argument for those who view the Parisian *Calcaire grossier* as having been deposited in a sea spreading eastward from the Atlantic. Mr. Worth brings his conclusions together in the form of an interesting geological history of the depression which resulted in the English Channel.

IN *Meteorologische Zeitschrift* for May, Dr. J. Hann contributed an interesting paper on the problem of the vertical distribution of sea temperature in the eastern Mediterranean. He asks what conceivable physical process would allow the surface temperature to penetrate to a depth of about 500 metres, as has sometimes been assumed, in the period of half a year; the chief object of the paper is to raise a discussion on this question. Dr. Hann thinks that the lower limit of vertical circulation might be assumed to be about 100 metres, and that we should then have to distinguish between three different strata of temperature:—(1) the superficial, to a depth of about 100 metres; (2) from about 500 metres to the bottom, where the temperature is nearly uniform (14° C. to 13°·5 C.); and (3) the intervening space from, say, 100 to 500 metres.

WE have received vol. xlix., part ii., of the Annals of Harvard College Observatory, containing meteorological observations at eight auxiliary stations in Peru for the years 1892–5 from records of self-registering instruments. Although these records are not complete, especially at the mountain stations, where the difficulties of carrying on observations at such great altitudes are considerable, meteorologists are much indebted to the authorities of the college for this valuable contribution, which has been very carefully prepared for publication by Prof. Bailey under the direction of Prof. Pickering. In general, only the hourly means and extreme values for each month are given, but for the mountain stations individual readings are published. The observations at Arequipa for the same period were contained in part i. (to which we have already referred), and the eye observations, with descriptions of the stations and an account of the difficulties connected with them, were given in vol. xxxix., parts i. and ii.

STATISTICS issued by the Home Office show that the total production of coal in the United Kingdom last year was 267,830,962 tons, which is an increase of 16,763,334 tons over that of the previous year. The death-rate from accidents of underground and surface workers as a whole was 1·32 per 1000.

THE Marine Department of the Board of Trade has issued a circular (No. 1443) dealing with the manufacture and testing of steel. The instructions given are based on the reports of the Engineering Standards Committee, and deal with the testing of steel for use in boilers, plates,

angle, rivet and stay bars, steel forgings, and steel castings.

IN the *Engineering Magazine* (vol. xxxv., No. 3) Mr. H. T. Wade gives an illustrated description of an interesting exhibition, designed to show the best methods of safeguarding workmen and of protecting the general public, which was recently held in New York by the American Museum of Safety Devices and Industrial Hygiene. The exhibition was of great importance in showing that much of the loss of life in industrial operations in the United States is preventable, and that there are already developed methods and appliances that accomplish much in this direction.

THE Zoelly turbine is the youngest of the steam-turbines which have risen to any degree of commercial importance, and in view of the fact that it entered a field already occupied by powerful interests and well-established rivals, its progress has been remarkable. Designed by M. Heinrich Zoelly, of Zurich, it was first put on the market in 1904, and has since then been most energetically developed, particularly on the continent of Europe. It is of the compound impulse type, that is, the steam is expanded successively through small ranges of pressure, the velocity acquired during each expansion being utilised by a separate single wheel. Each wheel runs in a compartment by itself, the number of wheels required being determined by the range of expansion through which the turbine has to work, the pressure in each compartment being never less than 58 per cent. of that in the previous one. This limitation enables the full expansion at every stage to be obtained with simple convergent nozzles, which are easier to design and more efficient than the flared nozzles, which become necessary with greater expansion ratios. An exhaustive description of this turbine is given in *Engineering* of July 3, with dimensioned drawings and reproductions of photographs of the 210 horse-power Zoelly turbine direct-coupled to a centrifugal pump shown by Messrs. Mather and Platt at the Franco-British Exhibition.

MESSRS. NEGRETTI AND ZAMBRA have submitted to us for examination their new prismatic binocular, the "Minim," which they have recently issued. The distinguishing features of the new glass are its compactness, lightness, and small bulk. Its weight is only 10 oz., and it is as small as any other prismatic binocular of the same power, the height being only $3\frac{3}{8}$ inches. These points, however, have evidently been attained without any sacrifice of the essential rigidity of an instrument of such high power. The makers state in their specification that, in order to secure this compactness, lightness, and small bulk, in conjunction with so powerful a magnification as eight diameters, it is of course necessary that the lenses and prisms must be small, and that in consequence the light-transmitting power will, under certain conditions, be smaller than with glasses having large lenses. These conditions, however, are not likely to occur often enough to compensate for a conveniently portable instrument, and on an average day the "Minim" gives ample illumination. The size and shape are such that the binocular can be easily kept in the pocket, and for this purpose it can be supplied in a soft leather case instead of the usual stiff leather sling-case. It is constructed with a well-designed rack focus adjustment on the differential screw principle, giving very easy motion which can be operated by one finger, and which has the additional advantage of not wearing slack with continued use. One eye-lens is separately adjustable for the correction of anisometropia, and both tubes are on the usual swing pivot for adjustment of pupillary distance. The power of eight diameters magnification has been chosen after careful consideration as being the best for ordinary requirements, such as touring and every kind of sport; at the same time, it is not too high for marine work, and is about the limit for holding steady without any subsidiary support. We have also found it extremely useful for many objects in astronomy; for instance, the views of the half-moon on a clear night are magnificent. The general performance of the glass satisfies all of a series of tests on various objects which we have tried. The optical definition is very fine, a pleasing feature being the instantaneous change on either side of the best focus. The images are pleasingly achromatic. We would urge on users of all prismatic binoculars or high-power telescopes that to get critical definition it is necessary to re-focus whenever the distance of the object being viewed is changed, as these instruments have not the latitude in depth of field to which we are accustomed in the ordinary opera-glass of low power.

THE last number of the Proceedings of the Royal Society of Edinburgh (vol. xxviii., part iv.) includes a paper of forty-three pages on the problem of a spherical gaseous nebula, continuing and completing Lord Kelvin's work upon this subject. In his last paper, a contribution to NATURE of February 14, 1907, Lord Kelvin directed attention to what he called the curious "Perry theorem," which ought to be called the Ritter theorem, namely, that a spherical mass of gas of which the specific heat ratio is less than $1\frac{1}{3}$ must be unstable. What makes a paper of this kind particularly interesting is that Lord Kelvin never satisfied himself with a mere mathematical statement of such a theorem as this; he always sought out the physical meaning of it. It may be said that the paper gives a complete statement of the development of the past work of Lord Kelvin himself, also of Homer Lane, and of Ritter and Perry. It was left incomplete by the author, and it has been well edited by his secretary, Mr. George Green, who has given much time to the calculation of many useful tables of figures.

MESSRS. ASTON AND MANDER submit for examination a specimen of the "Compton" slide-rule, which they are selling at nine shillings. As is now universal, the divided surfaces are on white celluloid, and a glass cursor with one cross-line is provided. The radius of the A and D lines are 125 and 250 millimetres respectively, as is usual with rules about 10 inches long. The sine and tangent lines at the back of the slide are graduated from the same end, and in order to be able to read both sines and tangents, or to execute proportions in which one or other come in as factors, without shifting the slide, the slide when reversed is the right way end for end for both at the same time. Of course, as the tangents with this arrangement are read against the D line, they are on twice the scale, and may be read with twice the accuracy. The wood is mahogany, and two celluloid strips are used to face the thin portion of the rule. The two edges are divided, and the inside has the linear divisions continued after the manner of a hat measure. The divisions are fine and accurate, and the working easy and smooth.

THE three articles on the work done at the Physikalisch-Technische Reichsanstalt at Charlottenberg during the year 1907, which appeared in the April, May, and June numbers of the *Zeitschrift für Instrumentenkunde*, have now been issued separately, and form very interesting reading. Sufficient information is given to allow the reader to understand the work done and the methods used, and in many cases in which apparatus of a novel kind has been used a figure of it is given. It is scarcely necessary to say

that the work is of the highest order, and affords ample evidence of the close association of the institution with the manufacturers of Germany. The idea of publishing in the technical Press an account of work done is a good one, and might well be followed by similar institutions with which manufacturers have not yet learnt to cooperate as much as they might.

THE *Physikalische Zeitschrift* for July 1 contains an account of some observations made by Dr. S. Landau, of Göttingen, on the magnetic rotation of the plane of polarisation in rock salt, Iceland spar, water, and alcohol, with the view of testing the theories which have been advanced in explanation of the phenomenon. His method is a photographic one, the light from an iron arc passing through a polarising prism, the magnetic field, a half-shadow prism, and a spectrograph in succession, the slit of the latter instrument being at right angles to the dividing line of the half-shadow field. Several photographs are taken on the same plate, the polarising prism being rotated through a small angle between each, and from inspection of these the position of the prism for equal intensity of the two halves of a line in any part of the spectrum is found. The author concludes that the electron theory is capable of reproducing all his observations, but that some of the constants which, if only negative electrons are assumed to play a part in the phenomenon, should come out positive, have negative values, and suggest, therefore, that the positive electrons play a part. Against this, however, many objections may be raised.

