THURSDAY, JANUARY 18, 1906.

THE HIGHER TELEOLOGY.

The Interpretation of Nature. By C. Lloyd Morgan, LL.D., F.R.S. Pp. 164. (Bristol: J. W. Arrowsmith; London: Macmillan and Co. Ltd., 1905.) Price 2*s.* net.

PROF. LLOYD MORGAN stands as a daysman between the naturalistic and the teleological interpretations of Nature, and the result of his arbitration is that both are valid, though neither by itself is satisfying. Naturalism aims at an analysis of occurrences in terms of the simplest possible formulæ—mechanical by preference—at a genetic description of the stages by which any particular configuration—the solar system, the scenery of Scotland, the simplest organism, Man and his mind—has come about. "It finds its principle of unification in the universality and inter-connection of world-events; it works inwards from external nature to the life and mind of man which it interprets as expressions of natural law." It is a stern way of looking at things, knowing nothing of beginnings or ends, never asking "why?" and never really answering even the question "how?" It flourishes William of Occam's razor, searching as he who shaved Shagpat for the periodically sprouting "identical," "principle" or "entity" to lop it off. It speaks not willingly of "causes," but deals with "antecedent conditions." "It regards the state of the whole universe at any given moment as a configuration of very great complexity, involving accelerations of many different orders co-existing in natural relationship, and it believes that the cause or condition of this configuration is that of the preceding moment, while the configuration of the succeeding moment is its effect. This involves a splendid act of faith, for it assuredly outruns what can, in the present state of knowledge, be definitely proved."

While many thinkers have sought to stay the progress of the triumphant chariot of Naturalism by exhibiting notices "No road this way," the chariot-drivers have paid no heed, but have gone nonchalantly on through the policies of Life and Mind, of Morals and Society, only pausing, as courtesy demanded, to say that they were giving no explanations, merely genetic descriptions. What is particularly interesting in Prof. Lloyd Morgan's attitude is that he wishes them God-speed, and is entirely disinclined to call a halt at any particular difficulty in the way of naturalistic formulation. It is true, he says, that the antecedent conditions of the genesis of protoplasm, for instance, are unknown, but they may not remain unknown, and "those who would concentrate the mystery of existence on the pin-point of the genesis of protoplasm do violence alike to philosophy and to religion." Or again, in reference to the naturalistic doctrine of the ego, that what we call mind is, from the restricted point of view of scientific psychology, the name we apply to a sequence of mental configurations, the author writes:—"But—it can't be proved. Never mind that. Some day it may be proved. And in any case to believe more than can be reduced to actual demonstration is not only a characteristic of human nature, but often one of the prime conditions of progress." It is evident, then, that this arbiter fully appreciates the naturalistic universe of discourse, and has no timidity in wishing that its ideal of formulation may be realised. For in proportion to the realisation of the naturalistic aim, which is to formulate our routine of experience in terms of the simplest possible ideal constructions, in proportion to its disclosure of determinate evolution all along the line, in proportion to its elimination of "purpose," "causal agency," and "end" from its universe of discourse, it will become clear that this mode of interpretation, however necessary and valuable for scientific workmanship, is too partial and abstract to satisfy those who feel that the purpose of their life is the most intimate and fundamental reality of which they have any knowledge. In other words, it is the aim of Lloyd Morgan's eirenicon "to show that a belief in purpose as the causal reality of which nature is the expression is not inconsistent with a full and whole-hearted acceptance of the explanations of naturalism within their appropriate sphere."

This little book deals with big questions, and many who have pondered over them will be grateful to the author for the lucidity of his argument, which is an expression of his own clear vision, and is also perhaps partly due to the fact that the book took shape as the Lowell lectures for 1904. Many will be grateful, we believe, for more than the pleasure of reading a vivid and stimulating course of lectures, namely, for a liberation from the obsession of a mechanistic outlook. The author expounds the naturalistic scheme with great sympathy, while disclosing its implications and limitations, but he maintains convincingly that "a complete and satisfactory interpretation of nature is, so far as it is attainable by man, partly scientific and partly metaphysical." We look, as it were, for a greatest common measure as well as a lowest common denominator of the fractions of reality which make up our experience. We cannot remain satisfied with a description of the observed moves among the pieces on the chequered chess-board of experience; we cannot but ask "how there comes to be a game to be played, and when this is settled how, or by what unseen agency, castles and knights and pawns are moved, each with a distinctive path, across the board." But this is beyond science; it is the other side of the shield; and the problem is:—By what ideal construction, valid in reason and valid in life, can we supplement the partiality of the naturalistic outlook? In a way of his own the poet feels that the whole universe "trembles with song"; the artist in his outlook, certainly not the least sane, has as little use for mechanistic categories as the mechanist has for wood-nymphs; the religious mood sees the iron chains of determinate evolution transmuted into golden chains which bind all things about the feet of God. But what more universal outlook is there for plain men dwelling in tents?

The answer given in this eirenicon is simple in expression but far-reaching in its outcome. It is that

"purpose is that of which all determinate sequence is the phenomenal expression." "Naturalism proclaims that I am just a little bit of nature, differentiated from the rest, a minute cluster of phenomena in relation with the total remainder of phenomena, a tiny, if somewhat complex configuration under the influence of the major configuration of the universe." But "I cannot do away with the conviction that there is something within me which unifies and relates and orders the configurations, something which is the source of my conception of causal agency. It is what I understand by *purpose*." . . . "But why should I suppose that the causal agency which, as purpose, underlies my own private and peculiar configuration, is of a different order of being from that of which nature at large is a manifestation. Just in so far as I *am* one with nature, and therefore in physical relationship with other manifestations in terms of matter and energy, is the purpose of my being one with the purpose which underlies the manifestations of nature, and am I in spiritual relationship with a wider and richer purpose which is thus manifested."

We agree so heartily with this higher teleology that we have no criticism to offer. We doubt, however, whether it is necessary to deal so generously with the naturalistic interpretation in its mechanistic expression as the author has seen fit to do. It may be well methodologically to deal with it as an ideal, but we cannot help feeling that its realisation is very far from being within the sphere of practical politics. Our other difficulty is that we cannot think of the concept purpose except as related to personality, except as an attribute or aspect of a larger reality still, which thinkers of all ages have spoken of as "Spirit."

J. A. T.

TWO BOOKS ON THE SOIL.

Bodenkunde. By E. Ramann. Second edition. Pp. xii+431. (Berlin: Springer, 1905.)

Soils and Fertilisers. By Prof. H. Snyder. Second edition. Pp. x+294. (Easton, Pa.: The Chemical Publishing Co., 1905.) Price 1.50 dollars.

DR. RAMANN'S treatise on soils, which has grown out of an earlier book on forest soils published in 1895, is of very different type and design from such books on the same subject as have appeared in English. In the first place, a considerable portion of the book is occupied with a somewhat generalised and academic consideration of the soil, its origin, its relation to climate and vegetation, its types, &c., in all of which the point of view of the geographer, the geologist, or the botanist is more to the fore than that of the farmer. Soils and their constituents and properties are classified and described as though they were a set of museum specimens, with little or no reference to their behaviour in the field. Indeed, the author has rather a passion for classification, and the work contains too many generalisations and definitions of the following kind, which are accorded the dignity of large type.

"*Bodenkraft* is the sum of all the chemical and physical properties of the soil. *Fruchbarkeit* is the relation between *Bodenkraft* and the development of plants. *Ertragsvermögen* is the relation between *Fruchbarkeit* and climatic factors in their action upon plant colonies or single kinds of plants."

Such definitions sound well in lecture, and serve to fill the industrious listener's notebook, but they do not help him much in the study of the real thing.

Similarly, in those sections of the book dealing with the examination of soils, we get directions for the carrying out of this or that determination—chemical analysis, water capacity, specific heat, &c.—but of the interpretation of the results we hear nothing at all. We are not, in fact, instructed how to add up that sum which is to indicate the fertility of the soil. But in its own special line Dr. Ramann's book cannot fail to be useful to our workers at the scientific study of soils. It is particularly good in dealing with the part of the subject most neglected in Britain, the physical properties of soils, and the portion in which Dr. Ramann is perhaps specially interested—the study of forest soils—contains an excellent summary of work that is almost unknown here. Such matters as the growth of forest soils, the effect of the leafy covering on the chemical composition, the temperature and the water content of soils, are dealt with at length; as again in later chapters are the questions of zones and types of soil and their delimitation upon soil maps. As a book of reference to modern German research on the soil (French and English investigations are practically ignored) Dr. Ramann's treatise will be of considerable service to the specialist; for the agricultural student or the farmer it will not serve.

Prof. Snyder's little book has been constructed out of a series of notes supplied to the students of his classes at the University of Minnesota, expanded somewhat and made more complete by the addition of descriptions of laboratory experiments upon soils and fertilisers. Essentially, however, the book still consists of notes which will serve to remind the student of the matter dealt with in the lectures; they lack both the filling in and the elucidation that comes from the lecturer himself. Too many things are mentioned and left without any adequate explanation, as though the author were afraid to pass them by wholly without notice, yet knew at once that he could not afford the time or space necessary to develop them properly. The result is a book which fulfils its original purpose of lecture notes, but when taken by itself is dull and difficult to read, and, as we would contend, a mistake educationally. A text-book should not be a miniature encyclopædia, and though the teacher is well advised in making occasional excursions into higher work beyond the average reach of his students, it should be done by working out principles, and not by scrappy enumerations of more advanced investigations.

But instead of criticising a book for what it is not, it is fairer to try and appreciate what it does accomplish. Prof. Snyder is a well known member of the band of American experiment station workers who have done so much to advance the application of science to the everyday practical side of farming, and have succeeded in making the United States

farmer regard the investigator as his necessary helper in the conduct of his business.

In matters connected with the physics of the soil and its bearing upon the operations of cultivation the American workers have accumulated much novel information, and to this some of the chapters of Prof. Snyder's book form a good introduction. The requirements of the crop are treated from a sound general standpoint which never forgets that water and air, soil texture, and cultivation are perhaps the prime factors in plant production. In this country students are a little too apt to fancy that farming begins and ends with the application of artificial manures; we can recommend this book to them for the truer point of view, even though the conditions which regulate our use of manures are not quite the same as in America.

RECENT ASPECTS OF ELEMENTARY GEOMETRY.

The First Book of Geometry. By Grace Chisholm Young, Ph.D., and W. H. Young, M.A., Sc.D. Pp. xvi+222. (London: J. M. Dent and Co., 1905.) Price 1*s.* 6*d.* net.

OF late years a very remarkable change has been made in the theory of elementary geometry, the general effect of which has been to make it more abstract, and to reduce a great deal of it to the application of logic without any appeal to intuition. It has been realised that geometry must be based on the assumption of certain undefinable entities, of elementary relations between them, and a complete system of independent axioms. For the purposes of ordinary Euclidean geometry, it is probably the simplest way to assume the straight line as the one undefinable entity, and intersection as the elementary relation from which the notions of point and plane may be derived. What system of axioms we adopt will partly depend upon the nature of the geometry we study; for instance, the axioms which are necessary and sufficient for the purposes of projective geometry require supplementing when we discuss the theory of measurement.

It is the theory of measurement which presents the greatest difficulty at the present time. If we assume all the results of projective geometry, we may proceed as follows:—Taking any three points O, I, X on a line, we may associate them with the numbers (or indices) 0, 1, ∞ (where ∞ is the vague infinity of ordinary arithmetical algebra). We can then give a purely projective rule for finding a point on the line to be associated with any given rational number p/q; we thus get on the line a set of points corresponding to the whole field of rational numbers, and, moreover, the arrangement of the points corresponds to the arrangement of the numbers according to their magnitude; that is, if $m>n>p$, the point N lies on that segment MP which does not contain X. If we like, we can define the distance AB as being measured by $b-a$, where a, b are the indices of A, B. This satisfies the relation AB+BC=AC, but equal segments as thus defined are not intuitionally equal, except when X is "the" point at infinity on the line; and even then we cannot prove, but must assume the intuitional equality. Moreover, there are points on the line which do not have rational indices, unless, in spite of common sense, we assume that the points on the line form a discrete aggregate. Now in arithmetic we have a perfect continuous aggregate, where each irrational element separates all the rational ones into two complementary parts, respectively greater or less than itself. If we *assume* that all the points in the line which have not rational indices behave in a similar way, we have a complete correspondence between the succession of points on a line and the elements of the arithmetical continuum. So far as appears at present, this is a pure assumption; but if it is not made, anything like the ordinary theory of measurement seems to be impossible, for two distinct points ought to have a measurable distance, and the measure must be a number; if the two distinct points cannot be associated with two distinct numbers, how is their distance to be defined as a measurable quantity? Other difficulties arise in connection with transfinite numbers and their representation by point aggregates; but these are comparatively unimportant, if it is remembered that the assumption of the correspondence of points on a line with the arithmetical continuum involves a similar correspondence between the arithmetical continuum and the points on any finite segment.

It is very interesting to see how this recent theory has reacted on the question of teaching elementary geometry. Instead of tending to make it more abstract and more logical, it has done exactly the reverse; and the reason for this is not difficult to find. The notions of geometry, so far as it is distinct from logic, are derived from concepts, and these, again, from experience. There must be an intuitional basis for geometry; and although, from a logical point of view, it is desirable, *for any given species of geometry*, to reduce its necessary assumptions to a minimum, progress in geometrical invention is to be expected from those who cultivate their powers of observation as well as their logical faculties. One result of recent research has been to explode, once for all, the pretence that the "Elements" of Euclid present geometry in its most logical form; on the other hand, to try to teach beginners the subject in what would now be considered the most rigorous way would be certain to end in failure.

The book which has been written by Dr. and Mrs. Young illustrates very well what has just been said. Its main object is to awaken the pupil's mind to the ideas by which we classify the properties of space; this is done by directions in paper-folding, in dissection of areas, in the construction of solid models, and the like. At the same time, various theorems are stated and proved, so that the beginner may learn the difference between experimental and deductive geometry. As in the case of other text-books with a similar aim, the teacher will have to be careful to see that his pupil distinguishes proofs from verifications; *e.g.*, on p. 173 we have a proof that the angles of a triangle make up two right angles, while on p. 121 we have a verification in a special case.

There is no doubt that the kind of first course laid out in this book is the right one from a psychological point of view. A quite young pupil, actually carrying out its directions with the help of a sympathetic teacher, will obtain clear conceptions of geometrical facts in a way that is really interesting and fruitful. The apparatus required is of the simplest possible kind—paper, pins, a pencil, and a pair of scissors are all that are absolutely necessary, though a compass and a scale might be provided with advantage, except at the beginning of the course. The attention given to solid figures is a feature which deserves commendation; and above all there does not seem to be anything said that is likely to lead to misapprehensions, which have to be painfully corrected afterwards.

There are a few points of detail which might be attended to in another edition. The letters in the diagrams are too small; the figure on p. 151 does not correspond to the text; on p. 35, "This gives us another axiom" is quite illogical; and there are some technical terms which might have been spared. It must be remembered, too, that this is not a book for a beginner to *learn* in the old-fashioned way; it is intended to make him experiment and think, and the guidance of the teacher is essential. Assuming this, the book ought to be very useful, and lead to good results, even in the case of pupils who have little faculty for demonstrative geometry.

G. B. M.

LEGIBILITY AND VISUAL ACUITY.

Physiologie de la Lecture et de l'Écriture. By Emile Javal. Pp. xv+296. (Paris: Félix Alcan, 1905.) Price 6 francs.

THE title of this book, which is written by a distinguished ophthalmologist, is somewhat misleading. One would naturally expect such a work to deal with the neuro-muscular mechanism, central and peripheral, of reading and writing. In reality, it treats almost exclusively of the legibility of printed and written matter, and the physiological processes are investigated only in so far as they throw light upon this aspect of the subject, and give indications for increased facility and rapidity in reading.