IN the note upon the seventh International Congress of Applied Chemistry in last week's NATURE (p. 229), it should have been stated that Sir William Ramsay, K.C.B., F.R.S., will be the acting president of the congress, and Sir Henry Roscoe the honorary president. We are informed that Prof. Nasini will not give one of the lectures to the congress, but a lecture will be given by Prof. Paterno, of Rome.

IN the issue of NATURE for June 2, 1904 (vol. lxx., p. 107), an optical illusion observed by Dr. T. Terada, of the College of Science, Tokyo, was described. Dr. Terada directs attention to another illusion he has remarked. After watching drops falling at the rate of about one a second into the centre of a small pool, and so causing circular ripples, he turned his eyes to a spot on a neighbouring bush. The bush appeared to contract slowly towards the point looked at, but the contracting motion was slower than the diverging motion of the ripples. A similar effect was noticed by looking at the ground or at a wall.

OUR ASTRONOMICAL COLUMN.

SATURN'S RINGS.—The June number of the *Astrophysical Journal* (vol. xxvii., No. 5, p. 363) contains a note by Prof. Wright in which he discusses the bright beads, or knots, which were observed during the recent opposition when the unilluminated surfaces of the rings were turned earthwards. Criticising Prof. Barnard's recent explanation, in which the author supposed the brightness of the beads to be due to light percolating by many reflections through the masses of meteorites composing the rings, he points out that whilst this is probably true for the crape ring, it seems impossible that sufficient light to produce the outer bright knots could pass between the more densely packed meteorites of the outer rings. Then turning to Bond's explanation of the phenomena, Prof. Wright shows that it accounts for the bright outer knots and for the very slight asymmetry which is suggested by comparing the measures of different observers. He further suggests that it is not unlikely that collisions among the meteorites may account for some, at least, of the observed luminosity over the surfaces of the two dense rings and in the knots.

NEW PHOTOGRAPHIC CELESTIAL CHARTS.—On a supplementary sheet to No. 4257 of the *Astronomische Nachrichten*, Prof. Johann Palisa invites subscriptions to a series of photographic star charts prepared by Prof. Max Wolf at Heidelberg. Having received copies of his maps privately from Prof. Wolf, Prof. Palisa found that his work of finding minor planets was reduced by 75 per cent., so he suggested that the sheets should be published, as they will undoubtedly prove very useful in other branches of astronomy. The sheets will be printed on smooth matte bromide paper with a degree *reseau*, and each sheet will include some fifty square degrees, the scale being such that 1°=36 mm. This enterprise is purely a private one, of which the cost must be borne by the subscribers, so that Prof. Palisa invites all who wish to subscribe to apply to him as soon as possible, and before December 31 at the latest; the price of the series containing twenty sheets is thirty shillings, and after the date named must be forty shillings. The maps reproduce stars down to about the fourteenth magnitude.

DOUBLE STARS.—An example of the good work that may be done by an amateur astronomer with but a moderate-sized instrument appears in No. 4259 of the *Astronomische Nachrichten*, where a list of double stars discovered and observed by Mr. E. D. Roe, jun., of Syracuse, N.Y. (U.S.A.), with a 6½-inch Clark refractor, is published. His observatory was erected in July, 1906, and by the end of 1907 he had independently discovered some 250 double stars (generally separated by less than 10″), of which he has since identified a number with doubles given by Prof. Burnham. The present list contains the measures of the stars thus identified.

In the same journal Herr J. Fr. Schroeter publishes a list of corrections to Prof. Burnham's "General Catalogue" for double stars included in the Christiania zone.

No. 4260 of the *Astronomische Nachrichten* (p. 185, July 3) contains a discussion by Herr E. Schoenberg, of Dorpat, of the orbits of several double stars, including β 581, β 883, 8 Sextantis=AC.5, and β 612.

THE ALBEDOES OF JUPITER'S FIRST AND THIRD SATELLITES.—In the July number of the *Bulletin de la Société astronomique de France*, M. Quénisset records some observations made in January and March showing the relatively low albedoes of the surfaces of Jupiter's first and third satellites. The disc of Ganymede when seen outside the planet was quite brilliant, but when projected on to the surface of the planet, during a transit, it became less and less bright until when near the central meridian it was very dark, in fact nearly as dark as its own shadow. This was observed on January 22 and March 12, and the same phenomenon, somewhat less marked, was observed in the case of the first satellite on March 27. As the satellites were projected on the bright equatorial band of the planet, it follows that the albedo of this region must be greatly superior to the albedoes of the two satellites.

A BRIGHT METEOR.—No. 4258 of the *Astronomische Nachrichten* contains a record of a bright meteor observed by Dr. J. Kaván at the Prag-Smichow Astronomical Institute on November 16, 1907. During its flight the meteor was seen to explode into two parts, but no trail, or detonation, was observed. The brightness of the object was about equal to that of Venus, and its flight, as observed by Dr. Kaván, was from $\alpha=196°{\cdot}2$, $\delta=+57°{\cdot}7$, to $\alpha=162°{\cdot}9$, $\delta=+46°{\cdot}7$; simultaneous observations by Herr L. Štetka gave approximately the same positions for the appearance and disappearance.

LATITUDE VARIATION.—When the international latitude service was instituted in 1899 the Cincinnati Observatory was asked to cooperate, and has made continuous observations since. As changes in the star-list were made in 1906 it seemed to Dr. Porter to afford a good opportunity to discuss the observations made to that date; this he does, in No. 16 of the Publications of the Cincinnati Observatory, giving an historical account of the observations, a description of the instruments and methods used, and a table of the observed latitudes day by day. From the yearly values given it is seen that the different years show considerable fluctuations, signifying that the annual digressions are not symmetrical with reference to the determined mean position.

ARCHÆOLOGICAL EXPLORATION IN GUATEMALA.

THE first part of the fourth volume of the Memoirs of the Peabody Museum, Harvard University, is devoted to an account of exploration by Mr. Teobert Maler in the valley of the Upper Usumatsintla, or the Usumacinta, as it appears in some modern maps, a river rising in Guatemala, falling into the Gulf of Mexico, and forming for part of its course the boundary between the Peten province of Guatemala and the Chiampas of Mexico. The exploration has thrown much new light on the geography of a region which has up to the present been very imperfectly explored. It is a wild country largely covered with tropical jungle, the main industry, that of lumber, attracting a particularly disreputable class of workmen, while agriculture is confined to a few scattered maize plantations. The author gives a very gloomy account of the population. "The dubious elements," he says, "sunk in sloth, filth, and every possible vice, whose miserable habitations are met with here and there, are constantly shifting since they acquire no fixed property rights." Whoever commits murder across the Mexican border takes refuge in Guatemala, and *vice versâ*. Attempts are, of course, made to secure the extradition of offenders, but these are generally unsuccessful. In fact, the negro is gradually taking the place of the Spanish-Indian population, which, having become enervated and degraded, is rapidly dying out.

FIG. 1.—Photographs at entrance of Tularosa Box Canyon below Delgars.

The difficulty of exploration is naturally increased in such a country by the failure of the so-called Government to enforce law and order. Further, in Spanish times many of the old native names were replaced by those of Christian saints. The few that have survived to our days have been supplanted by political catch-words, Progresso, Libertad, and the like. More serious is the damage to these ancient buildings, which the State seems unable to prevent. Mr. Maler tells a curious story which appears to show that certain valuable stelæ were destroyed during an attempt by a Government official to prepare moulds of the sculptures for the Chicago Exhibition. It is quite time that the American Government intervened to preserve these wonderful structures.

Taking all these obstacles to archæological inquiry into account, it is only natural that Mr. Maler's survey was little more than a reconnaissance. He had no opportunities for excavation, but was able to procure photographs and moulds of the most important remains. The four great groups of ruins were visited—those at the so-called Altar de Sacrificios and the more important sites, Itsimté-Sacluc, Seibal, Cankuen—the order of their occurrence along the course of the river. Of these, the Seibal site seems to be the most promising, though nothing so interesting as the great sacrificial altar, a mass of reddish sandstone 160 cm. in diameter, was discovered here. In the other sites the most remarkable remains are the groups of stelæ or pillars which have survived, while the buildings to which they formed an adjunct are in such a state of decay that without excavation little of their character can be ascertained. The stelæ bear usually the representation of a figure, probably hero, priest, deity, or all combined, with various emblems and accessories, following generally the type characteristic of Central American art. In some cases the figure is seated in European fashion on a sort of throne. In one stela at Seibal he holds in his outstretched right hand a large sawfish lance, and in his left a pouch decorated with elaborate arabesques and loops. In another two personages sit in Turkish style before an altar, at which they are performing some sacred rite. More remarkable is the "tiger-paw man," whose hands and feet are covered with tigers' paws fastened by

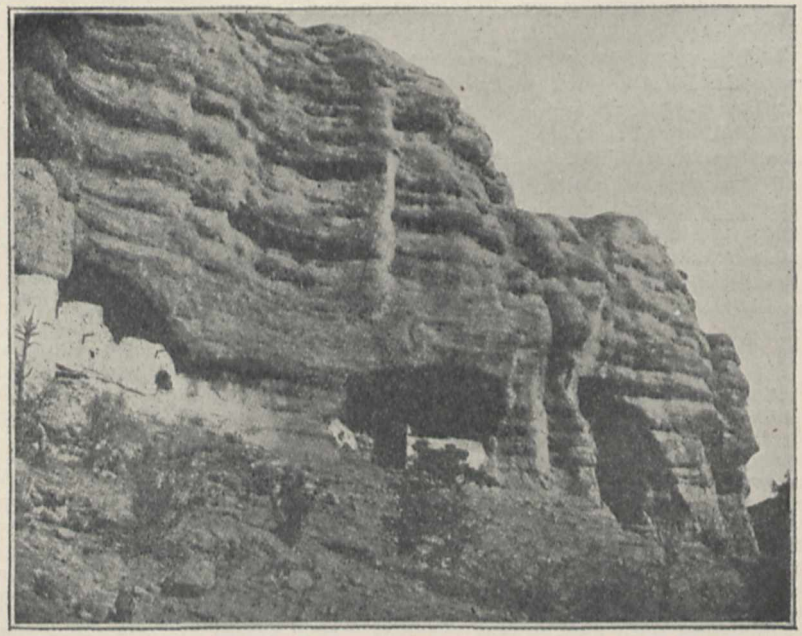

FIG. 2.—Cliff-dwellings, west fork of the Gila.

bandages to wrists and ankles. In another sculpture the hideous face of the figure seems to be masked by the flayed skin of a human victim. Indeed, as might have been expected, human sacrifice seems to have played a leading part in the cruel religious rites of this people.

Mr. Maler does not venture an explanation of the symbolism, nor does he speculate on the origin and significance of these sculptures, which cannot be interpreted until the buildings to which they were attached have been fully examined. Meanwhile, he has done good service in collecting drawings, moulds, and photographs of a remarkable series of monuments, which under the present government of the country are in imminent danger of destruction before they can be subjected to careful scientific examination.

THE NEW BUILDINGS OF THE UNIVERSITY OF LEEDS.

THE opening of the new buildings of the University of Leeds by the King, who was accompanied by the Queen, was briefly recorded in NATURE of July 9. A visit on the part of the Sovereign to a modern university, though not a unique occurrence, is sufficiently rare to be regarded, at least by the favoured institution, as an historical event. It is a Royal tribute to learning, cultivated not, as heretofore, in the silent precincts of sombre, mediæval halls, but strenuously pursued within earshot of busy factories and the hum of city life. It is, moreover, a public recognition and encouragement of the aims of a community which has provided from its own resources a centre of active scientific and academic life.

Historical.—Although the Leeds School of Medicine, which dates so far back as 1831, represents the oldest branch of the University, it is the Yorkshire College of Science, founded in 1874, which forms its real nucleus, the School of Medicine being incorporated in 1884. The College was then a modest block of buildings near the centre of the town, and began its first year with three professors and one student.

The first important development of the College of Science occurred in 1877, when it took over from the University Extension Committee the teaching of arts subjects, and became the Yorkshire College. In the same year the foundation-stone of the present buildings was laid by the late Dr. Thomson, Archbishop of York.

The Clothworkers' Company, the generosity of which to the technical departments of the college is as conspicuous as it is consistent, undertook the first section of the college buildings by erecting the textile industries and dyeing departments at a cost of 70,000*l.*

In 1887 the Yorkshire College entered the Victoria University as its third constituent college, and thus obtained the privilege of preparing its students for its own degrees.

To pass briefly in review the more recent developments, we must record the building of the Baines wing as a memorial to Sir Edward Baines, which was opened by the Prince and Princess of Wales (their present Majesties) in July, 1885; the building of the leather industries department in 1889 at a cost of 5668*l.*, mainly defrayed by the Skinners' Company; the founding of the agricultural department in 1890; and the building of the library, college hall, and medical school in 1894.

In 1903, when the union of the three constituent colleges of the Victoria University was dissolved and the Yorkshire College became the University of Leeds, the Privy Council, in recommending the grant of a university charter, stipulated that the capital of the institution should be increased.

The council has now succeeded in raising a little more than 100,000*l.*, more than half of which has already been expended in extensions, constituting the new buildings which His Majesty the King, as visitor of the University, opened on July 7.

The new buildings, the design and erection of which have been entrusted to Mr. Paul Waterhouse, comprise the main block extension in College Road for the arts and education departments, the temporary building for physics and chemistry, the mining, fuel, and metallurgical block, the laboratories for electrical engineering, the extension of the mechanical engineering building, certain additions to the textile department, and a central boiler house. The first of them in date of completion is the laboratory for mining, fuel, and metallurgy. The building was erected and equipped mainly from a fund of about 8000*l.* contributed by the Yorkshire Coal Owners. It stands by itself near the main university buildings, and is a simple three-storied red-brick structure. It is divided into two departments, that of mining, which is mainly on the ground floor, being under the supervision of Prof. Thompson, whilst the fuel and metallurgy department, under Prof. Bone, is housed mainly on the first floor.

The Mining Department.—This includes a lecture-room capable of seating fifty students, which it shares jointly with the department of fuel and metallurgy; a drawing office, which is equipped with surveying instruments; a general mining laboratory for the study of ore dressing and coal washing, which contains laboratory crushing and sampling machines, small jigs, slime tables, vanning shovel, and gold-washing pans, with the necessary assaying equipment for testing the products. Adjoining is an annexe for larger sized coal-washing and ore-dressing machinery, and includes a stone breaker, Cornish rolls, a stamp battery, jigging screens, &c. There are also fans and galleries for demonstrating the principles of ventilation of coal mines, and a photometric and lamp room for the study of safety-lamps and of different methods of gas-testing as ordinarily employed in collieries.

The Gas Engineering, Fuel, and Metallurgy Department.—This includes a large furnace-room, a general laboratory more especially for gas and fuel investigations, a balance and galvanometer room, stores, private laboratory, and a museum with a lecture-room on the top floor. The department represents a somewhat new departure in technical training, for in addition to the usual work connected with the study of metallurgy, it is laid out for the experimental study of different kinds of fuel and for preparing students for the working of gas plant for lighting and heating. In this connection it may be mentioned that the department is receiving financial assistance from the Institute of Gas Engineers in the form of an endowment of 500*l.* a year, which is being raised by the efforts of Sir George Livesey, and a fellowship of 100*l.* a year for research in connection with the gas industry. The furnace-room is equipped for the practical study of the characteristics of metals and alloys. The whole length of the room along one side is furnished with furnaces standing on stone slabs, including a full range of gas crucible furnaces, oil cyclone furnaces, a gas reverberatory furnace, muffle, sagger, and retort furnaces, with blast driven by a Crowell blower. Half the floor space is occupied by machines for testing the mechanical properties of metals and alloys, a rolling mill for reducing ½-inch rods to ¼-inch section, tensile-testing machine, a torsion-testing machine, and a set of electrically driven machines for cutting, grinding, and polishing sections, and preparing them for microscopic examination and photography. Adjoining the furnace-room is a laboratory with a special installation of apparatus for research on gaseous explosions under pressure, a compressing plant for obtaining compressed gases up to 200 atmospheres, and bench for analysis of coal, steel, &c.

The furnace and adjoining balance-room contain a complete installation of recording electrical and optical pyrometers, and the laboratory is also equipped with gas and bomb calorimeters for calorimetric determinations and apparatus for gas analysis. The equipment of these laboratories has been carried out at a cost of about 1000*l.*

The Electrical Engineering Department.—This department has been removed from its very cramped quarters in the main block, and now occupies a new and spacious building specially arranged, and standing by itself on the north side of the north quadrangle. It comprises a lecture theatre, drawing office, and photometer room equipped with the latest standards and apparatus for the measurement of the candle-power of electric glow and arc lamps, gas burners, &c.; a transformer room supplied with low- and high-pressure static transformers, rotary and electrolytic rectifiers, and apparatus for investigating efficiency of such plant; an instrument room, equipped with pressure, current and power standards, and a variety of testing

apparatus; an electromotor room, with eight types of motors for continuous current and for single, two- and three-phase alternating currents, including a 500-volt 25-B.H.P. tramway motor; a dynamo room with eight pairs of motor-driven generators and rotaries, each having its own switch-panel, and developing from 4 h.p. to 30 h.p. at almost any pressure and periodicity. These sixteen machines are nearly all of the latest types, and comprise series, shunt and compound wound generators, single-phase, two-phase, and three-phase alternators, a double commutator, continuous current rotary, and a polyphase rotary converter; and, finally, an electrical engineering laboratory with all the necessary apparatus for instruction in the principles and practice of the subject.

Physics Department.—Prior to 1884, when the present lecture-room and laboratory were erected, the number of students taking practical work was extremely small, and the accommodation provided was regarded at that time as ample. From 1884 to 1898 the number of laboratory students increased eight-fold, and accommodation for them could only be found by annexing and utilising various cellars and underground corridors. In 1898 the Department had about 100 students, and comprised 220 square yards on two different floors, serving for all but electrical work, and 300 square yards of cellars, in which electrical experiments had to be carried on. Subsequently, a dark room of 150 square yards in the form of a corrugated iron building was added for advanced optical work, and another cellar of 200 square yards for elementary physics. The new premises, which consist of a one-storey shed covering the former tennis courts, will add about 1600 square yards, and will be divided into sections for elementary and advanced work. It is anticipated that the space will not only accommodate the present number of students, but will allow of an increase up to 50 per cent. It is impossible, however, that the present structure should have a very long life. Glass-roofed sheds and thin brick walls do not furnish ideal conditions for a physical laboratory, and it is anticipated that as soon as funds allow, a building having some relation to the importance of the subject and the large number of students in attendance will be erected.