In the first part of the book a brief historical account of epigraphy, writing, typography, stenography, musical notation, and writing in relief for the blind is given. Typography is illustrated by examples from Garamond (1540), adopted by Plantin, of Antwerp, and the two Elzeviers, of Leyden and Amsterdam respectively, from very elegant designs by Jaugeon (1704), and from the Imprimerie Impériale (Didot, 1811) and the Imprimerie Nationale (Marcellin Legrand, 1847). Theoretical considerations of visual acuity, treated in the second part, show that the visibility of a letter increases indefinitely with the illumination, whereas its legibility depends upon the neuro-epithelial mosaic of the retina, and is therefore independent of illumination above a certain minimum. Investigation of the mechanism of reading a line of print has shown that the eyes move in a series of jerks, in each of which a group of about ten letters is appreciated, the grouping being independent of the distance of the book from the eyes so long as this is consistent with legibility. Bar reading gives some indication of the relative part played by the two eyes when binocular vision is present. The difference of accommodation in different parts of a line when the book is held close to the eyes, as in myopia, is very appreciable, and must be taken into account in treatment; thus in a myope of 15 dioptres a line of 10 centimetres involves a difference of accommodation of about 7 dioptres. The characteristic features of letters are for the most part in the upper portion, so that attention is specially directed here; consequently it is easy to read with the lower halves of the letters covered, whilst the reverse occasions considerable difficulty. These considerations indicate some improvements in typography. They have been carried out in some designs prepared for the author by M. Ch. Dreyfuss. It will be admitted that the result is successful as regards legibility and rapidity of reading, though at no small cost to the artistic sense. M. Javal points out that nearly all the improvements are to be seen in the well known enamelled-iron advertisement of Willing; indeed, English printing as a whole compares favourably in his estimation with that of other countries.

The terrible misfortune of blindness overtook the author a few years ago, so that it is not surprising that he has given much attention to Braille type. Even those born blind rarely attain to a rate of 100 words a minute in reading, or 10 in writing. It is surprising to find that the tactile acuity of the blind is actually less than that of normal people; the reading finger tires rapidly, and though the acuity of other fingers is greater, they are comparatively useless for reading. The author gives valuable suggestions for improving and simplifying Braille type, as well as general instructions as to the hygiene of vision and of writing.

J. HERBERT PARSONS.

OUR BOOK SHELF.

Exercises in Quantitative Chemistry. By Harmon Northrop Morse. Pp. xx+356. (Boston and London: Ginn and Co., 1905.) Price 8*s.* 6*d.*

THE time when the sole desideratum in the training of the chemical student was the acquirement of greater or less proficiency in the processes of analytical chemistry has, happily, gone by. Courses of experimental work arranged with the view of familiarising him with the most important general reactions, the preparation of typical organic compounds, and the methods peculiar to physical chemistry are now recognised as the essentials of chemical training. The work under review has been written from this standpoint, and makes no attempt to present a course of work for the training of expert analysts.

Although much diversity of opinion must necessarily attach to the problem of the choice of an ideal course of exercises, the unbiased critic can have but little fault to find with the author's selection. At first sight the heterogeneous character of the sixty-four exercises creates an impression of a lack of systematic arrangement, but this is more apparent than real. The first eight chapters deal with the balance, the

barometer and thermometer, the calibration of apparatus for the measurement of liquids and gases, the preparation of standard solutions, the determination of specific gravity and molecular weights, and with the purification of substances. Analytical exercises involving gravimetric and volumetric measurements and the manipulation of gases are contained in the succeeding twelve chapters, the selection being such that the student acquires familiarity with a large number of different kinds of operations. Chapters dealing with the electrolytic determination of metals, the analysis of butter, and electrical heating appliances for laboratory use complete the work.

Much care has evidently been devoted to the text. The remarks on p. 167 in reference to Victor Meyer's vapour-density method are, however, quite unintelligible, and in the methods of butter analysis described no mention is made of the standardised apparatus and method of working which has been adopted in this country for the determination of the volatile acids. These, however, are blemishes of small import, and the book represents an addition to laboratory literature to which attention may be directed with confidence. H. M. D.

Handbook of Physiology for Students and Practitioners of Medicine. By Dr. Austin Flint. Pp. xxvi+877 and xvi plates. (London: Macmillan and Co., Ltd., 1905.) Price 21*s.* net.

THERE are reasons for congratulating the author of this book upon its appearance, and not the least of them is the cheery optimism everywhere displayed. The growth that has taken place in the subject in the course of the last half-century is no more remarkable than the courage with which this writer, at the end of that time, turns round to attempt its description. To old friends of his handbook this gallant effort must afford great pleasure. It is doubtful, however, whether, outside this circle, much influence can be anticipated for this volume, since it has many competitors appealing more directly to the market of the present time.

"It is the outcome of a desire to connect pure physiology with the physiology specially useful to physicians." Let it be said that there is but one physiology. The physiology, which is of use to medicine, is not an applied science with a wealth of knowledge accumulated in its special interest; it is the essence of the pure science of physiology. There are also anatomy and histology. It is useless to claim credit from an attempt to provide a judicious blend of these separated subjects, since they are now more conveniently, and usually, studied separately. In this case, also, the standard of the extraneous matter is such as in no way to raise the standard of the general contents of the book.

As to the treatment of the more legitimately included contents, much can be said briefly.

The additions which have been made to knowledge in the last twenty years have made their bow to the author of this book, and have had the honour of an introduction. The names on their visiting cards have been forgotten; their inventions have been expressed at such hurried interviews as frequently to have escaped comprehension. The fact that they have called in such numbers has, however, made an impression, of which this new edition forms the record. The additions of recent years are, however, of such importance that nothing short of a complete—even if concise—consideration of their nature will suffice. The kindly sketched shadows, which here vaguely occupy the space that ascertained facts should definitely fill, render it impossible to recommend this book for general reading. J. S. MACDONALD.

Penrose's Pictorial Annual. Vol. xi. The Process Year Book for 1905–6. Edited by William Gamble. Pp. xvi+168. (London: A. W. Penrose and Co., Ltd., 1905.)

LAST year, in bringing to the notice of our readers this annual illustrated review of the graphic arts, we suggested that the standard of the volume in every respect was so high that it would be exceedingly difficult to eclipse it in the future. We were, however, wrong in our surmise, for the present volume surpasses those that have preceded it and illustrates the high state of efficiency of processes in use at the present time.

In the production of such a volume the task of the editor was no light one, but with his large acquaintance with all process methods he has given us an excellent survey of the latest achievements in process work. As in previous issues, we have a number of most interesting articles on various methods of procedure and allied subjects, and mingled with them is a host of first-class illustrations indicating the type and quality of work that can be accomplished by the various processes now available. To mention a few of the host of illustrations, attention may be directed to the frontispiece, a specimen of power-press printed copper etching by Bruckmann, of Munich, examples of work with the metzograph screen, the new four-colour process of Mr. C. G. Zander, and the spray-relief process of the aërograph which illuminates the front of the cover of the volume. The reader must, however, refer to the book itself if he wishes to revel in high-class illustrations, for no object would be gained in referring any more here to the numerous pictures.

In concluding, one cannot but congratulate all those concerned in the production of this really beautiful volume. The book should not only be in the hands of all process workers, but in the possession of photographers and others interested in book illustration.

Philips' Large Planisphere. Designed by H. Gewecke. (London: G. Philip and Son, Ltd.) Price 6*s.*

MOST students of the aspects of the heavens are familiar with the small circular planisphere having a revolving disc which can be adjusted to show the stars visible at any time of the year. The new planisphere now available is constructed upon the same plan as the earlier one, but its diameter is about twenty inches, and some changes have been made with the view of adding to its usefulness. The horizon can be taken off so that the whole of the chart can be seen if desired. A graduated strip is arranged across the chart, and by means of it the position of an object can be found when the right ascension and declination are known. The scale of right ascension on the outer edge of the circular chart is in degrees, but it would have been more conveniently expressed in hours and minutes in the usual way

The chart shows all the stars visible to the naked eye from the north celestial pole to 33° south of the celestial equator. The distortion is very great in some parts, and it is difficult to identify a few of the groups on this account and because the spots representing bright stars are so large. Fourth magnitude stars are represented by rings, and the effect is very unsatisfactory. A chart of this kind should aim at conveying a more or less faithful impression of the appearance of the stellar sky, but these white rings on a blue ground spoil the picture and ought not to have been introduced. Though the chart is said to have been "designed both for beginners and advanced students of astronomy," we are afraid that beginners would find it very confusing, and that working observers of the heavens would derive little real assistance from it.

Lehrbuch der Meteorologie. Second edition. By Prof. Julius Hann. Pp. 642. (Leipzig: Herm. Tauchnitz, 1905.) Price 24 marks.

IN the year 1901 the author of this volume published the first edition, and on its appearance it was universally announced as the "classic" of meteorological literature. The work itself was a veritable mine of information, and the host of reference to original sources made it an absolute necessity for anyone dealing with this science to have it in his possession.

We have now before us a second edition. In this the author has made considerable alteration. In the first place, the size of the volume, as regards amount of matter it contains, has been very much reduced, a host of original references have been dispensed with, and the subject is dealt with in a more brief form. So rapid has been the progress of meteorological science, and so many have been the changes in ideas on numerous fundamental issues, that in many places this matter has had to be completely overhauled. Thus, to take one instance, namely, the investigation of the upper air by means of kites, balloons, and *ballons-sondes*, new light has been thrown on the movements of atmospheric currents, and innumerable data collected relating to temperature, pressure, and other elements in the higher strata.

The above is one of many cases where reconstruction has been rigorously carried out. Further, the insertion of all this, the latest, material has necessitated a great number of new references, so that the present volume with regard to these may be considered as a supplement to the first.

Several new and useful tables have been inserted in an appendix, one of these being a table of mean monthly and annual temperatures of 143 places in different parts of the world.

In the text are eighty-nine figures, nine autotype plates, and fourteen charts. The get-up of the book is of the same high standard of order as that of the first edition, the paper and printing being all that could be desired.

The volume should be in the hands of everyone who is in any way interested in meteorology, and is another very valuable addition to our meteorological literature by the master of the subject.

The Uses of British Plants. By Rev. Prof. G. Henslow. Pp. vi+184. (London: Lovell Reeve and Co., Ltd., 1905.) Price 4*s.* 6*d.* net.

ABOUT forty years ago a book was published on the "Useful Plants of Great Britain," written by C. P. Johnson and illustrated by J. E. Sowerby. Judging from the few copies one meets with, there has not been in the past much demand for information of this nature, but there is some indication of increased interest being taken in economic botany. The arrangement adopted by Prof. Henslow, in which he follows the nomenclature and order laid down in Bentham's "British Flora," accompanied, too, by the same set of illustrations, makes this practically a companion volume. Owing to the cost of production or the discovery of better substitutes, several plants once grown in the British Isles for their products have gone out of cultivation; the dyes produced by Rhamnus, Genista, and Rubia have been superseded by aniline dyes, and very few woad mills remain; one of those still existing was described in NATURE, November 12, 1896; nettle-cloth is not likely to be revived unless the term is applied to the material produced from rhea or the Nilgherry nettle, two exotic Urticaceæ. Such productions, and the cultivation of certain plants formerly reputed to be efficacious, are mainly interesting on account of their historical association, and with these the author deals sufficiently fully; also he has given a good deal of space to the derivations of the Latin names. On the other hand, he might have enlarged with advantage in the case of those plants which are still cultivated or which are closely allied to plants of economic value. The book is restricted to flowering plants.

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.*]

Cheirality of Form of Crystals of Epsom Salt.

IN studying the optical behaviour of the optically active biaxial crystals of zinc sulphate ($ZnSO_4 7H_2O$) and Epsom salt ($MgSO_4 7H_2O$), I found that the rotation (which, the crystal being trimetric, is the same for each optic axis) was to the left in all the thirteen crystals that I prepared. I then turned my attention to the crystalline form, which affords a more rapid means of determination of the cheirality, and is, moreover, applicable to small crystals. In the case of Epsom salt, twenty-two crystals were examined; sixteen of them were found to be positive, six doubtful, while not one was found to be negative. The crystal accepted as positive is that of which a diagram is given in Watt's "Dictionary of Chemistry" (vol. ii., p. 150, diag. 282, 1883). In examining the form, the smallest of the faces $+P/2$ and $-P/2$ was looked for, and then considered as belonging to the set of small faces, even if, as occasionally happened, others of the same set were large. The cheirality of form of zinc sulphate crystals is not marked enough to permit of any certainty of identification. The reason for this constant selection by the substance of a particular one of the two possible forms is perhaps that the crystallisation may have been occasioned by particles of organic dust that are themselves cheiral.

H. C. POCKLINGTON.

Deposits on Telephone Wires.

AT East London, in the Cape Colony, one of the inhabitants recently complained that two telephone wires passing over his roof, an iron one, were seriously injuring it, and asked that they might be removed at once, and the building re-roofed at the cost of the Government. In support of his statements he referred to some lines of a whitish colour on the roof immediately under the wires. Many theories were advanced, one being that the moist sea air laden with salt had condensed on the wires, and that when the moisture had evaporated the salt had been shaken loose by the vibration and fallen on the roof, forming in time the lines referred to. The officials on the spot stated that they could taste the salt; but on some of the deposit being removed from the roof the iron was found to be quite intact. On the powder being analysed not a trace of salt or of any chloride, soluble or insoluble, could be found, and the result of the analysis showed the deposit to be nothing but silica, with very faint traces of iron and lime. The sand, a fine powder, must have been blown on to the wires when they were damp, and on evaporation of the moisture taking place have fallen on the roof owing to the vibration of the wires.

A SUBSCRIBER.

Sounding Stones.

APROPOS of Mr. Tingle's letter of last week, it may be of interest to note that fairly good specimens of "sounding stones" occur at Corick, on the borders of the barony of Erris, co. Mayo. The bridge at this village is known as the "musical bridge," from the fact that stones which form the coping of the parapet give out a musical note when struck with a piece of stone or metal.

T. DILLON.

Ballina, co. Mayo, January 8.

MORE ABOUT JAPAN.

THE interest that has been awakened in Japan through her wonderful exploits in the war against Russia makes a book on her systems of fighting—both ancient and modern—particularly welcome when military experts are still marvelling at the perfection of her organisation in war time, bringing as it has done the success which follows as the natural result of attention to the smallest details.

In "The Fighting Man of Japan"[1] we have a very interesting little book by Mr. F. J. Norman, who is eminently fitted to discourse on the "Exercises and Training of the Samurai," having passed many years in Japan as instructor to some of the military and civilian colleges. As the author claims the indulgence of his readers in his preface, it is perhaps hardly fair to notice the grammatical errors that occur here and there, and after all they do not alter the interest of the book; but it would have been advisable to omit the blatant advertisements of a certain jujitsu school both at the beginning and end of the book, for the especial benefit of which the author confesses to have written his work.

The book is divided into four chapters, each of which deals with a separate subject. The first gives a rapid sketch of Japanese military history dating from 1543, which is as far back as our European knowledge of it extends, and incidentally giving a description of the spirit which animated the "Samurai" of old—and a very different one, it would appear from Mr. Norman's account, from that which guided our knights and crusaders; but East is East and West is West, and however much the Orientals assimilate our ideas of civilisation and education, the spirit will remain unaltered; their ideals and ours will for ever be as far distant as the poles. One example of this is enough:—"The bushi (or warrior) . . . held to the maxim that 'all is fair in love and war,' and scrupled not to resort to devices of the most dishonourable kind in order to gain a desired object"; and in the case of a hand-to-hand fight, were his opponent to fall or lose his sword this was regarded as the best possible occasion for hacking at him while he was down and unable to defend himself.

Mr. Norman considers the Dutch to have been the first to attempt to train a Japanese naval force, although he allows that the Portuguese and Spanish friars of the sixteenth century must be credited as the first instructors of the "Far Easterners" in the art of shipbuilding and the science of navigation. It is a remarkable fact not generally known that in the fifteenth and sixteenth centuries many modes of self-defence were practised by the Dutch that were almost identical with those used by the Japanese in the art of jujitsu. The question is, Did the Dutch take their ideas to Japan, or were they taught by the Japanese? A very interesting book illustrating many modes of self-defence that are the same as those used to-day by the Japanese was written early in the sixteenth century by one Nicolas Petter.