Organic Chemistry Department.—The history of this department begins with the foundation of a lectureship and its recognition as a separate department in 1891. There was then no special provision for the study of practical organic chemistry. The department was first housed in a private laboratory and furnace-room on the ground floor; but as the number of students increased, additional accommodation had to be found, and a portion of the large lecture theatre was partitioned off, providing bench room for twenty-two students. The new temporary one-storey building, which adjoins the new physical laboratory, will double the present bench space, as well as provide a private laboratory for the professor and a temporary laboratory for occasional classes. As in the case of the Physics Department, it is only lack of funds which prevents suitable provision being made for this branch of practical chemistry.

Civil and Mechanical Engineering Department.—This department was founded in 1876, and for eight years was carried on under some difficulties as to space and equipment. In 1884 a special fund was raised by the engineers of the district for the building of a new department, with laboratories, drawing-office, lecture-rooms, &c. The accommodation proved sufficient for some years, but as the number of students increased, it was found necessary to absorb into the department other small rooms of the college, and in 1891 the authorities found themselves compelled to limit the number of students to eighty. The new block is an extension of the 1884 buildings on the north side, and contains a laboratory specially fitted up for hydraulics and one for applied mechanics, as well as an extension of the drawing-office.

This brief history of the university and the account of its new buildings is a record of small beginnings and steady growth. Each department has passed through a similar series of phases, a more or less rapid rise in numbers causing increasing pressure from within, which has led to expansion by various temporary expedients until the department has had to detach itself from the parent building and set up house for itself. There may be now an interval of apparent repose; but there is little doubt that the process will repeat itself. Temporary buildings will have to give place to permanent structures, properly adapted for the purpose which they have to serve, and physics and chemistry, the largest of the departments, will soon have to receive their share of attention. It will only be by constant appeals to the generosity of the public that the university will be able to fulfil the requirements which high teaching efficiency and modern equipment demand, if it is adequately to serve the interests of the city and county in which it is placed.

We have only referred to the work and appliances for ordinary teaching. The pursuit of research is eagerly encouraged, but here again the small sum at the disposal of the council for post-graduate fellowships and maintenance grants greatly reduces that form of assistance which heads of departments naturally look to in carrying out original investigations.

This form of assistance the Treasury has, unfortunately, not yet recommended in allocating funds for research, but its recognition cannot be urged too strongly or too frequently. J. B. C.

A CAPE CATALOGUE OF STARS.[1]

THE most recent catalogue of stars emanating from the Cape Observatory contains the places of 1680 stars for the equinox 1900·0, deduced from observations made during the years 1905–6 under the direction of Sir D. Gill. The introduction, which is signed by Mr. S. S. Hough, explains that the stars observed with the old non-reversible transit circle in the above-mentioned years, the places of which are included in this catalogue, are chiefly stars south of declination −36° required by Prof. Boss in connection with the formation of his fundamental catalogue. The catalogue also includes stars the places of which are required in connection with the geodetic survey of South Africa, and stars of which occultations by the moon have been observed.

With regard to the right ascensions, it may be noted that the places of stars employed for the determination of clock-error were those of Newcomb's Fundamental Catalogue. It is also to be noted that the correction has been applied for the observers' personality depending on magnitude. The existence of this kind of personality was first detected by Sir D. Gill in his discussion of the places of the comparison stars used in connection with his determination of the solar parallax by observations of Mars in 1877. It is fit and proper, therefore, that the Cape Observatory should be a pioneer in this direction of refinement, and should include this correction, as a matter of routine, in the ordinary reductions of meridian transits of stars.

The declinations have been reduced with refractions based on the Pulkowa tables and adopted mean latitude of the transit circle, −33° 56′ 3″·50. The observations have also been corrected for variation of latitude depending on the Chandler polar motion, in accordance with data supplied by Dr. Albrecht. Here again we note the anxious care of the authorities of the Cape Observatory to produce work of the highest excellence and refinement.

The catalogued places of the stars have been reduced by the application of precession alone (based on Newcomb's determination of the precessional constant) from the mean epoch of observation to 1900·0, but the necessary corrections for the inclusion of proper motions are given in a separate column. The adopted values of the latter elements have been taken from Newcomb, Boss, or Auwers.

In view of the uncertainty attaching to the proper motions of stars south of the zenith of the Cape, it is of interest to exhibit the corrections to the places of Prof. Boss's catalogue of 627 standard stars (*Astronomical Journal*, Nos. 531–2), derived from the comparison with the

1 "Catalogue of 1680 Stars for the Equinox 1900·0 from Observations made at the Royal Observatory, Cape of Good Hope, during the Years 1905–6." Under the direction of Sir David Gill, K.C.B., F.R.S., with Introduction by S. S. Hough, F.R.S. Pp. xii+44. (Edinburgh: Printed for H.M. Stationery Office by Neill and Co., Ltd., Bellevue, 1907.) Price 3s.

places of the Cape catalogue before us, for the stars specified above, when arranged in zones of declination :—

South decl.	$\Delta\alpha$	$\Delta\delta$	No. of stars
° °	s.	"	
34–46 ...	−0·004 ...	+0·33 ...	39
46–56 ...	−0·008 ..	+0·42 ...	34
56–66 ...	+0·009 ...	+0·45 ...	30
66–80 ...	−0·049 ...	+0·44 ...	16

The discordances in right ascension for the first three zones are not larger than would be anticipated, bearing in mind the fact that Prof. Boss has not corrected his places for personality depending on magnitude. The mean correction for the polar zone is, however, quite uncertain, the mean (without regard to sign) of the individual discordances from the mean value entered above being as much as 0·102s., pointing to the extreme uncertainty with which right ascensions of even so-called "standard" stars situated in this portion of the sky are carried forward for a term of years.

There appears to be a well-marked systematic discordance of about 0″·4 in the declinations. This, however, is not the place in which to inquire into the origin of this discordance, which will doubtless receive due attention at the hands of Prof. Boss.

A melancholy interest attaches to the publication under review. Sir D. Gill, in a short preface, addresses a few words of farewell to the members of the staff of the Cape Observatory, referring to this catalogue as the last that will probably appear in connection with his name. The splendid work performed by Sir D. Gill at the Cape Observatory need not be emphasised here. It must be a satisfaction to him, as well as to astronomers all the world over, that he was able to accomplish another excellent piece of work before the close of his official career, during which he has done so much to enhance the fair fame of British astronomy.

A. M. W. D.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

BIRMINGHAM.—Dr. John Cadman, one of H.M. inspectors of mines, has been appointed to the chair of mining rendered vacant by the resignation of Prof. R. A. S. Redmayne.

GLASGOW.—The University Court has established a lectureship in bacteriology, and appointed Dr. C. H. Browning as the first lecturer. The Court has also established a lectureship in geography, to which an appointment will be made in October.

THE annual meeting of the Midland Agricultural and Dairy College will be held on Monday, July 27, at 3.15 p.m., when the report on the year's work will be presented. The Duke of Portland will address the meeting and present the certificates gained during last session.

To secure the best results, it is highly important that technical colleges should work in close connection with the needs of local industries. A distinguishing characteristic of the prospectus of the day classes at the Heriot-Watt College, Edinburgh, is the excellent system of co-ordinating the more theoretical work of the college with the practical experience gained during apprenticeship. Arrangements have been made with several of the leading firms of engineers in Edinburgh by which students of the college are allowed to begin their apprenticeship at the end of the second winter college session, returning to college the following winter to complete their third winter session. Students holding the college diploma have their term of apprenticeship reduced by a year, and in some cases either reduced premiums are charged to college students or the premiums are entirely dispensed with. The Edinburgh and Leith Corporations' gas commissioners, also, have agreed to allow students who have been three years in the chemistry department of the college to spend four summer months in the laboratories of their gas works, and thus to obtain a thorough knowledge of the analysis of fuels, products of combustion, coal gas, and coal distillation products. A two years' course of instruction in mining, again, has been arranged, which is accepted by the Home Office as equivalent to the two years' underground training required of those who wish to obtain the mine manager's certificate. In connection with the department of technical mycology, an arrangement has been made between the college and the Brewers' Association of Scotland by which brewers' apprentices who have completed satisfactorily an approved course will receive a joint certificate awarded by the association and the college. Students who already hold a university science degree can obtain special post-graduate instruction in several departments of technology. These instances are typical of the successful efforts which are being made in Edinburgh to make technical instruction of real benefit to those employed in industrial pursuits.