Speaking of the Portuguese and Spanish friars, the name of St. Francis Xavier stands out above all others on account of his wide personal influence among the Japanese, and this clever Jesuit made more converts to the Roman faith than have ever been made since by the missionaries of any other creed. That he loved the Japanese is proved by his writing to France early in the sixteenth century:—"These people (meaning the Japanese) are the delight of my soul." Unfortunately, his good influence was entirely destroyed by the arrival of European traders who exploited the unsuspecting Orientals in such an unprincipled way that they rose *en masse* and massacred almost every one of the foreigners, and after this regarded them with such distrust and detestation that it was many years before they could regain any foothold in the country.

An interesting chapter is that on the education of the naval and military officers, showing what a very fine sieve has to be passed through before the aspirants are thought capable and worthy of defending their country either as sailors or soldiers. The system of the fine sieve is of course applied to the officers only in each service; the rank and file receive a sound practical training, but "little or no attention is paid by the officers to the teaching of parade and show movements to their men. . . . Women not occupying the position in Japanese Society they do in the West, little or no pains are taken by the military authorities of the Mikado to cater for their amusement, and the result is one never sees any 'Agricultural Hall tomfoolery' in Japan."

FIG. 1.—Corps à Corps à la Japonaise. From "The Fighting Man of Japan."

The chapter on "Kenjutsu" deals with the affection the Japanese have always felt for the sword, and the great cleverness they exhibit when using it in a hand-to-hand fight. This cleverness would appear to be the result of much practice in "kenjutsu," for which a "shinai," or practice sword, is used, made from four strips of bamboo bound together at the

[1] "The Fighting Man of Japan." By F. J. Norman. (The Training and Exercises of the Samurai.) Pp. xii+79. (London: Archibald Constable and Co., Ltd., 1905.) Price 2s. 6d.

handle with a strong leather covering. One illustration here reproduced represents a *corps à corps à la Japonaise*, and, judging from the photograph, it is allowable to combine a trip with a hit, as one fencer is trying to knock his opponent over with a hit at the neck, at the same time taking his leg from under him with a sort of jujitsu trip.

The last chapter describes the sumō or wrestling of the Japanese—to many a most repulsive spectacle on account of the enormously fat bodies of the particular class of men who follow this profession; but a fight between two expert sumōtori is for the Japanese an event of almost national importance, and they flock in thousands to the huge amphitheatre in the centre of which the tussle takes place. The second illustration shows two combatants in a crouching position waiting for a chance to spring at each other.

The last few pages of the book are devoted to jujitsu, but as nothing new is said on this subject and the photographs are very poor there is no need to enter into detailed description. For the rest, a very pleasant hour may be spent over the perusal of this interesting little book. E. W.

FIG. 2.—Tachi-ai, or watching for an opening. From "The Fighting Man of Japan."

THE MOTION OF THE MOON.[1]

PER ARDUA AD ASTRA should be the motto for a cultivator of the lunar theory. There is no austerer road to prove oneself a man of mettle. *Incredibile studium atque indefessus labor* was Euler's summary upon it, and improvement of method since Euler's time has diminished neither *studium* nor *labor*. The work now brought to completion has occupied Prof. Brown (and a computer) since 1895, almost to the exclusion of other researches, and for some years before that he was busied with developing its methods. Moreover, the present stage is only a level whence he can take breath to proceed.

It is a fact to remember in mathematical astronomy that problems mathematically identical are often astronomically opposite as the poles. The theory of the moon from a geometer's point of view is simply the theory of one of the planets. It is the special values of the constants alone which distinguishes the case. The astronomer seeks a correct ephemeris, but a mathematical instinct seeks to solve the question as a case of the problem of three bodies, and Delaunay's two enormous volumes will show what labours may be undertaken to obtain full literal development of the moon's coordinates which shall be approximate enough to meet the needs of the observer. Unfortunately the expressions when obtained are in many cases so imperfectly convergent that they give neither a solution of the three-bodies-problem nor do they surpass the observations in precision, as calculation should. It seems that unless some wholly new device is found we must be content to separate the problem into two parts, leaving literal developments for special mathematical researches throwing light upon the problem of three bodies, such as G. W. Hill's investigations of periodic moons of different mean motions, and making the developments essentially numerical when they are designed to form the basis for tables, although by so doing the former part loses all observational interest and the latter nearly all that is mathematical. Prof. Brown's theory is neither wholly numerical like that of Hansen nor wholly literal like that of Delaunay. The mean motion alone is treated as numerical, the other constants as eccentricities and inclination appearing in literal form. This was a plan Adams always urged, and from time to time he made considerable studies to give effect to it. When there otherwise remain four parameters according to powers of which each coefficient must converge, it is clearly an immense gain to omit a fifth when that fifth is answerable for all the worst cases of slow convergence; and while the mean motion may be considered known, it is hardly the case with the other constants, the lunar eccentricity, for example, and the ratio of the mean distances of the sun and moon being uncertain within the limits over which debate ranges, so that it is essential that the calculator should not be tied to a single set of elements at the outset.

Besides this idea Prof. Brown's research rests upon two clear and solid supports. First is the use of rectangular moving axes of reference, which he points out—and otherwise it seems to have passed from memory—was developed by Euler. But perhaps as much as anything his success is due to the brilliant transformation of the equations of motion given by G. W. Hill. It detracts not the least from Prof. Brown's achievement that his main ideas and methods are derived from earlier masters. The tools were ready to hand for one who had the learning and judgment to use them. Anyone who has faced a similar task knows that there remain abundant calls for resource and invention, as well as for comprehensive patience, in fitting given plans together and working them out abreast in every remote ramification of a subject, without fidgeting about "originality."

The work is not yet at a stage to put to proof by calculation of an ephemeris, which indeed would need the calculation of lunar places for a great many years backwards and forwards to prove that it is superior to Hansen, or to Hansen *plus* Newcomb. But even now it is almost certain that it will be so. First its methods are more intelligible and above

[1] "Theory of the Motion of the Moon." By Ernest W. Brown, F.R.S. In the Memoirs of the Royal Astronomical Society, vols. liii., liv., lvii.

board than those of Hansen, and so there is a better chance of correcting the errors, which no mortal can altogether escape. Next the constants are not stereotyped, and if it is necessary to change them the effect can be made visible; and for a searching piece of evidence, Prof. Brown has shown already that his calculations remove the last shred of disagreement between the calculated and observed motions of the moon's apse. Finally, in a recent analysis of the Greenwich observations back to 1750, Mr. P. H. Cowell has given a most striking verification of all Prof. Brown's coefficients.

When Prof. Brown constructs his tables there is an error Hansen fell into which he may be trusted to avoid. In order to improve the agreement with observation, Hansen introduced a certain empirical element. An empirical correction is better than nothing, but it cannot be too clearly recognised that until it is furnished with a theoretical basis it is no more than a mathematical *memoria technica*. Certainly its place is not in a set of tables, the sole function of which is to expose correctly and fully the consequences of a clear theory and definite elements, with the view of testing the one and amending the others. R. A. S.

THE CONTROL OF THE GAS SUPPLY OF THE METROPOLIS.

THE notification of the metropolitan gas referees just issued differs in several respects from that for the preceding year, a change necessitated by the provisions of the London Gas Act, 1905. For some years past the London gas companies have been asking for the revision of their Acts, with reference more especially to the system of testing to which their gas is subjected. In the early days of gas supply, when there was free competition and the consumer had the choice of more than one company, no testing was regarded as necessary, but when, owing to the amalgamation and consolidation of the gas companies, the supply became a monopoly, a system of testing the purity and illuminating power of the gas was instituted. The whole of the arrangements for testing London gas, with the exception of one or two points specially laid down in some of the Acts, are left to the discretion of the gas referees, originally appointed under the City of London Gas Act, 1868. It was alleged by the companies that the requirements of the referees were too stringent and out of touch with the modern developments of gas manufacture. In January, 1904, a departmental committee of the Board of Trade was appointed to inquire and report as to the whole system of gas-testing in the metropolis. At the inquiry the committee heard evidence from the gas referees, and from representatives of the London County Council, the Corporation of London, and each of the three gas companies concerned. It is noteworthy that no actual consumer was heard, although on one of the most important points dealt with by the committee, the question of sulphur impurity, the committee in its report says, "It does not appear that any complaints are made by the inhabitants of other districts on the ground that the gas thus unpurified causes injury to health or is more destructive to articles such as leather, &c., than it is supposed to be in London."

The report of the committee was almost wholly favourable to the companies. The mode of testing for sulphuretted hydrogen is to be relaxed, a test lasting three minutes being substituted for one spread over 15 hours, and all sulphur compounds other than sulphuretted hydrogen may be, and henceforth will be, left in the gas. The evidence of the companies as to the amount of sulphur impurity under the new conditions was to the effect that an average of 35 grains per 100 c.ft. or under might be expected, with the possibility of an occasional rise to 40, the maximum under the Acts just repealed being 17 grains in summer and 22 grains in winter. The figures for the amount of sulphur present in the gas supplied by the South Metropolitan Company during December last throw an instructive light on the value of this evidence, the weekly average increasing from 40.8 to 44.6 grains per 100 c.ft. with a single maximum of 61.3. On one occasion the Commercial Gas Company surpassed even this figure with a maximum of 70.2. It is clear, therefore, that the gas now to be supplied to London may contain about double the amount of sulphur contemplated by the departmental committee, and this is of interest in view of the fact that a Bill is now before Parliament promulgated by various provincial gas companies asking to be placed in the same position as the London companies as regards the removal of sulphur restrictions.

In one point the report of the departmental committee was favourable to the consumer. It recommended that the standard burner for testing the illuminating power of all qualities of gas should be the burner at present in use, the Sugg's London Argand No. 1, the gas to be burnt at the rate of five feet per hour. The gas referees in their present notification disregard this recommendation, and prescribe a burner devised by the engineer to the South Metropolitan Gas Company. The practical effect of this will be to increase the nominal illuminating power of the gas supplied by those companies having a 14-candle standard. It will be seen, therefore, that the new conditions are wholly favourable to the companies.

There remains one new point in the gas referees' notification, the prescription of a method of determining the calorific power of gas. The calorimeter, which has been devised by Mr. C. V. Boys, appears to be a distinct advance over its predecessors of the same type, and when it is installed in the testing stations systematic measurements of the calorific power of London gas will, for the first time, be on record, and will be available for the next battle on the gas question, calorific power *v.* illuminating power.

PROF. C. J. JOLY, F.R.S.

THE lamentable death of Prof. C. J. Joly at the early age of forty-one closes a career which was likely to influence favourably the mathematical side of astronomy. But his tenancy of the post of Royal Astronomer of Ireland and Andrews Professor in the University of Dublin was, alas! too short for him to make his individuality felt in the science with which he was connected by his occupancy of the chair, that has of late been held by Sir Robert Ball and Dr. Arthur Rambaut. The traditions of the office, and it may be the interrupted work of these astronomers, would naturally compel him for a time to follow certain definite lines which the previous occupants of the chair had approved. But his work in the department of pure and applied mathematics was of a high order and affords abundant evidence of originality and capacity.

From the time that Prof. Joly entered Trinity College, Dublin, his academic career was marked by his devotion to natural science, and mathematical scholarships and studentships were the natural preliminaries that led to a later fellowship. In this position he distinguished himself as a successful teacher of advanced science, but in 1897, when Dr. Arthur Rambaut was appointed to the office of Radcliffe observer, Dr. Joly

succeeded to the chair of astronomy, and his lectures and teaching were necessarily more limited.

Prof Joly will be best remembered by his loyalty to the memory of Sir William Hamilton, of whose "Manual of Quaternions" he prepared a new edition. He endeavoured to promote the study of this branch of mathematics in various ways, by his original writings, in which he sought to bring projective geometry within this special method of treatment, and by the support he gave to the International Association for Promoting the Study of Quaternions and Allied Systems of Mathematics. We are also indebted to him for the third edition of Preston's "Theory of Light," while many papers in the *Transactions of the Royal Irish Academy* testify to his industry and power.

Prof. Joly was elected a Fellow of the Royal Society in 1904; he acted as secretary to the Royal Irish Academy from 1902, and was a member of many learned societies. He was a delightful companion, with a memory well stored with anecdotes of Hamilton, of Airy, of Robinson, and many another worthy; as a teacher he had the power of interesting his class and awakening their energies, and all too soon he is removed from a circle which he loved, and a society that his abilities adorned. W. E. P.

NOTES.

SIR MOUNTSTUART E. GRANT-DUFF, G.C.S.I., F.R.S., who died in London on Thursday, January 11, at seventy-six years of age, will long be remembered by his "Notes from a Diary"—a series of fourteen volumes full of chatty reminiscences extending from January, 1851, to January, 1901. Many distinguished men of science, both at home and abroad, were met by the author during this period of fifty years, and in each of the volumes of his diary are preserved interesting anecdotes and pithy remarks made by his acquaintances in the scientific world. Sir Mountstuart was fond of natural history, and particularly of botany, to which he devoted much attention. The 117th volume of the *Botanical Magazine* was dedicated to him by Sir Joseph Hooker "as a slight acknowledgment of the valuable services which you rendered to botany and horticulture when Under-Secretary of State, first for India and then for the Colonies, and lately when Governor of the Madras Presidency." He was president of the Royal Geographical Society from 1889 to 1893, and a member of the Senate of the University of London in 1891. By his spirit of investigation and sympathetic interest in scientific work—attributes not possessed by many statesmen—Sir Mountstuart secured the kindly feelings of all who are concerned with the study of nature.

WE regret to see the announcement that Dr. H. J. P. Sprengel, F.R.S., the inventor of the mercury air-pump which bears his name, died on Sunday, at seventy-two years of age.

A MEMORIAL to the late Dr. George Salmon, F.R.S., Provost of Trinity College, Dublin, was unveiled on Friday, January 5, in the national cathedral of St. Patrick's, with which Dr. Salmon was officially associated during the best years of his life. An account of the ceremony appeared in the *Kensington Express* of January 5, from which we learn that the memorial consists of two windows in St. Peter's Chapel, the work of Mr. C. E. Kempe, depicting scenes in the career of St. Peter, and a medallion of Dr. Salmon, by Mr. A. Bruce-Joy, with a Latin inscription of which the following is a translation:—"That the name of George Salmon may abide in the memory of mankind this monument has been erected by his faithful friends and grateful pupils. Fellow of Trinity College, Dublin—afterwards Regius Professor of Divinity, and finally Provost, he was for thirty-three years Chancellor of this Cathedral Church. A mathematician both adroit and powerful, he probed with keen insight the beginnings of Christian history, and specially the origin of the New Testament Books; as teacher and councillor he was unwearied in the service of the Irish Church. Shrewd, courteous, serious, kindly. He was born in 1819, and died in 1904. The fear of the Lord is the distinction of wisdom, and before honour is humility."

A GIFT of 1000*l.* has been received by the Royal Botanic Society from a fellow of the society, Dr. Robert Barnes.

THE widow and children of the late Dr. von Siegle, of Stuttgart, have presented 50,000 marks in memory of the deceased to the chemical institute of the University of Tübingen.

PROF. EMIL FISCHER has been elected president of the German Chemical Society for this year. Prof. S. Gabriel, Berlin, and Prof. W. Städel, Darmstadt, have been appointed vice-presidents in succession to Profs. O. N. Witt and H. Caro, who are retiring, whilst Drs. F. Mylius and A. Bannon have undertaken the duties of the secretaryship in succession to Drs. C. Schotten and W. Will. The post of librarian to the society, which hitherto has been held by Prof. Gabriel, has yet to be filled by the president. The society's funds are estimated at 762,635 marks, whilst the A. W. von Hofmann fund has nearly reached 45,000 marks.