ON the occasion of the visit of the King and Queen on July 9 to open the Royal Edward Dock at Avonmouth, an address was presented to their Majesties by the council and senate of the Bristol University College. After detailing the efforts which have been made to provide Bristol with a complete system of education, the address proceeds :—"We humbly trust that your Majesty will regard with satisfaction the provision that has thus been made in our city for education in its various grades, and will look with favour on our hope that our educational system will be completed and crowned by the establishment of a University in Bristol similar to those founded in recent years in other important cities of the realm. The public spirit and generosity lately shown by a member of a well-known Bristol family in promising the sum of one hundred thousand pounds towards the endowment of a Bristol University leads us to anticipate that with the help of other liberal benefactors our city may shortly be in a position to crave of your Majesty the grant of a Royal Charter for the incorporation of this University." During the course of his reply, the King said :—"It is now recognised by the great municipalities and other education authorities of my kingdom that it is their duty to provide facilities for the acquirement of special knowledge, so that young men may be enabled to obtain efficient equipment, both literary and technical, without travelling to distant Universities to obtain it. The generous emulation of rival cities in this respect is necessarily beneficial, for every addition to the practical efficiency and culture of a community, and every stimulus thereby supplied to others, are gains to the whole nation. I will take care that your petition for a grant of a charter for the incorporation of a University in Bristol is referred to a committee of my Privy Council, who will give it careful and sympathetic consideration, and then submit to me their advice." The Society of Merchant Venturers also presented an address in which reference was made to the willingness of the society to maintain a faculty of engineering in the University.

THE Department of Agriculture and Technical Instruction for Ireland has for some years been very active in encouraging the teaching of science both in Irish secondary schools and technical institutes. Technical instruction also, through the efforts of the department, is being given successfully in numerous centres throughout Ireland. Illustrated accounts of the technical work in different districts are published in the Journal of the department from time to time, and afterwards re-published for wide distribution; the latest pamphlet to be issued in this way is a well illustrated description of the facilities for technical instruction in Queenstown, by Mr. George Thompson, the principal of the technical school in that town. The department also does very useful work in providing science teachers in Irish secondary schools with careful guidance as to the best methods of teaching and the most suitable courses of work in science for boys and girls in secondary schools. We have received copies of the revised syllabuses in physics and in physiology and hygiene. The syllabuses, in addition to a general introduction describing the aim and object of the instruction, outline experimental courses of study for each of the four years during which science is taught in the secondary school. During the first two years of their study of science the pupils investigate practically the simple fundamental principles of physics and chemistry, while during the third and fourth years some specialisation is allowed, and the study becomes more intensive. The syllabuses are well worth the careful atten-

tion of all teachers of science in secondary schools, whether they are teaching in Ireland or elsewhere. We notice, too, that the department will, in August, 1908, award not more than six industrial scholarships—of the value of 80*l.* each, and renewable for a second and third year—to persons engaged in industries, such as the woollen, linen, leather, and tanning industries. The object of these scholarships is to enable selected persons, who must already have been engaged in one of the higher branches of the industry, to take a full course of instruction in an institution providing special courses of an approved character, with the view of training them for the management of such an industry. Candidates will be required to show that there is a reasonable expectation of their being able to find suitable employment in the industry in Ireland after the termination of their scholarships.

THE installation of Lord Morley of Blackburn as Chancellor of the University of Manchester took place on July 10. Replying to an address presented to him by the Vice-Chancellor, Mr. A. Hopkinson, Lord Morley dealt with the functions of universities. He urged those present not to allow technical teaching, valuable as that science was, to throw into a second place the true object and scope of a University. It is a remarkable and encouraging fact, he said, that there has been no disposition during the last twenty or twenty-five years among the many benefactors of these institutions to limit their benefactions. On the contrary, some of the most remarkable of these benefactions have been for music, for philosophy, for theology, and for literature. This would seem to justify the hope that merely and purely technical teaching will not drive out teaching of the University type. After the installation Lord Morley and Mr. Arthur Balfour were entertained at luncheon. Mr. Balfour, in replying to a toast, said:—"In order to pursue knowledge to the best advantage, knowledge must be pursued for her own sake; and she is more likely to be successfully pursued for her own sake in a great academical house than by any other method or machinery which the wit of man has as yet devised. As knowledge is to be pursued for its own sake, mankind has found its greatest instrument for the better prosecution of knowledge in science. The great advancement of mankind is to be looked for in our ever-increasing knowledge of the secrets of nature—secrets, however, which are not to be unlocked by the men who pursue them for purely material ends, but secrets which are open in their fulness only to men who pursue them in a disinterested spirit. The motive power which is really going to change the external surface of civilisation, which is going to add to the well-being of mankind, which is going to stimulate the imagination of all those who are interested in the universe in which our lot is cast, that lies after all with science. I would rather be known," Mr. Balfour continued, "as having added to the sum of our knowledge of the truth of nature than anything else I can imagine. Unfortunately for me, my opportunities have lain in different directions; but the happiest of men surely are those whom fortune has given time, leisure, the opportunity, and, above all, the genius which enables them to penetrate into the secrets of nature in such a way that, perhaps unknown to themselves, unknown even to the generation in which they are born, something will have been given to mankind which posterity can develop into some great practical discovery on which the felicity of mankind may depend."

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 12.—"On Reciprocal Innervation in Vaso-motor Reflexes and the Action of Strychnine and of Chloroform thereon." By Dr. W. M. **Bayliss**, F.R.S.

(1) In depressor reflexes there is, along with inhibition of tone in the vaso-constrictor centres, an excitation of vaso-dilator centres. This has been shown in the cases of the submaxillary gland, the penis, the hind-limb, the external ear, and probably the tongue.

(2) Correspondingly, in pressor reflexes, along with excitation of constrictors, there is, in appropriate conditions, inhibition of dilator tone. This is, however, more difficult to demonstrate.

(3) Similarly, in the local, or Lovén, reflexes, there is also both excitation of dilators and inhibition of constrictors.

(4) The action of strychnine is to convert the inhibitory phase of all vascular reflexes into an excitation, so that:—

(5) The depressor nerve produces a rise of blood-pressure under full doses of the alkaloid. It does this by exciting the constrictor centre by the same mechanism which normally inhibits it.

(6) In the "dilator" animal under strychnine, pressor reflexes become depressor, in that inhibition of dilators is converted into excitation.

(7) Various parts (synapses) of the reflex arc are differently sensitive to the alkaloid, the synapse of the pressor fibres with the constrictor centre being the first to show paralysis as the dose is increased.

(8) In the "dilator" animal strychnine causes a fall of blood-pressure on injection by exciting dilator centres. In the normal animal the first dose causes a rise, and subsequent ones a fall of pressure, since the first dose, if not too small, after exciting the vaso-constrictor centre, paralyses the synapses concerned, so that the simultaneous excitation of the dilator centres can now make itself felt.

(9) The excitation of constrictors produced by reversal of inhibition is more resistant to the alkaloid than that produced in the normal way.

(10) Asphyxial blood does not act directly on the efferent constrictor neurones, since it has no action at a stage of strychnine poisoning at which the depressor still excites constriction, by reversal of inhibition.

(11) Chloroform converts pressor into depressor reflexes (in the rabbit) by reversal of excitation of constrictors into inhibition.

(12) This effect of chloroform is not exerted on the efferent neurones directly, but at some point considerably earlier in the reflex arc. This is shown by the fact that asphyxial blood causes rise of pressure when excitation of sensory nerves causes fall.

June 4.—"The Optical Constants of Gypsum at Different Temperatures, and the Mitscherlich Experiment." By Dr. A. E. H. **Tutton**, F.R.S.

The experimental work on selenite now described confirms the author's previously published conclusion, derived from other examples, that the phenomenon of crossed-axial-plane dispersion is due to very low double refraction, combined with close approximation of the intermediate index of refraction to one of the extreme indices, and to the fact that change of wave-length of the light or change of temperature, or both, cause the intermediate index to approach still nearer to the extreme one in question until it becomes identical with it, and eventually to pass it, the relative positions of the two indices thus becoming reversed. The uniaxial rectangular cross and circular rings are produced at the critical point of identity. This critical point is a function of both wave-length and temperature, being a fixed one only for a particular wave-length and specific temperature. The temperature has a maximum for wave-length 573 on the greenish-yellow side of the D lines (589). The optic axial angle has a maximum for the same wave-length 573, for all temperatures below that of the crossing of the optic axes, and a minimum for temperatures superior thereto up to the temperature of decomposition (120°) of selenite. The change of orientation of the median lines (bisectrices of the optic axial acute and obtuse angles) within the symmetry plane, at any specific temperature, also exhibits a critical limit for this greenish-yellow light of wave-length 573, which is thus a very important radiation in connection with the optics of selenite. The range of temperature which includes the production of the uniaxial figure for all colours of the spectrum does not exceed 4°, varying in different crystals from 3°·5 to 4°. The absolute temperatures of crossing for the four crystals investigated varied 9°, the maxima (for wave-length 573) varying from 105°·5 to 114°·5, corrected for conduction of crystal holder.

Zoological Society, June 16.—Dr. Henry Woodward, F.R.S., vice-president, in the chair.—Photographs and fragments of skin and bone of a mammoth and a rhinoceros discovered in an ozokerite mine at Starunia, Galicia:

Dr. A. Smith **Woodward.** The carcases of these animals appeared to have found their way into an old marsh saturated with petroleum, which had completely preserved them. The photographs and specimens had been received from Dr. George von Kaufmann, who intended to present them to the British Museum.—The lower jaw of a young Canadian beaver in which there was present on each side a small conical tooth anterior to the deciduous premolar: Dr. C. I. Forsyth **Major.** The supernumerary premolar was considered to be a case of atavism.—Drawings made from examples of two species of Castor from the East Runton forest-bed: Dr. Forsyth **Major.** It was remarked that truly forest-bed species were found in association with Pliocene species.—Photographs of Pliocene Bovinæ from specimens in the Florence Museum: Dr. Forsyth **Major.** These unpublished figures showed the great variability of the Pliocene Bovinæ. The exhibitor endorsed Falconer's opinion that these Pliocene Bovinæ were nearly related to the primitive buffaloes from the Siwaliks.—Mammals from the provinces of Chih-li and Shan-si, N. China, collected by Mr. M. P. Anderson, being the tenth of the series of papers on the results of the Duke of Bedford's zoological exploration of eastern Asia: Oldfield **Thomas.** Very little material had hitherto existed from this part of northern China, although a certain number of specimens had been sent to Paris by Père David, and it was therefore of great importance to have a series representing the species he discovered for comparison with mammals from other regions. The present collection consisted of about 100 specimens, belonging to twenty species, of which several are new.—A case of imperfect development in *Echinus esculentus*: J. **Ritchie** and D. C. **McIntosh.**—The minute structure of calcareous sponge-spicules: Prof. E. A. **Minchin** and Dr. D. J. **Reid.** The primary object of this investigation was to demonstrate, by means of photomicrographs, certain structures, the existence of which had been strenuously denied by some of the most competent of previous investigators, namely, the presence, after the spicules had been cautiously decalcified, of a residue in the form of an axial filament which could be stained and rendered evident by certain dyes, in addition to the sheath universally acknowledged to exist. The axial filament was found to be very distinct in the spicules of Clathrinidæ, but much less so in those of Leucosoleniidæ and Heterocœla. Incidentally, the study of the axial filaments led to some interesting conclusions regarding the comparative morphology of the two principal types of spicules, monaxon and triradiate, occurring in calcareous sponges.—*Cyaniris chennellii* of de Niceville: Dr. T. A. **Chapman.** It was shown that this was not a Cyaniris (Celastrina, Tutt), but belonged to a new genus near to Everes, and that a specimen in Colonel Bingham's collection, placed with *chennellii*, was a species almost entitled to be placed in Cyaniris, for which he proposed new generic and specific names. Another specimen of the latter species was in the Tring Museum. It was suggested that de Niceville had both these species together in dealing with *chennellii*, and unfortunately selected as his type the one that was not a Cyaniris. The two forms probably fly together, and are therefore mimetic.—(1) A contribution to knowledge of the batrachian *Rhinoderma darwini*; (2) some notes upon the anatomy of *Chiromys madagascariensis*, with references to other lemurs: F. E. **Beddard.**—*Leucocytozoon musculi*, sp.n., a parasitic protozoon from the blood of white mice: Annie **Porter.** The parasites occur in mononuclear and transitional leucocytes, and free in the plasma. The free trophozoites are gregariniform vermicules, their average size being 10·9 μ long by 5·1 μ broad.—Descriptions of African micro-Lepidoptera: E. **Meyrick.** 108 species and eleven genera of Tortricina and Tineina from the African region (especially the Transvaal) were described as new.—A collection of calcareous sponges made by Mr. Cyril Crossland in the Cape Verde Islands: A. G. **Thacker.**

Royal Microscopical Society, June 17.—Mr. A. N. Disney in the chair.—*Exhibits.*—A lens for high-power microscopy to obviate the use of the oscillating screen: J. W. **Gordon** and H. Fletcher **Moulton.**—A small, simple microscope by Cary: A. **Skinner.** The instrument was only $4\frac{3}{4}$ inches high. It was provided with a plane mirror and a mechanical stage having movements of 4/10-inch horizontally and $\frac{1}{2}$-inch vertically. Focussing the object was effected by moving the stage by rack and pinion, the teeth of the rack being set obliquely, as in modern microscopes.—Micro-slides illustrating the structural parts of the chick at various stages of its development from about two days to $4\frac{1}{2}$ days: A. **Flatters.**—Stereophotomicrographs: Wm. P. **Dollman.** These were photographs of Alveolina ×6, fungus in eye of horse×350, statoblast of a freshwater polyzoa from Bombay×350, *Biddulphia antedeluviana* from Baltic mud×350.—*Papers.*—Cyclologulina, a new generic type of Foraminifera found on the shore of Selsey Bill: E. **Heron-Allen** and A. **Earland.** The paper was illustrated by a large map, on which the localities where the specimens were collected were pointed out. A number of slides of specimens under microscopes, and lantern-slides were shown upon the screen. Mr. Earland remarked that he believed they would eventually trace the specimens to some Eocene deposit which was not exposed above low-water mark. The source of origin could not be very far away from the place of discovery, for the specimens were too fragile to travel any considerable distance.—Illuminating apparatus for the microscope: J. W. **Gordon.** The light from a Nernst lamp is transmitted through a glass rod, the end of which nearest to the lamp is cut to a plane surface and finely ground; the other end has a polished surface, flat or lenticular in form, according to the user's requirements.—*Corethron criophilum*: E. M. **Nelson.**

Linnean Society, June 18.—Dr. D. H. Scott, F.R.S., president, in the chair; afterwards, Dr. A. Smith Woodward, F.R.S., vice-president.—Altitude and distribution of plants in southern Mexico: Dr. Hans **Gadow.**—Reports on the marine biology of the Sudanese Red Sea from collections made by Mr. Cyril Crossland, together with collections made in the Red Sea by Dr. R. Hartmeyer. On the Bryozoa, part i., Cheilostomata: A. W. **Waters.** The author enumerates thirty-nine species of Cheilostomata collected by Mr. Crossland, and twenty-three collected by Dr. Hartmeyer; besides these, eighteen other species are known from the Red Sea, making eighty Cheilostomata in all. The distribution of Red Sea species is in most cases very wide, often extending from the Atlantic to Eastern seas.—The algæ of the Yan Yean reservoir: G. S. **West.**—*Gardenia Thunbergia* and its allies: Dr. **Stapf** and J. **Hutchinson.** These Gardenias, fifteen in number, form the bulk of the section Eu-Gardenia in Africa, and extend over the whole of the continent with the exception of the temperate north. Owing to the instability of certain characters and the scantiness of the material in the older collections, they have not been well discriminated so far, with the result that *Gardenia Thunbergia* came to cover finally half a dozen perfectly distinct species ranging all over Africa, whilst the plant originally described under that name is actually confined to a limited area in South Africa. The distinctive characters of the species admitted—of which six are here described for the first time—are set out in key form, whilst their distribution and synonymy and full descriptions of the new species are given in the second part of the paper. It is also pointed out that the segregation of the "Thunbergia" group from the closely allied Indo-Malayan stock of § Eu-Gardenia must have taken place in pre-Tertiary times.—The marine algæ collected in the Indian Ocean by H.M.S. *Sealark*: A. **Gepp.**—Nudibranchs from the Red Sea, collected by Mr. C. Crossland: Sir Charles **Eliot.**

Royal Anthropological Institute, June 23.—Prof. W. Ridgeway, president, in the chair.—The Kurdish tribes of the Ottoman Empire: Mark **Sykes.** The tribes, of which the author distinguished about 323, inhabit that part of Asiatic Turkey between Uruma, in Persia, and Angora, in Asia Minor. Classification is difficult. They may be distinguished as nomadic, semi-sedentary, and sedentary, but any other kind of classification is almost impossible. As to religion, there are to be found among them Sunni Moslems, Shias, Devil worshippers, Pagans, Pantheists, and Christians. Linguistically, they are divided into a

variety of dialects, which are said to form two broad divisions, Zaza and Kermanji. Physically, the most extraordinary contrasts are to be found. In Hakkiari they are small, wiry mountaineers; tall, slim horsemen in Irak; those north of Lake Van are clumsy, heavily built, big-boned, and hook-nosed; in north Mesopotamia they are full-bearded, with regular features; while to the north and west of Erzinjian the men are fair-haired and of ruddy complexion. In point of civilisation the contrasts are just as marked.

CAMBRIDGE.

Philosophical Society, May 18.—Mr S. Ruhemann, vice-president, in the chair.—Radio-activity of solutions of potassium salts: N. R. **Campbell.** (1) All attempts to observe or to produce any difference in the activity of different samples of the same potassium compound in the same physical state have failed completely. No evidence has been obtained of any such separation of the activity as is to be expected, whatever view may be taken of the source of the activity. (2) The activity of a thick layer of a potassium compound is not accurately proportional to the amount of potassium which it contains. It is probable that the variation from strict proportionality is to be attributed to a difference in different compounds of the values of the ratio of the density of the substance to the absorption coefficient of the rays emitted by it. In the case of solutions, at least, the variations in the value of this ratio are surprisingly large and irregular. The ratio is not necessarily greater for the solution of greater density or greater concentration.—A preliminary note on an effect observed when palladium foil is heated in air at a low pressure: Rev. H. V. **Gill.** Strips of palladium foil were mounted in a glass tube so that they could be heated by means of an electric current. When heated in air at a pressure of about 0·15 mm. first to a dull red and then to a bright white heat, the palladium foil was seen to be surrounded by a purple-blue glow. This glow had all the appearance of a kathode discharge in a vacuum tube. There was no electric field except that due to the current which came from two storage cells to heat the foil. The glow gradually disappeared, and could not be again obtained from a strip which had been already used. This experiment was repeated many times, and with palladium foil obtained from different sources. The cause of this glow is being investigated.—The absorption spectra of some compounds of pyridine (second paper): J. E. **Purvis.** The results indicate that in these isomeric compounds the relative positions and the persistencies of the absorption bands are influenced by the type and the spatial positions of the atoms or groups of atoms introduced into the nucleus.—Further researches in the theory of divergent series and integrals: G. H. **Hardy.**—Some reactions of phenyliodidechloride and iodosobenzene acetate: H. H. **Hodgson.**—Integral forms and their connection with physical equations: R. **Hargreaves.**—The determination of the rate of chemical change by measurement of the gases evolved: F. E. E. **Lamplough.**

MANCHESTER.