AT Christiania on December 29, 1905, there gathered together under the presidency of Mr. John Sebelien a number of men interested in questions of agriculture and scientific subjects to celebrate the acquisition of a national independence in the past year. A fund was opened for the purpose of fostering research in the subject of Norwegian agriculture, to which fund all Norwegians, both at home and abroad, are invited to subscribe. When the sum of 15,000 kr. (833*l.*) has been subscribed, it is proposed to invite prize essays on particular questions, and to reward Norwegian scientific work in certain branches of learning; and later still it is intended financially to aid research work in agricultural science directly.

A REUTER message from Naples states that on January 10 three streams of lava were pouring down Vesuvius on the side upon which is situated Cook's funicular railway. The railway was seriously damaged, and the lava had reached the lower station. At the same date Etna was also active, a large amount of volcanic ash being ejected from the principal crater.

THE Geological Society of London will this year make the following awards of medals and funds:—Wollaston medal to Dr. Henry Woodward, F.R.S.; Murchison medal to Mr. C. T. Clough; Lyell medal to Prof. F. D. Adams, of Montreal; Prestwich medal to Mr. W. Whitaker, F.R.S.; Wollaston fund to Dr. F. L. Kitchin; Murchison fund to Mr. H. Lapworth; Lyell fund to Mr. W. G. Fearnsides and Mr. R. H. Solly; Barlow-Jameson fund to Mr. H. C. Beasley.

DURING this month and next an exhibition of studies and effects obtained by current methods of colour photography will be open at the office of the *British Journal of Photography*, 24 Wellington Street, Strand, W.C. The

aim of the exhibition is to show results produced without the intervention of half-tone blocks, or the aid of printing machines. Flower and fruit studies, portraits, and landscapes are represented by three-colour prints produced by various processes, and among the subjects of transparencies are stained glass windows, diffraction grating spectrum, micro-organisms and crystals, butterflies, and a Lippmann spectrum.

WE learn from the *British Medical Journal* that an international exhibition will be held under the patronage of the King of Italy at Milan on the occasion of the opening of the Simplon Tunnel. It will include a section of hygiene embracing general hygiene, public health, sanitary services, rural and industrial hygiene. The exhibition will be open from April to November. The third International Congress of Medical Electrology and Radiology will be held at Milan on September 5–9. Information as to membership may be obtained from Dr. Herschell, 36 Harley Street, London, W.

THE *Weekly Weather Report* of the Meteorological Office for the current year, which commenced with the issue of the report for the week ending Saturday, January 6, on Thursday last, has some novel features. The verbal description of the week's weather is placed in a more prominent position on the front page, and a table of the accumulated temperature, rainfall, and sunshine in the various districts for the aggregate of weeks from the commencement of the current season, winter, is given, in addition to the usual tables for the week and the aggregates from the commencement of the calendar year. In the table of detailed statistics for stations the groups of names included in the meteorological districts are subdivided to facilitate the compilation of values for the divisions of the country adopted for agricultural purposes by the Board of Agriculture. There is no change in the part of the report devoted to the daily summary of weather over Europe, but at the end, in place of the tables of addenda and errata, there appears an entirely new table of observations in the upper air. The first issue includes the observations by Mr. W. H. Dines at Oxshott on the 3rd, 4th, and 5th of the month, the days of international cooperation, and those of a kite ascent by Mr. C. J. P. Cave at Ditcham Park on the first day of the year. The last disclosed a remarkable temperature inversion, obviously in the region of junction between an eastern and western supply of south-easterly wind over the British Islands as shown on the maps. The juxtaposition of these observations and the maps showing the distribution of pressure over Europe make the inclusion of the week's results for the upper air in the report a very interesting feature, and it is to be hoped that in succeeding weeks the new development may be as fortunate as in its first number.

THE *Times* of January 6 contained an interesting account of despatches which have been received from the American travellers Mr. R. L. Barrett and Mr. Ellsworth Huntington, who are conducting an expedition in the Tarim basin. The explorers have fully studied some of the river systems between Khotan and Keriya, and made additions to our knowledge of the Tarim basin which bring out the striking resemblance of the basin to an inland sea. The examination of the ruins of abandoned villages appears to have thrown a good deal of fresh light on the gradual desiccation of Central Asia within historic times.

IN the issue of NATURE for August 13, 1903 (vol. lxviii. p 347), an illustrated account was given of the tetrahedral cell kites designed by Dr. A. Graham Bell. We learn from a Canadian contemporary, the *Halifax Herald*, that Dr. Bell thinks he is a step nearer the attainment of his ambition to perfect a flying machine based on the tetrahedral kite principle. A new kite, constructed of 1300 tetrahedral cells, having a total area of 752 square feet of silk, making a supporting surface of 440 square feet, carried to a height of 30 feet, in a recent trial, not only its own weight of 61 lb., but also a load comprising flying lines, dangling ropes, and a rope ladder, making 62 lb. more, together with a man weighing 168 lb., a total altogether of 291 lb.

IN the *Engineering and Mining Journal* of New York of December 23, 1905, there is a reproduction of the selected design for the United Engineering Building, the building presented by Mr. Andrew Carnegie to the American Institute of Electrical Engineers, the American Society of Mechanical Engineers, the American Institute of Mining Engineers, and the Engineers' Club. The site has a frontage of 125 feet and a depth of 100 feet. The contract for construction was signed in July, 1905, and the contract limit is fifteen months to the date of expected completion. The building will serve the convenience of the four societies mentioned, and is also to furnish accommodation for other societies that have engineering or some other department of science as their principal object.

THE disaster at Charing Cross Station at 3.30 p.m. on December 5, 1905, caused by the sudden snapping of the tie-bar in the truss next to the wind-screen at the southern end of the station has caused much perturbation in engineering circles, and is dealt with at considerable length in the engineering journals. An excellent illustrated description of the roof is given in the January issue of the *Engineering Review*, and photographs of the fracture of the tie-bar are given in the *Engineer* and in *Engineering* of January 12. The tie-bar was nominally $4\frac{1}{2}$ inches in diameter, and it was found that at the point of fracture there was an imperfect weld, the iron having been united properly over only about one-third of the section, so that the stress at that point was three times as great as it was designed to be. In fact, it was more than this, for the sound metal, being at one side of the line of tension, was subject to a bending force, and the state of affairs was somewhat similar to a notched bar under bending stress. The verdict given at the coroner's inquest on January 8 was to the effect that the accident was due to the breaking of the tie-rod through an unforeseen flaw, and that no blame was attached to any of the railway company's officials.

WE have received a copy of part v. of the "Marine Fauna of Ireland," published by the fisheries branch of the Irish Department of Agriculture, in which Mr. W. M. Tattersall discusses the isopod crustaceans. Some difficulty has been experienced in getting a good series of these creatures owing to the fact that the majority are not pelagic, and are, therefore, not taken in tow-nets. Nevertheless, the author describes no less than ten species as new, half of which are made the types of new genera, while one is regarded as representing a new family.

AMONG the numerous and varied contents of the *Proceedings of the Indiana Academy* for 1904, attention may be directed to a remarkably fine series of photographs of the nests and eggs—in some instances also the young—of a number of the birds of the district in their natural surroundings. Two of these are of special interest as showing the nest of the little green heron, first with eggs and then with the downy young. In many cases great difficulty

must have been experienced in getting the camera into position, and in some instances the whole side of a tree-stem has been cut away in order to show the eggs. Indian ceremonies form the subject of several articles at the close of the volume.

IN the course of an account of the Hastings Museum, Worcester, published in the December (1905) issue of the *Museums Journal*, the curator, Mr. W. H. Edwards, takes occasion to emphasise the extreme importance of the development of local collections. "If there are among my hearers," he observes, "any who are in the happy position of having charge of a newly started museum may I strongly urge them to make their local, or county collections, in all branches, as complete as possible, as no opportunity should be lost in acquiring specimens which have any bearing on the past history of a district." These views accord with those that have on more than one occasion been advanced in our columns. In a second article in the same issue it is somewhat amusing to find an author urging that a proposed new institution should be, as regards the exhibited series, "unlike ordinary museums, where, as far as possible, every species, and even varieties, are represented." In how many museums, "ordinary" or otherwise, is such a series displayed, and where is there one which would hold it?

THE whole of parts iii. and iv. of vol. xxxiv. of Gegenbaur's *Morphol. Jahrbuch* are occupied by a long essay on the tympanic region of the mammalian skull, by Dr. P. N. van Kampen, of Amsterdam. The article is an expansion of an address delivered by the author in Amsterdam in 1904. Within the space of a brief paragraph it is quite impossible to do justice to its contents, and it must in the main suffice to direct the attention of those interested in the subject to the mine of information it contains. It is interesting, however, to note that the author regards the primitive condition of the mammalian tympanum as consisting of a small and often incomplete ring, with, at most, an imperfect ventral wall to the tympanic cavity, and that a close approximation to this condition is presented by Ornithorhynchus. The tympano-hyal is the characteristic mammalian element in this region, but the ento-tympanic is also regarded as peculiar to the group, and unrepresented among the lower classes. As regards the tympanum itself, the author considers it to be a special development from one of the elements—probably the supra-angular—of the reptilian compound lower jaw. The features presented by the region are held to be of considerable value in classification.

THE Carnegie Institution of Washington has published a volume of 193 pages, by Profs. W. O. Atwater and F. G. Benedict, giving a description of a respiration calorimeter with appliances for the direct determination of oxygen. The apparatus has been in process of development for twelve years, and has been designed with a view to a proper understanding of the metabolism or transformations of matter and energy in the body, by obtaining a knowledge of both total income and total outgo. After describing the calorimeter and the methods adopted for the calculation of results, the experiments with man are considered. Since the completion of the new apparatus, twenty-two experiments with five different subjects, covering a total of sixty days, have been conducted. These experiments lasted from one to thirteen days, during which time the subject remained enclosed in the calorimeter chamber. In general, each experiment was preceded by a preliminary period outside the chamber, during which the subject was given the special diet to be tested, and his habits of life were so modified as to conform with those to be followed in the chamber. The following determinations of intake and output of material were made in the experiments:—The intake consists of food, drink, and oxygen from respired air. The amounts are determined by weighing. The output of material consists of products of respiration and perspiration, urine, and fæces. In the measurement of intake and output of energy the intake is derived from the potential energy, *i.e.* heats of combustion of the food. The output consists of sensible heat given off from the body, the latent heat of the water vapourised, and the potential energy, *i.e.* heat of combustion of the unoxidised portions of the dry matter of urine and fæces. In certain cases, *e.g.* work experiments, a portion of the output is in the heat equivalent of external muscular work.

IN the *Bulletin du Jardin impérial botanique* of St. Petersburg, vol. v., part iv., Mr. N. Busch describes a new Aconite, section Napellus, and a new Delphinium. Both plants were grown in the garden from seed collected in Tibet by Mr. W. T. Ladygin. A list of the known species of Iris from Turkestan is contributed by Mr. and Mrs. B. Fedtchenko, including several new species all belonging to the section Juno.

DR. B. M. DUGGAR, formerly a member of the scientific staff of the United States Department of Agriculture, has for some years been experimenting on better methods of propagation of mushrooms than the present chance method depending upon natural virgin spawn. His latest results are published in Bulletin No. 85 of the Bureau of Plant Industry. No more certain method for germinating the spores has been devised than that discovered by Dr. Margaret Ferguson of adding a portion of mycelium to the culture; but the latest experiments proceed on a new line of producing virgin spawn from pure cultures. A portion of the inner tissue of a young selected mushroom is transferred to a sterilised compost in tubes, and the mycelium produced in this way under pure culture conditions is sown on bricks of manure.

TWO recent numbers of the *Transactions of the Academy of Science of St. Louis* deal with botanical subjects. In vol. xiv., No. 7, Mr. B. F. Bush presents a summary of the species of Tradescantia from Texas, in which he adopts the view that certain forms referred to *Tradescantia virginiana*, notably *Tradescantia reflexa*, should rank as independent species. In vol. xv., No. 1, Dr. L. Wittmack writes on our present knowledge of ancient plants. He mentions that some of the wheat found in Egyptian sarcophagi and in Asia Minor shows the characters of the wild grain, and that the barley is of the variety *hexastrichum*, having six rows in the ear. From Peruvian sepulchres two kinds of bean have been identified as the Lima bean, *Phaseolus lunatus*, and the French or haricot bean, *Phaseolus vulgaris*. The author pronounces in favour of American origin for the latter.

IT will be known to readers of NATURE that one of the principal objects before the botanical congress held in Vienna last June was to formulate satisfactory laws for regulating systematic botanical nomenclature. A concise account of the main questions under dispute, and of the alternative suggestions put forward, is given by Dr. H. Harms in *Naturwissenschaftliche Wochenschrift*, December 10, 1905. There were three principal points of contention,

these being the earliest date for reference of priority, the extent to which priority of genus name should be observed, and how priority of specific name is to be decided. The year 1753, in which Linnæus first established his system of binomial nomenclature, was accepted as the critical date; the difficulty with regard to genera was settled by the confirmation of a list of names that are too well established to be superseded, while the decision in the matter of specific names was a compromise between the German practice of adopting the earliest name and the Kew rule that favours the first correct binomial.

THE growing of Egyptian and other varieties of cotton is, says a writer in the *Pioneer Mail*, being carried on steadily in Upper Sind. It is indicative of the difficulty of forecasting the future of a transplanted variety that "Sannovitch," the finest of the Egyptian varieties, but regarded as the most delicate of those experimented with, has suffered the smallest amount of deterioration in staple from the quality of the Egyptian grown product, and that Mitaffifi, which is considered the most robust, has shown the greatest amount of deterioration. The general results must, however, be considered as satisfactory in yield as compared even with the Egyptian crop, and by the figures the best Egyptian variety should prove 250 per cent. more profitable to the cultivator than the indigenous Sindhi variety.

ACCORDING to a writer in the *Journal of the Society of Arts*, the rubber industry continues to expand rapidly. The imports of rubber last year were exceptionally large, and throughout 1905 the price was better than in the preceding year. It may be expected that before very long the supply will be ample for all demands. Not only are there immense tracts of rubber which remain untouched in Liberia and elsewhere, but the cultivation of the rubber tree is being rapidly extended. Java, for example, is planting extensively, and within the next six or eight years the exports from that island are likely to be very large. In Ceylon, too, and the Malay Peninsula, considerable tracts of country are being planted with rubber. The way in which the tree adapts itself to the various climatic conditions obtaining in different countries is almost unique in tropical cultivation.

OF the life of a born naturalist no better example could be given than the account of the late Prof. Federico Delpino contributed by his pupil Borzì to the *Atti dei Lincei*, xiv. (2), 9. Born at Chiavari (Liguria) on December 27, 1833, Delpino's delicate state of health resulted in his spending much of his early life in a garden, where he soon became absorbed in observing ants, wasps, and flowers. In 1850 he commenced, by his own choice, a course of mathematics at the University of Genoa, but his love of botany prevailed, and he determined to make that subject his life work. After a sea voyage to the east, which gave him an opportunity of making a collection of the flora of the Dardanelles, he was employed in office work under the Minister of Finance at Turin, and later (1865) at Florence, where he soon resigned his post to take a subordinate assistant's position in the botanical museum. Four years later he was appointed professor at the school of forestry at Vallombrosa, and in 1875 he became associate professor of botany at Genoa. Later he held appointments at Bologna and Naples. He died on May 14 of last year. Delpino, who was entirely self-taught, became one of the pioneers in the study of vegetable biology. He was an ardent opponent of Darwinism, although a study of Darwin's work on orchids led to his first paper on fertilisation of the Asclepiadaceæ, published in 1865. Other important contributions dealt with the relations between plants and insects, particularly ants, and several of his results were confirmed by the observations of Belt in Nicaragua. In botanical geography he published writings on the distribution of the Ranunculaceæ, and on the relations between Arctic and Antarctic flora. Several of his writings have been mentioned in the "Notes" columns of NATURE up to quite recently. Another account of his life is given in the *Rendiconto* of the Naples Academy for May and June, 1905, and differs in one or two points of biographical detail from the preceding one.

WE have received a copy of the twelfth annual report of meteorology in Mysore, for the year 1904, compiled by Mr. J. Cook, director of the service. It includes the results obtained at the observatories of Bangalore, Mysore, Hassan, and Chitaldrug, with diagrams showing the range of the principal elements; also mean values for the twelve years 1893–1904. The data for this important Indian area are very carefully worked up, and the volume contains a large amount of valuable statistics.

THE tides of the North Sea have within recent years been the subject of investigation by Mr. J. P. van der Stok, and the results have been published in three papers by the Netherlands Meteorological Institute, "Études des Phénoménes de Marée sur les Côtes Neerlandaises" (Utrecht: Kemink & Zoon, 1905). The first of these papers consists of an analysis of the variation in the level of the sea. The second deals with the results of observations, made on board the Netherlands lightships, of the tidal currents; and the third contains a table of these currents, the corresponding velocity and direction of the wind at five different stations, and the date of the new and full moon for every month up to 1952. Mr. Stok more particularly directed his investigation to the horizontal movement of the water and the rotatory currents in the North Sea. There are two subjects in connection with the tides of the North Sea that more particularly require consideration—the effect of the tidal wave of great length moving along the coast inclined to the direction of its propagation; and why the wave that comes from the north-east of Shetland is propagated principally along the coast of Scotland. This, he suggests, is due to the rotation of the earth. Mr. Stok considers that the tides of the North Sea are well worth the attention of physico-mathematicians interested in hydrodynamics, as they afford a model for the study of the mechanics of the tides.

IN a paper on fluorescence (*Journal de Physique*, December, 1905), M. G. Camichel deduces from experiments and theoretical reasoning connected with them that the coefficient of fluorescence of a fluorescent substance remains constant during the period of fluorescence, at any rate under the conditions of the experiments.

IN the *Journal de Physique* for December, 1905, MM. Bouasse and Berthier discuss the elongation of wires by flexion, in particular in connection with the property that a wire which is incapable of being elongated more than 0·1 per cent. by simple traction can be lengthened by as much as 10 per cent. or 20 per cent. by bending. Observations of the changes of microscopic structure, as well as of the torsional rigidity of the wire at various stages of the processes, seem to indicate that this discrepancy is attributable to want of homogeneity in the wire, the effects of which disappear when the deformation is made to take place point by point along the wire.

IN the *Bulletin des Séances* of the French Physical Society, M. E. Haudié gives a brief illustrated account of

the method of determining the magnification of an astronomical or Galilean telescope by photography. The telescope is placed in front of a camera pointed at a distant object (a church spire), and measurements of the telephotograph thus obtained, as compared with the picture obtained with the camera alone, give the magnification.

OF the many important topics discussed in the *Economic Journal* for December, 1905, we find a note of eight pages on political economy in Germany, by Prof. G. Cohn, of Göttingen. In it we learn that thirty or forty years ago there were two schools of political economy, namely, on the one hand, the Free Traders, whose science was confined to a few very elementary principles and who appealed to the people, and, on the other hand, the economic teaching of the universities. At the present time the universities, strengthened by the high degree of freedom which their professors enjoy, play an important and ever-increasing part in determining public opinion on economic questions throughout the Empire. Indeed, the author concludes:—"We do not claim too much for our German Political Economy and our German Universities when we say that the spirit which rules them is as wide and many sided as it is active and far seeing."

FROM the point of view of the disintegration hypothesis of the nature of radio-activity, a brief note by P. G. Costanzo in the *Bolletino Mensuale* of the Italian Meteorological Society (vol. xxiv., p. 25) is of interest; it is stated that several lavas and solid deposits from Vesuvius and the solfatara of Pozzuoli which, on examination, were found not to exhibit any sign of radio-activity were equally destitute of any trace of helium.

FOR his inaugural address, delivered on November 22 of last year, Prof. R. Threlfall, as chairman of the Birmingham section of the Institution of Electrical Engineers, chose the subject "Some Problems of Electro- and Electrothermal Chemistry." The principal question dealt with was the conversion of carbon into the "non-conducting" variety, and Ludwig's recent attempts to produce diamonds on the large scale were discussed, principally by considering theoretically the probable conditions governing the inter-conversion of the various forms of carbon. Other subjects touched upon included the fixation of atmospheric nitrogen, the ionic theory, and the use of osmium and tantalum in incandescent lamps.

THE final number (No. 7) of the second volume of the *Central*, the magazine of the Old Students' Association of the Central Technical College, well maintains the high level of its predecessors. It contains a photogravure of Prof. Ayrton, president of the association, whilst a special feature is the large number of photographs illustrating the articles contained in it. Of these articles we may mention an interesting account by Mr. A. A. Barnes of the work recently carried out in excluding the Nile from two of its three channels at Ashmant for purposes of land reclamation; a summary by Prof. Armstrong of the various researches made on camphor at the college during the past twenty years, indicating the widely ramified growth of the problem; and a description of several types of electromagnetic ore crushers by Mr. C. J. Guttmann. Two photographs of a new camphor-model illustrate Prof. Armstrong's article.

A BRIEF note by F. Giolitti in the *Gazzetta* (vol. xxxv. p. 181) contains some interesting particulars with regard to the coagulation of colloidal solutions of ferric hydroxide, the observations forming an extension of the earlier ones of Péan de St. Gilles. Whereas a trace of any polybasic acid, for example sulphuric acid, added to the colloidal solution obtained by boiling ferric acetate with water instantly precipitates a flocculent "hydrogel" which is insoluble in water, a considerable quantity of a monobasic acid such as nitric acid has to be added to the colloidal solution before a precipitate is produced. The product in this case is a reddish powder which re-dissolves in pure water, and is hence a "solid hydrosol." The quantity of monobasic acid necessary for complete precipitation of the solid hydrosol appears to be fairly definite for a definite set of conditions. The character of the colloidal solutions of a substance, however, seems to depend very largely on the way in which they are prepared. Thus a solution of ferric hydroxide prepared by dialysis according to Graham's method gives on coagulation very different results from those obtained with the solution prepared from ferric acetate. Moreover, other colloidal solutions, such as those prepared from ammonium uranate, plumbic acid, and silicic acid, have certain features which characterise their coagulation. It seems necessary, indeed, in considering the general question of colloidal solution, to recognise that several distinct types of coagulation exist.

THE adhesion of electrical contacts in delicate seismoscopes continues to exercise the minds of Italian seismologists. No other form of seismoscope can be made so sensitive as one which records electrically, but the force tending to separate the contacts is so small that the circuit sometimes remains closed. In the concluding number of vol. x. of the *Bolletino della Società Sismologica Italiana* Dr. Agamennone reviews all the devices which have been proposed to overcome the adhesion, and concludes that the only efficient one is that suggested by Dr. T. Alippi, of attaching a vibrator to the seismoscope, which shall act like the decoherer in wireless telegraphy, but adds that his experience in the observatory at Rocca di Papa shows the necessity of carefully adjusting the energy of this vibrator. If too energetic it may produce the very evil it is designed to cure.

THE annual report of the Iowa Geological Survey has just been published at Des Moines under the able editorship of Dr. F. A. Wilder, the State geologist. It deals with the year 1904, and forms a handsome quarto volume of 560 pages with 10 folding coloured geological maps of counties, 7 plates, and 51 illustrations in the text. In addition to the State mineral statistics for 1904, and reports on the geology of Benton, Emmet, Palo Alto, Pocahontas, Jasper, Clinton, and Fayette counties, the volume contains an important report on the Portland cement industry and Iowa's natural resources with reference to that material by Mr. E. C. Eckel and Mr. H. F. Bain. The report shows plainly that the limestones and clays of Iowa are well suited for the careful study of the cement manufactures. Despite the large amount of material available and the convenient fuel and transportation facilities, no Portland cement plants have yet been established in Iowa, although a number are in operation in adjacent States.

WE have received from the Home Office an advance proof, subject to correction, of the statement of fatal accidents and deaths in and about the mines and quarries of the United Kingdom during 1905. The total separate fatal accidents were 955 in collieries, 41 in metalliferous mines, and 94 in quarries.

MR. WILLIAM HEINEMANN has in hand, under the title of "A Handbook of Metabolism," an English translation of the second German edition of von Noorden's "Lehrbuch des Stoffwechsels," edited by Dr. Walker Hall, of Manchester.

WITH the title the *Australian Journal of Science*, a new periodical edited by Prof. Liversidge, F.R.S., is to appear during the present month. At first the journal will be issued monthly, but afterwards, if it meets with sufficient support, at more frequent intervals. Literary correspondence, and publications for review, should be addressed to the Editor, *Australian Journal of Science*, The University, Sydney.

THE thirty-third annual dinner of old students of the Royal School of Mines will be held on Friday, February 16, at the Hotel Cecil. The chair will be taken by Prof. S. Herbert Cox; and the opportunity afforded by the dinner will be taken to make a presentation to Prof. J. W. Judd on his retirement from the chair of geology. Subscriptions for this testimonial should be forwarded before the end of January to Mr. D. A. Louis, 77 Shirland Gardens, W., to whom applications for tickets for the dinner should also be sent.

THE publication by Mr. George A. Morton, of Edinburgh, at 3*s.* 6*d.*, of an attractive edition of Hugh Miller's "My Schools and Schoolmasters" should serve to re-direct attention to the work of a geologist whose writings were in the middle of last century the means of attracting many persons to the study of natural phenomena. A biographical introduction to the volume by Mr. W. M. MacKenzie provides an interesting study of Hugh Miller's career as stonemason, bank clerk, editor, geologist, and author, and reminds the reader that this work of his was published in 1854. The stonemason who by his own unaided efforts could attain to such an acquaintance with the rocks of his native land as to become the author of "The Old Red Sandstone" should prove an encouragement to all students of science who are working in the face of great difficulties. This new re-issue deserves a wide popularity.

A BOOKLET by Mr. J. El. David entitled "Le Tunnel du Simplon" has been published by Messrs. Payot and Co., of Lausanne. Parts of the account have already appeared as articles in the *Gazette de Lausanne*. In view of an article which appeared in NATURE of November 9, 1905, p. 30, describing survey work of the Simplon Tunnel, it is unnecessary to do more than refer to the contents of the brochure. Before publication the text was submitted to the chief engineers in charge of the work, so that the book may be read with confidence as containing a correct account of the order of events. The biographical notices and portraits of the engineers in charge of the gigantic undertaking, and other numerous illustrations, add greatly to the value of this essay.

OUR ASTRONOMICAL COLUMN.

COMET 1905*c* (GIACOBINI).—A new set of elements and an ephemeris for comet 1905*c* appear in No. 88 of the Lick Observatory Bulletins; they have been computed by Mr. R. T. Crawford, of the Berkeley astronomical department, and the elements are as follows:—

$T = 1906$ Jan. 22·41845 G.M.T.

$\infty = 199^\circ\ 1'\ 28''\cdot8$
$\Omega = 92\ 2\ 00\cdot5$ } 1906·0
$i = 43\ 38\ 36\cdot7$
$\log q = 0\cdot217605$

The ephemeris shows that after perihelion (January 22) the comet's brightness will decrease rapidly, falling from 58·6 on that date to 22·7 on January 30. The positions (true) are given for alternate days during January, but only the three given below have been computed for dates subsequent to January 28:—

Ephemeris 0h. G.M.T.

1906	α (true) h. m. s.	δ (true) ° ′ ″	Brightness
Jan. 30·5 ...	21 53 28 ...	− 25 44 25 ...	22·7
Mar. 1·5 ...	1 48 11 ...	− 6 2 44 ...	1·5
April 2·5 ...	3 29 3 ..	+ 7 9 50 ...	0·3

Numerous observations of this comet are recorded in No. 4065 of the *Astronomische Nachrichten*. Dr. Jost, observing at Strassburg on December 30, 1905, found that the magnitude was about 5·0, and that the comet had a sharp definite nucleus and a tail about ¾° in length. On January 1 the magnitude was 4·0–5·0, the diameter of the nucleus 4″, and the length of the tail about 1½°.

A daily ephemeris, extending from January 13 to January 31, is given by Herr E. Strömgren in the same journal.

NEBULOSITY AROUND NOVA AQUILÆ.—Prof. Frost reports that a careful examination of the photographs of Nova Aquilæ No. 2, taken with the Bruce telescope at Arequipa on October 16 and 21, 1905, shows the Nova to be surrounded with a faint nebulosity nearly circular in form and extending to about 0′·4 on each side of the star. The exposure in each case was 120 minutes, and the nebulosity was independently confirmed by Mr. Manson.

As no such nebulosity appeared on the engraving given in vol. xxii. (p. 269) of the *Astrophysical Journal*, representing the Nova on September 21, 1905, Prof. E. C. Pickering suggests that it radiated from the Nova early in October, as was the case in Nova Persei No. 2. He points out, however, that, if it can be shown that the spectrum is peculiar, the apparent nebulosity on the Bruce photographs may be explained as being due to chromatic aberration which does not exist in the reflector, and would therefore not affect the earlier photograph (*Astronomische Nachrichten*, No. 4065).

THE FIGURE OF THE SUN.—Continuing his research on the variable figure of the sun, Dr. C. L. Poor has reduced the values of the solar diameter obtained by Schur and Ambronn, with the 6-inch Repsold heliometer of the Göttingen Observatory, during the thirteen years 1890 to 1902.

A detailed description of the methods of reduction is given in No. 5, vol. xxii., if the *Astrophysical Journal*, and the results tend to confirm those obtained in Dr. Poor's previous research, viz. that the ratio between the polar and equatorial radii of the sun varies periodically, the period being nearly the same as that of sun-spots. The amplitude of the variation is about 0″·2, the greatest difference between the extreme values of the quantity (polar − equatorial diameter) being 0″·5.

STELLAR MAGNITUDE OF THE SUN.—The results of an interesting research made by Prof. Ceraski at Moscow on the relative magnitudes of the sun and Polaris, Procyon, and Sirius, are given in No. 4065 of the *Astronomische Nachrichten*. During the day Prof. Ceraski photometrically compared the light received from Venus with that obtained from a reflected image of the sun, and then at night compared Venus with the stars named.

As a result he found that the sun sends us 290550×10^6 times more light than Polaris, 77630×10^6 times more light than Procyon, and 17045×10^6 more than Sirius. Taking the magnitudes of these stars as 2·15, 0·56, and −1·09 respectively, this gives −26·51, −26·66, and −26·67 as the stellar magnitude of the sun, and the weighted mean value becomes −26·59. As Prof. Ceraski objects to the obvious paradox in assigning a *negative* value to the sun's magnitude, he omits the *minus* sign and gives his result as "26·59 *super magnitude*."

VARIABILITY OF IRIS.—The results of a number of photometric measurements of the apparent brightness of Iris, carried out by Dr. H. Clemens during February and March, 1904, are given in No. 4063 of the *Astronomische Nachrichten*.

The lowest magnitude was recorded at 10h. 15m. (M.E.T.) on March 28, and was 10·34; the highest maximum observed (8·80) took place on February 9 at 8h. 46m. From the consideration of his results, Dr. Clemens concludes that Iris has a real variation of magnitude amounting to 0·25m.–0·30m., and having a period of approximately four hours.

SOME QUESTIONS FOR ARCHÆOLOGISTS.

THE study of a few of our British stone monuments from an astronomical point of view has led me to the conclusion that if such an inquiry be continued information will ultimately be obtained touching the order of succession of the various swarms of immigrants who set out the various systems of alignments. Approximate dates of the changes of temple worship representing different cults, and, therefore, possibly different tribes, have already been obtained, for I have evidence that the risings of stars, as well as of the sun, were observed in some of the circles. I also believe that much folklore and many myths may find their explanation.

I begin with the fact that some circles used in the worship of the May year were in operation 2000 B.C., and there was a change of cult about 1600 B.C., or shortly afterwards, in southern Britain, so definite that the changes in the chief orientation lines in the stone circles can be traced.