Literary and Philosophical Society, May 12.—Prof. H. B. Dixon, F.R.S., president, in the chair.—Spore formation in the genus Chætoceros: Miss Nellie **Snape.** Spined resting spores occur during the late summer; these are set free by the breaking up of the Chætoceros filament and the throwing off of the old shells. Individuals of Chætoceros are also often seen containing a number of small rounded spore-like bodies formed by the contraction of the protoplasm and its aggregation round the chromatophores. The number of these bodies varies considerably, but their size is remarkably constant. It would appear rather probable that these spore-like bodies are really gametes, but confirmatory evidence on this point is at present lacking.—The mummy of Khnumu Nekht in the Manchester Museum: Miss Margaret A. **Murray.** The coffin was found in a rock tomb at Rifeh, near Assiout, in Upper Egypt, and dates from the XIIth Dynasty, or, roughly, about 2500 B.C. That this was a real mummy was shown by the fact that the nails of the hands and feet were carefully bound with threads so as to preserve them in position when the epithelium fell away. This proves the practice of mummifying, which rapidly disappeared on the introduction into Egypt of Christianity, to be more ancient than some have maintained, who give 1600 B.C. as the earliest date of its occurrence. The practice was held by some to be connected with the belief in re-incarnation. On the coffin were inscriptions said to be variants of the Pyramid text. Some of these read as follows:—"Thy mother Nut spreads herself above thee: she causes thee to be as a god without enemies"; "Comes to thee, comes to thee, thy mother Nut"; "To Anubis, Lord of Sepa, may he grant that thou cross heaven, and that thou reach land at the pure places which are in heaven."—Dr. **Cameron** gave an account of the anatomical features of the remains. The bones were remarkably slender. Measurements of the capacity and "indices" of the skull showed that it compared favourably with the average modern European type, whilst the limb bones rather tended towards the Simian character. There were indications that Khnumu Nekht was of lethargic habit, and spent much time in a squatting posture. His height was probably between 5 feet 3 inches and 5 feet 10 inches, and his age between sixty and seventy years. The teeth, with the exception of one, were intact, and only one of them showed any sign of decay, but all were extraordinarily worn, which showed that the food consumed must have been exceedingly gritty.

EDINBURGH.

Royal Society, June 22.—Prof. Ewart, F.R.S., vice-president, in the chair.—Equilibrium in the system water, and a pair of enantiomorph solids: Dr. W. W. **Taylor** and Dr. T. **Rettie.** The system investigated was water and the optically active tartar emetics, the systems water with *r* tartar emetic along with *d*- or *l*-tartar emetics being also included to complete the scheme. Series of confirmatory experiments were made with *d*- and *l*-sodium ammonium tartrates and sodium ammonium racemate. In the former case the transition temperature was unknown; it was determined by the solubility and dilatometer methods to be between 60° and 61° C. It was confirmed by crystallisation experiments above and below the transition temperature. The results show that the enantiomorph solids behave as two absolutely distinct phases, any mixture of the two being more soluble than either component alone; and the maximum solubility is possessed by the equimolecular mixture. Owing to the occurrence of labile equilibria, true equilibrium in each system was found to be attained much more slowly than was generally supposed. In some cases 20 days' shaking was found to be necessary.—The electrolytic conductivity of aqueous solutions of lactic acid, and on changes in conductivity accompanying the alcoholic fermentation: Dr. John **Gibson** and Andrew **King.**—An improved thermostat and other apparatus used in conductivity work: Dr. John **Gibson** and G. E. **Gibson.**—Determinations of the conductivity of concentrated solutions of good electrolytes:—(1) hydriodic and hydrobromic acids: Dr. John **Gibson** and Andrew **King**; (2) hydrochloric acid: Dr. John **Gibson** and W. H. **Paterson**; (3) ammonium bromide, lithium bromide, and sodium bromide: Dr. John **Gibson** and Dr. E. B. R. **Prideaux.**—The precipitation of certain chlorides by hydrochloric acid: Dr. John **Gibson** and Dr. R. B. **Denison.** These papers all bore more or less upon a general line of research which has occupied Dr. Gibson's attention for years. The discussion of the facts established was held over for a future communication. The improved thermostat was electrically controlled, the circuit of the incandescent lamps which supplied the heat being interrupted or closed (as the case might be) by an electromagnetic relay controlled by a modification of the usual form of cut-off. By means of this thermostat the temperature could be kept absolutely constant for months at a time.—Andrews's measurements of the compression of carbon dioxide and of mixtures of carbon dioxide and nitrogen: Dr. C. G. **Knott.** This completed a work which was begun by Prof. Tait in 1899 with the view of

supplying the true pressures as indicated by the air and hydrogen manometers used by Andrews in his well-known experiments. See a letter by K. Tsuruta, of Tokyo, in NATURE, February 2, 1899, which directed attention to the importance of finding the true pressures instead of those given by Andrews and explicitly referred to by him as only provisional. With the assistance of Dr. Andrews's daughter, Miss M. K. Andrews, the experimental note-books had been carefully and successfully investigated, and the data obtained from which the true pressures could be calculated.

PARIS.

Academy of Sciences, July 6.—M. Bouchard in the chair.—A fundamental hypothesis implicitly admitted in the classical treatment of astronomy: J. **Boussinesq.** It has been implicitly assumed that the path of any planet with respect to the sun forms a closed trajectory described periodically. The tendency to make the simplest hypothesis consistent with the observed facts is unavoidable; thus the ancient astronomers assumed circular uniform motion for the stars, an assumption which had to be complicated as observations became more exact.—The triboluminescence of racemic compounds: D. **Gernez.** It has been shown by Tschugaeff that whilst with certain optically active bodies both the right- and left-handed constituents are triboluminescent, the racemic compound is not so. The author has filled up some gaps in Tschugaeff's table, and added fresh optically active substances, but is unable to confirm his hypothesis. There seems to be no general relation of cause and effect between triboluminescence of bodies and their symmetrical or unsymmetrical constitution.—The eclipse of the sun of June 28, 1908, at the Observatory of Lyons: Ch. **André.** The results of observations of contacts, chords, and angles of position. The last contact was partially obscured by clouds.—The action of metallic oxides on primary alcohols. The case of oxides undergoing reduction: Paul **Sabatier** and A. **Mailhe.** The simplest case is that of the oxides of antimony and bismuth, which, at 360° C., are reduced to metal, water and aldehyde being the only products. With HgO and MnO_2 the oxidation goes further, some carbon dioxide being formed. The reduced metal in these cases shows no catalytic power, but with nickel, cobalt, lead, and copper the catalytic effects of the reduced metal are added to the reducing power of the oxides, and the reaction becomes more complicated. With some metals (iron, cadmium, tin) the oxides also can act catalytically.—The floating population on canals and public health: MM. **Chantemesse** and **Pomès.** The possibility of infection being carried in this way was overlooked in the legislation of 1902. Cases are cited showing how widely infection has been carried by canal boats, and the necessity of suitable prophylactic measures is pointed out.—Some new peculiarities of short-period variable stars: a method of distinguishing their effects from those due to dispersion in a vacuum: Charles **Nordmann.** It is shown that the results obtained by the method of monochromatic images can separate, for a numerous class of variable stars, the two classes of phenomena in question.—The variations of duration of twilight: Ernest **Esclangon.** The visibility of celestial objects, depending as it does on two factors, the apparent brightness of the sky and the transparency of the air, is a faulty method of observation; the photometric state of the sky is more suitable for quantitative study. The great influence of suspended particles in the air is pointed out, and the abnormal twilight of July 1 considered from this point of view.—The partial eclipse of the sun observed at the Observatory of Besançon on June 28, 1908: MM. **Brück, Chofardet,** and **Pernot.**—Observation at the Observatory of Marseilles of the partial eclipse of the sun of June 28, 1908: Henry **Bourget.**—A problem relating to the theory of partial differential equations of the hyperbolic type: A. **Myller.**—A new integrometer: M. **Jacob.** The apparatus described on May 11, 1908, allows the integration of the equation