To the worship of the sun in May, August, November, and February was added a solstitial worship in June and December.

The easiest explanation is the advent of a new swarm of immigrants about that date.

The associated phenomena are that the May–November Balder and Beltaine people made much of the rowan and maythorn. The June–December people brought the worship of the mistletoe.

The flowering of the rowan and thorntree in May, and their berries in early November, made them the most appropriate and striking floral accompaniments of the May and November worships, and the same ideas would point to a similar use of the mistletoe in June and December.

Another associated phenomenon is that chambered barrows seem sometimes to have been used by the solstitial people instead of, or in addition to, stones to mark sight-lines.

If there were such swarms, and the June–December succeeded and largely replaced the May–November one, this could hardly have been put in a cryptic and poetic statement more happily than it appears in folklore: Balder was killed by mistletoe.

In the May–November circles and alignments we deal with unhewn stones. In the June–December alignments the stones in Brittany are tooled.

In this we have a strong argument in favour of the same order of succession.

The Worship Conditions and a Working Hypothesis.

In a colony of the astronomer-priests who built and used the ancient temples we had of necessity:—

(1) Observatories, *i.e.* circles, alignments, coves or holed stones, for viewing the alignments or sight-lines.

A study of the sight-lines shows us that the stones—collimation marks—were of set purposes, placed some distance away from the circles, so far that they would be required to be illuminated in some way for the dawn observations. When there was no wind, one or more hollows in a stone, whether a menhir or a quoit, might have held oil or grease to feed a wick. But in a wind some shelter would be necessary, and the light might have been used in a cromlech or allée couverte. Stones have been found with such cups, and débris of fires have been found in cromlechs.

(2) Dwellings, which would be cromlechs or many-chambered barrows, according to the number of astronomer-priests at the station, and possibly some arrangement for protecting a sacred fire.

(3) A water supply for drinking and bathing, which might be a spring, river or lake, according to the locality.

Assuming this, I ask whether we may not consider the following working hypothesis, the accuracy of which can be easily tested by those conversant with these subjects, which I am not; nor have I time to look over the vast and scattered literature where the facts are recorded.

Everything relating to these three different classes of things was regarded as very holy, because they were closely associated with the astronomer-priests, on whom the early peoples depended for guidance in all things, not only of economic, but of religious, medical and superstitious value.

Hence the circles, mounds and alignments, as sacred places, were subsequently used for burials, as Westminster Abbey has been; but burials were not the object of their erection by the first swarms.[1] I believe they were afterwards used for burials by later swarms, who imitated them, and built round barrows without living chambers for the dead.

The perforated stones were regarded as sacred, so that marriages took place at them, and passing through them was supposed to cure disease. Whether men and women, or children only, passed through the hole depended upon its size. But a hole large enough for a head to be inserted was good for head complaints. I may state that I have traced holed stones on May-November alignments. In too many cases the temples connected with them have been so ruthlessly destroyed that their use cannot so easily be established.

The cups for the light would also become sacred objects; have not many of them since been used for holy water?

The wells, rivers, and lakes used by the priests were, as holy places, invested with curative properties, and offerings of garments (skins?), and pins to fasten them on, were made at them to the priests, as well as bread and wine and cheese.

The fact that the tree on which the garment was hung was either a rowan or a thorn shows that these offerings commenced as early as the May–November worship.

These wells are in many cases alongside cromlechs, circles or unhewn stones. In others they are near churches which have been built upon the sites of the more ancient temples.

At the coming of the June–December people all the old practices and superstitions were retained, only the time of year at which they took place was changed. As the change of cult was slow, in any one locality the celebrations would be continued at *both* times of the year.

The June–December people did what they could to favour their own cult by changing the old holidays, with the result that for long both sets of holidays were retained.

Since I have shown that the solstitial worship came last, as a rule traces of this would be most obvious in places where it eventually prevailed over the cult of the May year. In such places the absence of traces of the May festival would afford no valid argument against its former prevalence. In other places, like Scotland, where the solstitial cult was apparently introduced late and was never prevalent, we should expect strong traces of the May worship, and, as a matter of fact, it is very evident in the folk-lore and customs of Scotland.

The Conditions of Migration.

May we suppose that any of the races reached Britain by sea?

Some facts with regard to ancient travel are the following. Our start-point may be that Gudea, a Babylonian king who reigned about 2500 B.C., brought stones from Melukhkha and Makan, that is, Egypt and Sinai (Budge, "History of Egypt," ii., 130). Now these stones were taken coastwise from Sinai to Eridu, at the head of the Persian Gulf, a distance of 4000 miles, and it is also said that then, or even before then, there was a coast-wise traffic to Malabar, where teak was got to be used in house-building. The distance from Eridu coastwise to Malabar, say the present Cannanore, is 2400 miles.

The distance, coastwise, from Alexandria to Sandwich, where we learn that Phœnicians and others shipped the tin extracted from the mines in Cornwall, is only 5300 miles, so that a voyage of this length was quite within the powers of the compassless navigators of 2500 B.C.

The old idea that the ancient merchants could make a course from Ushant to, say, Falmouth or Penzance need no longer be entertained; the crossing from Africa to Gibraltar and from Cape Grisnez to Sandwich were both to visible land, *i.e.* coastwise. The cliffs on the opposite land are easily seen on a clear day.

Hence it would have been easier before the days of astronomical knowledge and compasses to have reached

1 "Les Celtes et les Gaulois dans les Vallées du Pô et du Danube," p. 82.

England, and therefore Ireland and the Orkneys, than to get to some of the islands in the Mediterranean itself; and the prevalence of solstitial customs in Sardinia and Corsica, with apparently no trace of the May year, tends to support this view, which is also strengthened by the fact that the solstitial customs in Morocco are very similar to those we read of in Britain.[1] The May year is unnoticed, and there is a second feast at Easter (March 16).

The May Year.

I traced the May year in Egypt at Thebes, the temple being that of Min, and the possible date 3200 B.C. Mr. Penrose showed that the Hecatompedon and the Archaic temple of Minerva at Athens were May temples, the dates of the foundations being 1495 B.C. and 2020 B.C. respectively; but the cult must have been there before the foundations; and the cult may well have come from Thebes, and I fancy it must have been all over the known world at the time. The warning stars at Athens were the Pleiades for temples facing the east, and Antares for temples using the western horizon.

But the equinoctial pyramid- and Babylonian-cult in vogue in Egypt in the early dynasties (4000 B.C.), with the warning stars Aldebaran (March) and Vega (September), was also represented in Greece at a much later period.

In Egypt generally, the solstitial worship followed that of the May and equinoctial years. The religion of Thothmes III. and the Rameses was in greatest vogue 2200–1500 B.C.

We find little trace of it in Greece proper, though Mr. Penrose has traced it in Calabria and Pompeii, and in some of the islands.

Because in the first glimpse of the May year we have dates from 3200 B.C. at Thebes, it does not follow that it did not reach Athens before 2000 B.C., because Mr. Penrose found a temple of that date. It is clear, also, that with the possibilities of coastwise traffic as we have found it, it might have easily reached Ireland by then; 2000 B.C., therefore, is a probable date for the May worship to have reached Britain, arguing on general principles; we now know as a matter of fact that it really reached Britain earlier.

May we assume, then, a traffic transferring even astronomer priests from *Egypt* to Britain at that date?

But why not *Greece* to Britain? Because by that time, as we learn from Mr. Penrose, the equinoctial worship from Babylonia had reached Greece as well as the May year from Egypt, and traffic from *Greece* would have brought *both*, but the equinoctial cult did not reach us then; there is no trace of Easter worship in the earliest stone circles.

The solstitial cult was born in Egypt; it is a child of the Nile-rise. I have shown in my "Dawn of Astronomy" that the long series of temples connected with the solstice may have commenced about 3000 B.C.; but for long it was a secondary cult; it was parochial until the twelfth dynasty, say 2300 B.C., Egypt's solstitial "golden age" may be given as 1700 B.C., and her influence abroad was very great, so that much travel, "coastwise" and other, may be anticipated. It is for some centuries after the first date that the introduction of the solstitial worship into Britain may be anticipated. It, for instance, is quite probable that the pioneers of sun worship should have reached Stonehenge in 2000 B.C., but the solstitial worship can only be proved after 1680 B.C.

A paper by Prof. J. Morris Jones on "Pre-Aryan Syntax in Insular Celtic" appears in the "Welsh People," by Rhys and Brynmor-Jones (Fisher Unwin), pp. 617–641. Prof. Jones was led to make the comparisons contained in it by the theory that the long-headed early inhabitants of Britain had migrated into Britain from North Africa. He finds that the syntax of Welsh and Irish differs from that of other Aryan languages in many important respects, *e.g.* the verb is put first in every simple sentence. Prof. Rhys had suggested that these differences represented the persistence in Welsh and Irish of the syntax of a pre-Aryan dialect, and as the anthropologists hold that the pre-Aryan population of these islands came from North Africa, it seemed to Prof. Jones that that was the obvious place to look for the origin of these syntactical peculiarities. He finds the similarities between Old Egyptian and neo-Celtic syntax to be astonishing; he shows that practically all the peculiarities of Welsh and Irish syntax are found in the Hamitic languages.

This conclusion practically implies that the bulk of the population of these islands, before the arrival of the Celts, spoke dialects allied to those of North Africa. The syntactical peculiarities must have represented the habits of thought of the people, which survived in the Celtic vocabulary imposed upon them.

These conclusions were not known to me when I began to see the necessity of separating the cult of the June from that of the May years, and the identity of the conclusions drawn from astronomical and linguistic data is to me very striking, and also suggests further special inquiries.

The temple conditions in Greece investigated by Mr. Penrose, and on which the above generalisation is based, may be tabulated as follows:—

May Year.

		Dec.	Day	Year
		° ′		B.C.
Archaic temple of Minerva	Pleiades	+ 7 50	April 20	2020
Hiero of Epidaurus, Asclepieion	,,	+ 9 15	,, 28	1275
Hecatompedon	,,	+ 9 58	,, 26	1150
Older Erechtheum	Antares (setting)	− 14 31	,, 29	1070
Temple of Bacchus	Pleiades	+ 10 35	,, 29	1030
Corinth	Antares (setting)	− 16 0	May 6	770
Aegina	,,	− 16 45	,, 7	630

Solstitial Year.

June

Athens. Dionysus (Upper Temple)	Antares (setting)	− 11 2	June 20	1700
Pompeii (Isis)	β Geminorum	− 16 44	,, 19	750

December.

Metapontum	β Geminorum (setting)	+ 29 38	Dec. 21	610
Locri	,,	+ 29 40	,, 21	610

Equinoctial Year.

March.

Nike Apteros	Spica (setting)	+ 6 10	Mar. 17	1130
Juno Lacinia (near Croton)	α Arietis	+ 7 27	,, 28	1000
Paestum (Neptune)	Spica (setting)	+ 3 5	,, 22	535
Gergenti (Hercules)	,,	+ 2 30	,, 30	470

September.

Rhamnus (Themis)	Spica	+ 6 0	Sept. 17	1092
Tegea (Minerva)	,,	+ 5 51	,, 18	1075
Syracuse (? Minerva)	,,	+ 4 30	,, 20	815
Athens (dedication unknown)	,,	+ 4 17	,, 23	780
Rhamnus (Nemesis)	,,	+ 4 5	,, 22	747
Bassæ (Apollo)	,,	+ 3 57	,, 22	728
Ephesus (Diana)	,,	+ 3 57	,, 25	715
Syracuse (Diana)	,,	+ 2 22	,, 26	450
Ephesus (Diana) (re-orientation)	,,	—	Oct. 6	355

Special Orientations.

Thebes	γ Draconis	+ 54 28	Sept. 20	1160
The City of the Dragon (Cadmus, p. 830)				
Eleusis (Ceres)	Sirius rising at midnight	− 18 0	,, 13	1400

Britain—Canaan.

Since we have traces of temple worship in Britain 1000 years before the building of Solomon's temple, it may be

[1] Westermarck in "Folk-lore." Vol. xxi., p. 27.

useful to see what common practices can be gathered from Semitic and British traditions. We have common to both :—

(1) Worship in high places.
(2) Setting up of stones.
(3) Sacrifices with blood poured on the altar.
(4) Fire worship of Baal or Bel.
(5) Human beings passing through the fire.

The question arises, then, were not the circle builders Semites antedating the Aryans?

The Dolmen Builders.

Another matter of great interest is connected with the erection of dolmens in imitation of the caves first used for Semitic worship. The most philosophical study of this question I have seen [1] certainly suggests that much light may be expected from this source.

NORMAN LOCKYER.

THE SKELETON OF BRONTOSAURUS AND SKULL OF MOROSAURUS.

THE exploration of the American Jurassic by Cope and Marsh for remains of the Sauropoda practically began on an extended scale in 1877. It has been continued by these pioneers and their successors with some interruptions to the present time.

During this period a number of more or less complete skeletons have been found. The first was that of *Camarasaurus supremus*, a sauropod closely related to the Morosaurus of Marsh, found in the Jurassic of Colorado in 1877, and partially described by Cope. It was restored life-size by Ryder on large sheets of linen and exhibited, but never published. The skeleton is now being prepared for mounting in the American Museum of Natural History. The most complete skeleton known of Brontosaurus is the type of *B. excelsus*, Marsh, which was found in the Como Bluffs of Wyoming in 1879, and made the basis of Marsh's restoration of 1883, the first published. This beautiful specimen was unfortunately taken out before the method of removal from the matrix was as effective as it is now. It is, however, capable of being mounted, and will undoubtedly some day be one of the great ornaments of the Yale University Museum, in which it is preserved. In 1897 the American Museum party found the entire hind portion of the skeleton of a Diplodocus also in the rich region of the Como Bluffs. Two years later another skeleton of a Diplodocus, the best yet discovered, was secured by the Carnegie Museum expedition, and forms the chief basis of the great cast recently presented to the British Museum. In 1901 the Field Columbian Museum, of Chicago, secured another fine sauropod skeleton, the basis of the restoration by Dr. E. S. Riggs. It is termed Apatosaurus, a name which Dr. Riggs thinks preoccupies Brontosaurus.

In 1897 the American Museum expedition discovered the skeleton of the Brontosaurus or Apatosaurus represented in the accompanying photograph. It enjoys the distinction of being the first of the Sauropoda to be mounted from the original materials.

The field and museum work on this skeleton occupied the American Museum staff more or less continuously from 1897 to the spring of 1905. In 1898 and 1899 the excavation was carried on, and a little more than two-thirds of the entire skeleton was recovered. In the following year a few more vertebræ were found. The special features are the very large size of the animal, the absence of crushing of the bones, and the completeness of the ribs. The original parts are supplemented by bones and casts or models from other individuals. The chief parts entirely missing are the skull, which was restored partly from an imperfect skull of Brontosaurus, partly from that of the Morosaurus described below, the three anterior cervical vertebræ, the forearms of both sides from the shoulder down, which were restored from the Yale University specimen, the upper portions of the sacrum, the hind-limb of one side, and the terminal portion of the tail. The hind-limb and the tail were completed from other individuals in the American Museum of Natural History.

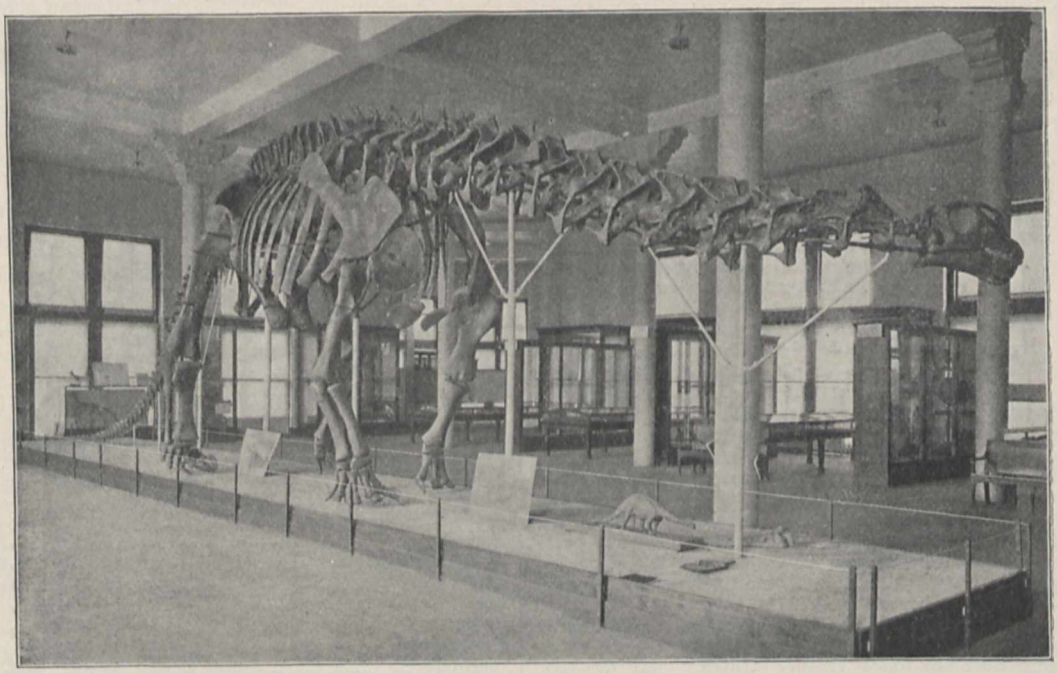

FIG. 1.—Skeleton of the *Brontosaurus excelsus* in the American Museum of Natural History, New York.

The mounting represents the prolonged work of very difficult restoration and the solution of a number of quite new mechanical problems for the support of the immense weight of the fossil skeleton without making the iron and steel work too obtrusive. For this the head preparator, Mr. Adam Hermann, deserves chief credit. A number of new anatomical problems arose, especially as to the position and angulation of the fore-limbs. In this

[1] "The Builders and the Antiquity of our Cornish Dolmens," by Rev. D. Gath Whitley (*Journal R.I. Cornwall*, No. 1.).

connection the writer's assistants, Messrs. Matthew and Granger, made a complete restoration of the muscles of the shoulder girdle and of the neck on the basis of dissections of the alligator and lizard. As a result, two important modifications of previous restorations have been made, first, the scapula is considerably more depressed below the level of the back than in previous restorations, thus allowing space for the cartilages between the ribs and coracoid, second, the elbows are considerably everted.

In all previous restorations the manus is represented as provided with a nearly complete series of terminal claws like those of the pes, which lacks the terminal claw only on two digits. Comparison of ten specimens of Sauropoda in various museums has convinced the writer that, *according to present evidence*, in Diplodocus and Brontosaurus there is but one claw in the manus, and that a small one, on the pollex. The arching and elevation of the backbone also come in for considerable modification. Although, as previously supposed by the writer on other grounds, the sacrum was the centre of power and of motion in this great animal, as a result of the depression of the scapula the posterior portion of the neck and middle portion of the back were elevated, and the highest vertebra of the back is not necessarily the spine of the sacrum. Another characteristic of all Sauropoda is the elongation of the neck and the extreme abbreviation of the back, which now in several forms is found to be composed of from ten to eleven vertebræ only. Brontosaurus seems to differ from Diplodocus in the relative abbreviation of length as a whole correlated with the greater massiveness of the skeleton, but especially in the abbreviation of the tail.

	Cervicals	Dorso-lumbars	Sacrals	Caudals
Brontosaurus	13 est.	10	5–6	49 ± est.
Diplodocus	15	11	4–5	35–40

In three specimens of Diplodocus evidence has been found of the consolidation of certain vertebræ of the tail (caudals, 17–18 and 19–21) at the point where they reach the ground. From this it has been inferred that the tail was used partly as a bracing or supporting organ when the anterior half of the body was elevated. There is no evidence of such consolidation in Brontosaurus, and the tail was relatively much shorter. Another difference is that in the tail of Diplodocus the vertebral spines are very lofty, and the transverse processes laterally compressed, indicating that this organ was partly used for propulsion in the water. These characters are much less strongly developed in the massive limbed Brontosaurus.

In this connection we may mention two partly antagonistic theories of the habits of this animal. First, the aquatic theory suggested by Owen in his original study of Cetiosaurus on account of the shape of the caudal vertebræ, and partly supported by Cope on the ground of the extreme lightness of the dorsal vertebræ; this has been more recently supported by Matthew and Gidley on the ground that the limbs were incapable of progression upon land, and were very much more strongly flexed than in any of the restorations of the animal which have been published. The amphibious theory has been partly developed by Cope and the present writer, namely, that the animals spent a considerable part of their life in the water, but were also capable of progression, and even of feeding, upon land; that during the reproductive and hatching period they spent a considerable time on land guarding their nests. A similar theory was advocated by Hatcher in his memoir on Diplodocus.

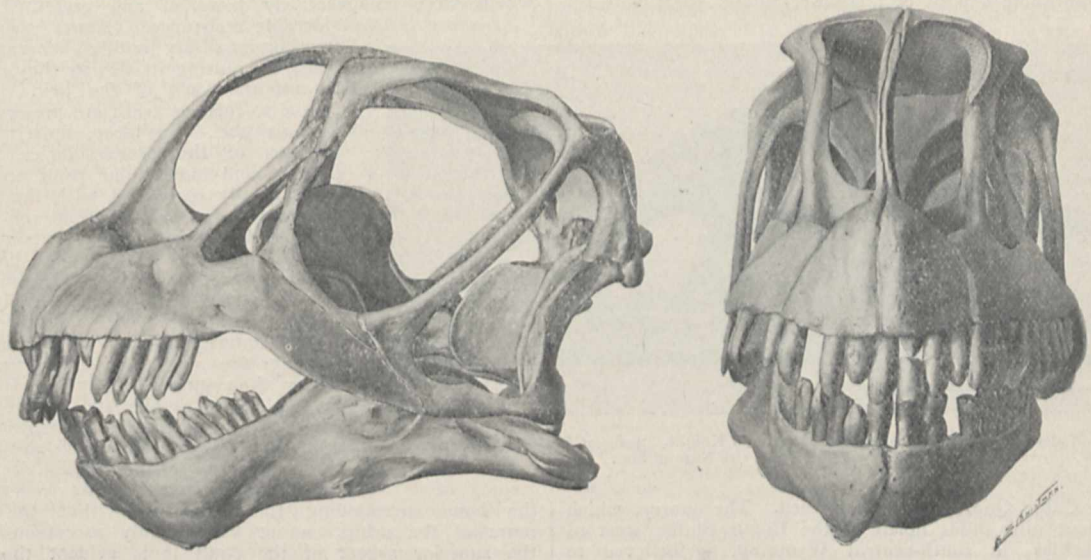

FIG. 2.—Skull of the *Morosaurus grandis*, 1/7 Natural Size.

The size of the Brontosaurus has been very generally overestimated. The chief measurements of the present skeleton as mounted are:—

	Feet	Inches
Length over all from head to tip of tail	66	8
Length of vertebral column	64	4
Length of neck	16	10
Length of tail	31	4
Length of longest rib	6	9
Length of hind-limb, including foot	10	7
Length of fore-limb, including foot	8	6
Depth of body from lower end of pubis to top of posterior dorsal spine	8	7
Length of head as restored	2	4
Estimated weight of animal when alive	38 tons	

As above noted, the long-limbed Diplodocus attained a greater length; the specimen recently presented to the British Museum is 84 feet long. The little known Barosaurus, related to Diplodocus, was of still larger size, and the Brachiosaurus of Riggs had a much greater length of limb, but we have no means of ascertaining its length over all.

It is interesting to compare these measurements with those of a fully grown "sulphur bottom" whale, carefully measured by Mr. F. A. Lucas, and reproduced at the St. Louis Exposition. This animal, a male, measured 74 feet 8 inches from the notch of the flukes to the tip of the nose. The approximate weight of the bones was 17,920 pounds. The entire animal was estimated at not much less than 63 tons.

Our estimate of the weight of Brontosaurus is based on a model by Mr. Charles R. Knight on a one-sixteenth scale, founded upon the actual measurements of the present skeleton. As carefully estimated by Mr. W. K. Gregory

and Prof. William Hallock, of the physical department of Columbia University, the Brontosaurus displaced 34¼ tons of water. If the animal was slightly heavier than the water which it displaced, say 10 per cent., it would weigh 38 tons. Prof. Hallock thinks that an estimate of from 35 tons to 40 tons would be very near the truth, even allowing for errors of restoration.

Skull of Morosaurus.

Before the British Association at the Cambridge meeting the remarkable deposit of dinosaur remains known as the

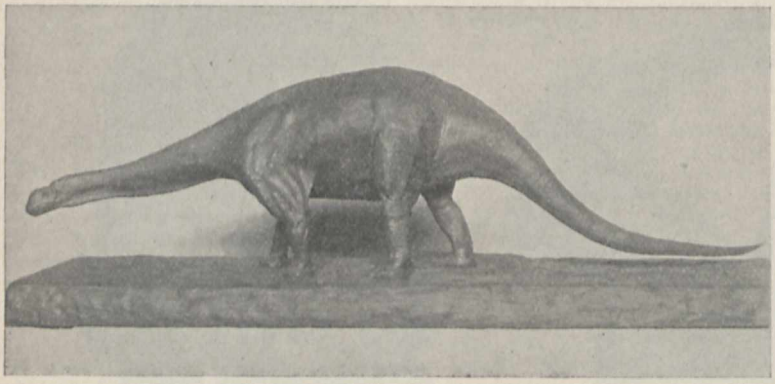

FIG. 3.—Model of the Brontosaurus, by Charles R. Knight. Scale of Photo., 1/109. Scale of Model, 308 mm. high, 1/16 Natural Size.

"Bone Cabin Quarry" was described. The quarry, which lies about nine miles north of the Como Bluffs, west of the Rockies in south-central Wyoming, is believed to represent a delta or mud and sand bar formation, in which were accumulated more or less complete remains of all the dinosaurs of the period.

One of the most rare and welcome products of this quarry in the continuous workings which began in 1897 and were recently completed have been the series of skulls, because the skull is the rarest and most fragmentary part of any of the Jurassic dinosaurs. They include one complete and two incomplete skulls of Diplodocus, two complete skulls of the carnivorous Allosaurus, one of Ornitholestes, the supposed bird-catching dinosaur, one of Laosaurus, a primitive iguanodont, one complete skull and portions of two other skulls of Morosaurus. This last is herewith described and illustrated for the first time. It was found at the end of a series of cervical vertebræ by Dr. W. D. Matthew in an extremely crushed condition, and its restoration required great skill and care.

Hitherto our knowledge of the skull of the Sauropoda has been limited to the single complete skull of Diplodocus and to the posterior portion of the cranium of one specimen of Morosaurus, both described by Marsh. These new materials, therefore, greatly expand our knowledge.

The most important point brought out is that all three skulls exhibit a well defined tubular opening on top of the skull at the junction of the parietals and paroccipitals. This foramen is smoothly lined with bone, and leads directly down into the cerebral cavity. It is thus probable that it lodged a large pineal eye, an organ the existence of which was left problematical by Marsh, as shown in the following passage:—

"There is no true pineal foramen, but in the skull here figured (Plate ii.) there is the small unossified tract mentioned above. In one specimen of Morosaurus a similar opening has been observed, but in other Sauropoda the parietal bones, even if thin, are complete." In Marsh's drawing the parietal opening is indicated rather as a fontanelle than as a foramen. While this opening is observed in the form of a bony tube in three skulls, it is of course possible that it was not invariably present in the Sauropoda, and that in some forms the foramen was partially or completely roofed over.

It will be recalled that the skull of Diplodocus has a long snout or antorbital extension supporting a series of slender, pencil-like teeth. The skull of Morosaurus differs widely from this type, first in the highly convex forehead or antorbital region, which is undoubtedly correlated with the presence of the great spoon-shaped cropping teeth, which were comparatively powerful and presented considerable resistance. Above, there are four premaxillary and eight maxillary teeth, decreasing in size as they extend toward the back of the jaw. From twelve to thirteen teeth are preserved in the mandible. The deep, massive proportions of the premaxillaries, maxillaries, and mandibular rami are also mechanically correlated with the insertion and powerful functions of these large teeth. It is evident, however, that as in Diplodocus the animal had no power of masticating its food, and that these anterior teeth served simply for prehensile purposes.

The anterior narial or respiratory openings are very large, facing forward rather than more directly upward, as in Diplodocus, while the openings in front of the orbits are correspondingly reduced. As restored in this specimen, the orbits are of enormous size, but considerable restoration was necessary in the bone surrounding this region, so that the contours of the orbits cannot be certainly ascertained. In the superior aspect of the skull it is evident that the frontal and nasal bones were much longer than in Diplodocus. It is noteworthy that the occiput or back part of the skull has practically the same composition as in the carnivorous Dinosaurs, namely, the parietals hardly enter at all into the top of the cranial roof except to bound the

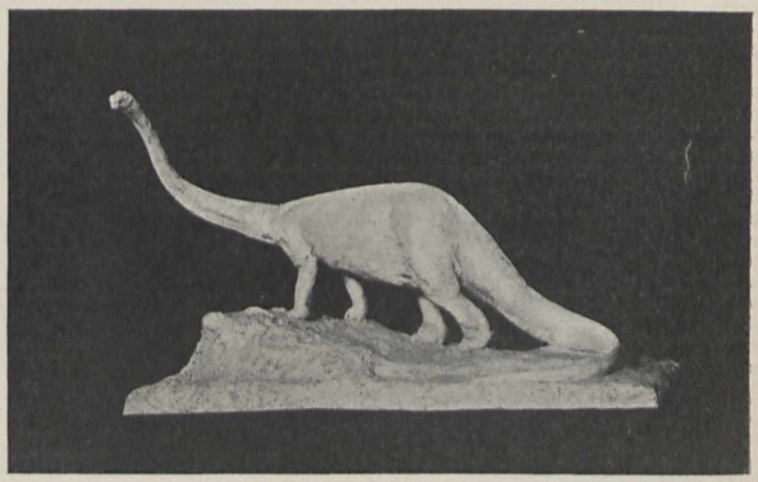

FIG. 4.—Model of the Diplodocus, by Charles R. Knight. Scale of Photo., 1/105. Scale of Model, 826 mm. long, 1/16 Natural Size.

parietal or pineal foramen at the sides; this foramen, which is absent in the carnivorous dinosaurs, is bounded posteriorly by the supraoccipitals. The squamosals form the infralateral portions of the occiput. These resemblances tend, so far as they are of value, to sustain Prof. Seeley's view that the Sauropoda and Theropoda, or carnivorous dinosaurs, are more nearly related to each other (Saurischia, Seeley) than either are to the Predentata (Ornithischia, Seeley); in fact, it is possible to derive the sauropod type from a primitive quadrupedal theropod type, but not to derive either from an iguanodont type.

HENRY FAIRFIELD OSBORN.
American Museum of Natural History, October 5, 1905.

THE PRESENT POSITION OF RADIO-ACTIVITY.[1]

THERE are three fundamental conceptions, the atom, the electron, and the ether. The seventy odd different kinds of atoms known, although fundamentally distinct, form a class to themselves in the complexity of matter, so that any discovery fundamentally affecting one must embrace all. The electron expresses for electricity the same idea as the atom does for any one kind of elementary matter, and may be termed the atom of negative electricity. Only one kind of electricity, and only one kind of electron, is known, and this possesses the same essential properties in all its various manifestations. The ether renders possible "action at a distance," and all actions transmitted through the ether are of essentially the same character and travel at one speed, namely, the speed of light.