$$y' = Ay^3 + By^2 + Cy + D,$$

if a particular solution of this equation is known. By slightly modifying the apparatus, the latter restriction is removed.—The useful weight of aëroplanes: Rodolphe **Soreau.**—The use of detectors, sensitive to electric oscillations, based on thermoelectric phenomena: C. **Tissot.**—Researches on ionised gases: A. **Blanc.** The method of measurement used was a modification of the alternating field method of Rutherford, and was applied to the study of mixtures of carbon dioxide and hydrogen, and air and carbon dioxide. The mobility in air of an ion produced in carbon dioxide is the same as if this ion had been directly produced in air, and this is true for ions of both signs.—The influence of temperature on the electromotive force of the cadmium element: R. **Jouaust.** The formula given in 1901 by Jäger and Lindeck for the variation in the electromotive force of the cadmium cell between 0 and 20 for an amalgam containing between 12 and 13 per cent. of cadmium has been confirmed. More recently, Smith has stated that between 10° and 20° C. amalgams of 10 per cent. and 12·5 per cent. show an identical relation; this, however, is now shown not to be true at 0° C., and the anomalies shown by the cells with 10 per cent. amalgam require further investigation.—Interference fringes shown by colour photographs: E. **Rothé.**—A repeating auto-ballistic galvanometer: A. **Guillet.** If successive small impulses are imparted to the ballistic needle at periods corresponding to its vibration period, a large increase of sensibility results. An automatic arrangement for effecting this is described in the present paper.—Dynamos without a collector: C. **Limb.** The application of electrolytic values to dynamos.—The stability of the alternating arc as a function of the atomic weight of the metals forming the electrodes: C. E. **Guye** and A. **Bron.**—The orientation of crystals by the magnetic field. The importance of the optical properties of mixed liquids from the point of view of crystalline symmetry: A. **Cotton** and H. **Mouton.**—The phenomena of Bose and the laws of contact electrification: Édouard **Guillaume.**—The Bose-Guillaume phenomenon and contact electrification: Jean **Perrin.**—A relation between the magnetic and chemical properties of complex iron salts: P. **Pascal.**—The total heats of baryta, witherite, and fused lime: M. **Latschenko.**—The development of negatives in radiography: Maxime **Ménard.** A description of the modification in the details visible in the negative which can be produced by variations in the method of working with the same developing bath.—The influence of the medium on the Brownian movements: Victor **Henri.** A quantitative study by means of a kinematograph microscope of the effects produced by the addition of various amounts of acids and alkalis to the latex of india-rubber. A new iodide of titanium, titanous oxide, TiI_2: Ed. **Defacqz** and H. **Copaux.** The new iodide is obtained by the action of mercury vapour upon TiI_4 in an atmosphere of hydrogen at a red heat.—The heat of neutralisation of picric acid by various aromatic bases in benzene solution: Léo **Vignon** and M. **Évieux.** Picric acid differs from acetic and benzoic acids in that it forms salts readily with aromatic bases in benzene solution. It furnishes examples of formation of salts in the absence of ionisation.—The direct transformation of borneol into campholic and iso-campholic acids: Marcel **Guerbet.** If borneol is heated in sealed tubes at 250° to 280° with recently fused potash it is almost quantitatively converted into the potassium salts of campholic and *iso*campholic acids, hydrogen being evolved.—The preparation of benzoylacetic esters: A. **Wahl.** By the action of sodium upon an ethereal solution of ethyl benzoate, benzoin is produced. Hence, in the condensation of ethyl acetate and benzoate with sodium, three distinct reactions are produced.—Ergosterin and fongosterin: C. **Tanret.**—Study of the *rôle* of yeasts in the aldehydification of alcohol: MM. **Trillat** and **Sauton.**—The influence of formic acid vapours on the growth of *Rhizopus nigricans*: Henri **Coupin.**—The recollection of the tides in *Convoluta Roscoffensis* and its alteration: Louis **Martin.**—The structure of the renal cell: L. **Bruntz.**—The first venous circulation of *Carassius auratus*: P. **Wintrebert.**—Study of the immunising action of chlorinated derivatives of bacilli: MM. **Moussu** and **Goupil.**—The quaternary alluvium of the Loire and Allier: E. **Chaput.**

NEW SOUTH WALES.

Linnean Society, May 27.—Mr. J. H. Maiden, vice-president, in the chair.—The behaviour of *Hyla aurea* to strychnine: Dr. H. G. **Chapman.** The common Australian frog *Hyla aurea* has been noted not infrequently to be much less susceptible to the poisonous alkaloid strychnine than European frogs of the genus Rana. The minimal lethal dose for various species of Rana has been measured by numerous observers, and there seems to be general agreement that it may be said to lie between 2 mg. and 5·5 mg. per kilogram of body-weight. For *Hyla aurea* the minimal lethal dose is 0·1 mg. per gram of body-weight, and is somewhat higher in frogs collected in winter than in those collected in summer, but is unaffected by differences in sex. The receptive substance of the muscles of *Hyla aurea* is sensitive to strychnine, so that the frogs show, with appropriate doses, typical curare paralysis. The prominence of this action produces a characteristic type of poisoning in Hyla.—Notes from the Botanic Gardens, Sydney, No. 13: J. H. **Maiden** and E. **Betche.** The authors described several new species, new varieties, new records for New South Wales, and new localities, and made some remarks on notable plants.—A contribution to our knowledge of Australian Hirudinea. Part i.: E. J. **Goddard.**

CALCUTTA.

Asiatic Society of Bengal, June 3.—Tibetan charms obtained by Lieut.-Colonel S. H. Godfrey in Ladakh, one for chasing away evil spirits and the other for compelling fortune: Dr. S. C. **Vidyabhusana.** These two charms are printed from wood blocks, and used by people of Ladakh who are entirely ignorant of the meaning of the writing on them. The writing is Sanskrit in Tibetan characters.—A polyglot list of birds in Manchu, Chinese, and Turki: Dr. E. D. **Ross.**—Materials for a flora of the Malay Peninsula, part No. 21: Sir George **King** and J. S. **Gamble.** The part contains the two families which complete the Gamopetalæ, viz. No. 86, Gesneraceæ, and No. 90, Verbenaceæ. A review of the former of these families was published in 1905 by Mr. H. N. Ridley, director of the Singapore Botanic Garden, in the Journal of the Straits Branch of the Royal Asiatic Society, but as the form of that publication was not quite the same as has been used by Sir G. King and his various helpers, Mr. Ridley's work has been revised by Mr. Gamble with the help of Lieut.-Colonel D. Prain, of Kew. The Verbenaceæ have been worked up by Mr. Gamble. Part No. 21 also contains the addenda and corrigenda of the Gamopetalæ and the index to vol. lxxiv.—Note on the peregrine falcon (*Falco peregrinus*): Lieut.-Colonel D. C. **Phillott.**—The use of the abacus in ancient India: E. R. **Kaye.** Tylor, Woepcke, Rodel, Burnell, Bayley, and other writers on Indian mathematics assume that the abacus was in common use in ancient India, but they give no evidence of such use. They, however, on this assumption build up elaborate arguments to prove that our arithmetical notation was invented in India, and incidentally that the Arabs owe their arithmetic to the Hindus. An examination of their statements shows that their assumption is unwarranted, and, indeed, that no evidence at all has yet been given of the use of this instrument in ancient India. This, of course, does not prove that the abacus was not used by the early Hindus, and it is with the idea of eliciting evidence on this point, if it exists, that this paper was read.—Plea for an aquarium in Bengal: Rai Ram Brahma **Sanyal.** The author advocates the establishment of an aquarium at Puri, chiefly for the study of economic questions regarding the fisheries of the Bay of Bengal.—A descriptive list of works on the Madhyamika philosophy: Dr. S. C. **Vidyabhusana.** This paper gives a short account of the Tibetan versions of twenty-seven works on the Madhyamika philosophy, the Sanskrit originals of which, with one exception, appear to have long been lost. The Tibetan versions are included in the well-known collection called the Tangyur, which the writer of the paper examined while residing at the monastery of Labrang, in Sikkim, in June, 1907. They include the works of Arya Nagarjuna, Arya Deva, and Buddha Palita, besides those of the teacher Bhavya, who criticised the contemporaneous systems of Hindu philosophy, viz. the Yoga, Samkhya, Vaisesika, Vedanta, and Mimamsa. These works, which have not been noticed elsewhere, are very important, as they throw a good deal of light on the history of Indian philosophy.—The mechanical, physical, and chemical theories of the ancient Hindus, part i.: Principal B. N. **Seal.** A synoptic view of the mechanical, physical, and chemical theories of the ancient Hindus, based chiefly on the Vyasa Bhashya or Patanjali's Sutras, the Samhita of Charaka, the Bhashya of Prasastapada, the Vartika of Udyotakara, and the Vrihat Samhita of Varaha Mihira, which belonged to the fourth, fifth, and sixth centuries of the Christian era.—Geometrical theory of a plane non-cyclic arc, finite, as well as infinitesimal: Prof. S. **Mukhopadhyaya.**—A memoir on the surgical instruments of the Hindus, with a comparative study of the instruments of Greek, Roman, Arab, and modern European surgeons, part i.: Dr. G. N. **Mukhopadhyaya.** The author describes the surgical instruments of the Hindus, and concludes that knowledge of the kind was considerably more advanced among them than previously held to be.—Rationalisation of algebraical equations: Mahendranath **De.**

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