The electron, although by origin an electrical conception, is in reality a material conception no less than the atom. At rest an electron is a simple charge—an electrostatic phenomenon. In motion it constitutes a current of electricity—an electromagnetic phenomenon. When an electron moves from rest to speed and back to rest again, the ether through which it moves at first has no magnetic qualities; then it acquires an amount of magnetic energy proportional to the speed of the electron, and then it again loses the same amount. Thus the electron cannot move without the expenditure of energy, and cannot be stopped until it has again given up the same amount. According to Newton's laws of motion, therefore, the electron is essentially a material particle. It possesses inertia, or "apparent mass," but it is not yet known whether it obeys the law of gravity, and possesses gravitational mass.

Since action at a distance travels through the ether at the speed of light, the magnetic field at a point some distance away from the line of motion of an electron cannot instantaneously accommodate itself to a change of motion of the electron, but the disturbance of the magnetic field travels outward from the electron with the speed of light. If the change of motion of the electron is periodic, as in the case of an electron revolving in an orbit within an atom, the disturbance constitutes ordinary light. In the Crookes's tube there is an irregular shower of free-flying independent electrons (kathode rays) upon the anti-kathode. The sudden irregular disturbances in the magnetic field travelling outward from the anti-kathode at the speed of light constitute the X-rays. The Hertz waves, on the other hand, result when electrons are caused to oscillate along paths of metrical rather than molecular dimensions, and their wave-length is measured in metres rather than in molecular diameters.

The apparatus employed largely to generate what are known to medical men as "high-frequency currents" admirably illustrate the inertia of electrons. Such a current will jump an air gap rather than traverse a spiral rod of copper, and will light a high-resistance incandescent lamp "short-circuited" by loop of bar copper. Lightning possesses the same characteristics, as Sir Oliver Lodge was the first to demonstrate.

The question arises whether there are two kinds of inertia, essentially similar, the one "material" and the other electromagnetic. If a sufficient number of electrons could be concentrated within a space of atomic dimensions, the total inertia of the aggregate could be made equal to that of an atom. Unfortunately, we know of no means whereby the mutual repulsions of the electrons could be overcome without introducing the hypothetical positive electron or its equivalent.

The present year is the decennary of M. Henri Becquerel's discovery of the natural radio-activity of matter. Radio-activity has been interpreted as the effect of a process of spontaneous disintegration occurring within the atoms of the radio-element, and already atomic disintegration is recognised as the probable cause of innumerable hitherto isolated phenomena in every branch of knowledge. It is the most fundamental and potent factor of evolution known. The ultimate cause of atomic disintegration, like that of most other common properties of matter, even gravitation, remains quite unknown. The view that radio-activity is the outward and visible sign of deep-seated material change followed from the elucidation of the nature of the emanations, and of the phenomenon of excited or induced activity. It was shown that the emanations and the allied bodies were new forms of matter continuously being *produced* from the radio-elements, and that they were the products of the changing atoms. Rutherford's discovery that the α radiation consisted of radiant particles, and the gradual accumulation of evidence, amounting to-day to practical proof, that the α particles are radiant atoms of the element helium, enabled the whole process to be simply elucidated. A single radiant atom is within the means of detection, for example, by the spinthariscope, whereas a million million atoms is not sufficient to be detected by the most delicate and refined spectroscopic test. The radio-atom suffers successive disintegration, and at each disintegration a single radiant particle is in general expelled. The radium atom successively expels five α particles, so that a residue of atomic weight about 205 should be left if these particles are helium atoms. There is strong indirect evidence for believing that the residue atom is that of lead. In the natural minerals, where the radio-elements occur, are to be found the ultimate products of ages of past accumulation. In the uranium minerals, helium, radium, polonium, and lead have been recognised as the constant companions of the uranium. Direct experiments have established in each case, except lead, the production of these elements during the disintegration. Polonium is the last changing member of the disintegration series, is a higher homologue of tellurium (Marckwald), and is identified with the radium F of Rutherford. The production of lead from polonium has not yet been directly observed, but Boltwood has shown it to be a constant constituent of the uranium minerals.

There is a comprehensiveness and subtlety in the operations of the laws of nature which the most vivid imagination cannot anticipate. The fact that the proportion of radium in any uranium mineral must be constant, being the ratio between the rate of disintegration of radium and that of uranium (or one to a million), cannot fail to have most important bearings. If to-morrow radium could be imported in quantity from outer space, after a few thousand years the quantity in the earth would be no more and no less than at present. By that time the quantity exhibited to-night will have had its day and ceased to be, but if the rest of the mineral from which it was extracted could again be examined a new amount no less than that originally present would be found to have grown in the interval.

How far are we justified in extending these ideas to explain analogous phenomena in the case of the inactive elements? We know that radio-activity is a mere accompaniment by no means essential to the process of atomic disintegration. The evidence available shows clearly that atomic disintegration might be universal and yet beyond the power of direct detection. A discovery fundamentally affecting any one element must embrace the whole class. The internal energy of the atom is merely revealed in radio-activity, in the same way as the internal energy of gun-cotton is revealed only when it explodes. The energy of the disintegration of an element is roughly a million times greater than that of any other change we are acquainted with. The attempt of the alchemist to build up a heavy element like gold from silver was futile, because, even if it could be done, it could not pay. The energy of some hundreds of tons of coal would have to be put into an ounce of silver to convert it into gold; but if gold could be formed from the degradation of a heavier element like lead, the gold would be a mere by-product, and the store of energy liberated simultaneously, however reckoned, would be of far greater value than the gold produced. At present we are totally ignorant of any means of altering or affecting in any way the rate of atomic disintegration proceeding spontaneously, or, in other words, we cannot effect artificial transmutation.

The experimental sciences do not hold out much hope of giving an immediate answer to the question whether atomic disintegration is general, and whether the scarcity or abundance of an element in the earth is a measure of its stability. We are forced back on such indirect evidence as lies ready to our hand. It is possible to obtain such evidence in the field of economics for the element gold,

[1] Abridged from the presidential address delivered to the Röntgen Society on January 4 by Mr. Frederick Soddy.

because gold has been established by long experience to be an excellent if not ideal metal for coinage. Analysing what this means, we find that an extremely complex condition must be satisfied. We are not a stereotyped or stagnant civilisation, and the demand for coinage metal experiences great fluctuations. With the scientific awakening of last century, an enormously increased demand arose in consequence of the rapid extension of commerce. In spite of this it is of the utmost importance that the value of other commodities expressed in terms of that of the coinage-metal must remain fairly constant from year to year, otherwise debtors and creditors might awake to find themselves ruined by some great variation in the value-ratio. Experience shows that this complex condition is, as a matter of fact, nearly fulfilled for the element gold. The first requirement that gold possesses enabling it to fulfil the condition is that it is a technically worthless metal. It possesses usefulness only on account of its value. Platinum, on the other hand, is unsuited for coinage because it possesses value on account of its usefulness. In the latter case the demand increases with fall of price, while in the former it decreases.

The second requirement that has to be satisfied if the value-ratio is to remain constant is that the output of gold should, on the average, bear some fixed ratio to the amount of human endeavour expended in the search. The scarcity must be relative, and some definite number of tons of the auriferous material must on the average be extracted to produce an ounce of the metal. That is to say, the scarcity must be mainly of concentration, as in the case of radium in the uranium minerals. If a technically worthless metal is a member of a disintegration series, so that its concentration in its ores is on the average fixed, it would obey the complex condition required for a coinage metal. So that the argument may be inverted, and indirect evidence obtained that gold is, like radium, a member of a disintegration series. The gold currency cost the world seventy million pounds worth of unproductive labour last year. A sum, which expressed in pounds runs into ten figures, representing the world's accumulated stock of bullion, has been *spent* in the past. To-day it exchanges at its face-value; to-morrow, with the introduction of a less expensive and more scientific system of book-keeping, it will become a mass of technically worthless metal.

This extension of the idea of atomic disintegration shows how powerfully the recent theories are bound in time to affect the life and thought of the community. Those who have grasped their significance know well that nothing appears the same or can again appear quite the same as before. It is not necessary that we should ever approach nearer than at present to the control and application of the new processes and reservoirs of energy. The mere possibility of being able to do so in the future cannot fail to leave its mark. By these discoveries the relation of mankind to nature has undergone a certain change, and man has caught a glimpse of some latent possibilities within his legitimate destiny which cannot be effaced. Energy is the life of the physical universe. You cannot multiply the existing store by a million and leave things as they were. Man, "nature's rebel," as Prof. Ray Lankester has depicted him, left isolated among the forces of nature to work out his own salvation, has had placed before his eyes a new material destiny. So far as physical possibility is concerned, he may one day attain to the power as well as the wish expressed in the quatrain of Omar:—

"O love! could you and I with fate conspire
To grasp this sorry scheme of things entire,
Would not we shatter it to bits—and then
Re-mould it nearer to the heart's desire!"

MEDICAL INSPECTION AND FEEDING OF CHILDREN IN SCHOOLS.[1]

WE welcome this extension of the inquiry begun in the physical deterioration report, however limited be the terms of reference, viz. (1) to report on what is being done, and with what result, in respect to medical inspection; (2) to inquire into the methods employed, the sums expended, and the relief given by various voluntary agencies for the provision of meals, and to report whether relief of this kind could be better organised without any charge upon the public funds.

(1) Upon the first subject, the results are shown to be most beneficial, the percentage of sufferers being by no means small; thus in defects of vision found in 7 per cent. to 20 per cent. of children examined, headache and apparent dulness often disappear. Twenty per cent. seems a common experience of the incidence of vermin, uncleanliness, and ringworm; here beneficial results have been generally of a marked character, cases being diminished by one-half in nine months in Gloucestershire.

The medical officer of health at Salford demonstrates to the teachers the symptoms to expect in infectious diseases, and the teachers are becoming so skilful in detecting symptoms, and at once excluding all suspected cases, that outbreaks of infectious disease demanding medical inspection are much less frequent. So will necessity for closing the schools diminish.

Diphtheria, it is stated, is now in several areas under such complete control that it can be stopped in a few days. We read in this and similar evidence an urgent call for the extension of medical inspection, and regret that the committee should water their conclusions with a comment that the "results" are to be given as statements of opinion rather than as ascertained facts. The contrary is the case, the facts are ascertained, and if the dozen witnesses coincide, surely we have progressed beyond opinion.

(2) In the second inquiry, in which the committee is to report whether relief can be better organised without any charge upon the public funds, much valuable sociological information has been collected. In many schools 2 per cent. to 5 per cent. of children require this aid, and a meal may cost from a penny to twopence. Seventeen recommendations outline business-like cooperation for charitable relief.

The committee has stated that in the ordinary run of cases which will come up to be dealt with, a woman's opinion upon the need of a household will be more valuable than a man's, and the opinion of two lady witnesses is given that the existing attendance officer is not sufficiently trained, and therefore of no use for the purpose. One would imagine a recommendation would follow that a lady official should be secured for this primary duty of selection of recipients. This omission does not seem explicable on financial grounds, for it might as readily be a charge upon voluntary subscription as upon the public funds. One feels that without such aid the frequent abuse of free meals, as reported in the evidence, is likely to recur.

In this inquiry, all who seek to avoid pauperising parents on the one hand, or the underfeeding of school children on the other, will find much useful information.

[1] Report of Interdepartmental Committee on Medical Inspection and Feeding of Children attending Public Elementary Schools. (Cd. 2779.) Price 1*s*. 3*d*.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—By the will of the late Sir J. S. Burdon-Sanderson, the laboratory of the pathological department of the University is bequeathed the sum of 2000*l*., payable within six months of his death, as an endowment to provide for pathological research there, the fund to be vested in the professors for the time being of human anatomy, physiology, and pathology, who are to have absolute discretion as to the application of the fund.

CAMBRIDGE.—Last Sunday completed the fiftieth year during which Dr. Atkinson has presided as Master over the fortunes of Clare College, and the University will on February 1 present him with an address of congratulation similar to that presented to the late Lord Braybrooke two years ago.

Mr. H. O. Jones, of Clare College, has been approved as deputy for the Jacksonian professor of experimental philosophy during the current Lent term.

The following awards to scholarships in mathematics have been made at Queens' College:—N. R. Krishnamma, Merchant Taylors', 45*l*.; C. F. Waterfall, Manchester Grammar School, 45*l*.; A. H. Pinder, Malvern College,

40*l.*; H. C. Bathurst, Dulwich College, 40*l.*; E. T. Lancaster, Exeter School, 30*l.*; G. D. Roechling, Winchester College, 30*l.*

THE death is announced, at the age of forty-nine, of Dr. W. R. Harper, president of Chicago University.

THE council of the University of Sheffield has appointed Dr. Louis Cobbett professor of pathology, and Mr. L. T. O'Shea professor of applied chemistry in the University.

SIR MICHAEL FOSTER, K.C.B., F.R.S., will preside at the meeting of the Public Schools Science Masters' Association at Westminster School on Saturday, January 20, in place of the president, Sir Oliver Lodge, F.R.S., who is prevented from being present.

WE learn from *Science* that at the recent special session of the State legislature the University of Wisconsin was again authorised to draw its income from the general fund of the State treasury, as according to the new method of appropriating funds for the university by setting aside two-sevenths of a mill on all taxes, the university income fund does not become available until February each year, whereas the university budget has always been estimated on the basis of the fiscal year, which extends from July 1 to June 30 of each year.

ON Saturday, January 13, the first annual dinner was held of the past chemical students of the Technical College, Finsbury. Prof. R. Meldola, F.R.S., took the chair, and there were present, in addition to the lecturers and demonstrators of the chemical department, seventy past students of the college. Prof. Meldola referred with pride to the number of past students, who had won distinction in the chemical world, and were gathered around him. Finsbury was one of the earliest technical colleges, and had a record of a quarter of a century's usefulness to the technical industries of the country. Dr. Moody, who proposed "The College," said that this year was a very appropriate one for the first annual dinner, as their head, Prof. Meldola, now held the highest distinction the Chemical Society had to offer, the office of president.

A DISCUSSION has been opened in *L'Enseignement mathématique* on the reforms to be accomplished in the teaching of mathematics, and numerous mathematicians have been asked to state their opinions on the conditions that should be satisfied by a complete course of mathematics, theoretical and practical, in institutions of higher grade. The questions are as follows:—What improvements should be effected in the teaching of pure mathematics? What part should be played by higher educational institutions in preparing teachers for secondary schools? And how should mathematical teaching be organised in order that it may respond better than hitherto to the requirements of other branches of pure and applied science? Of those who have already taken part in this referendum, we note the names of Prof. Gino Loria (Genoa), Prof. Emile Borel (Paris), Prof. Jules Andrade (Besançon), Prof. D. E. Smith (Columbia University), Prof. F. Mariotte (Paris).

SOCIETIES AND ACADEMIES.

LONDON.

Royal Microscopical Society, December 20, 1905.—Dr. Dukinfield H. Scott, F.R.S., president, in the chair.—An exhibit consisting of about twenty photographs of diatoms taken by the Zeiss apparatus, designed by Dr. August Köhler, of Jena, for photomicrography with ultra-violet light: Mr. **Rheinberg**. The objective and other lenses used in taking the photographs were made wholly of fused quartz, which rendered possible the utilisation of ultra-violet light having a wave-length of 275 $\mu\mu$ (=275 millionths of a millimetre). The photographs were taken with a 1·7 mm. monochromatic objective of 1·25 N.A., using light from the cadmium spark. The resolving power was therefore as great as would be that of an objective used with ordinary light if it were possible to give it an N.A. of 2·5. There were photographs of *Surirella gemma* and *Amphipleura pellucida*; one of the latter taken with oblique illumination showed the diatom clearly resolved into dots. There were also comparison photographs of the same diatoms, taken with a 2 mm. apochromatic objective of 1·4 N.A. using light from the magnesium spark (λ=383 $\mu\mu$) giving about the same amplification, viz. about 1800 diameters. The difference in the appearance of the images was very apparent.—A fern fructification from the lower Coal-measures of Shore, Lancashire: D. M. S. **Watson**.

Linnean Society, December 21, 1905.—Mr. C. B. Clarke, F.R.S., vice-president, in the chair.—(1) An aposporous seedling of *Polypodium vulgare*, with a frond bearing a well defined prothallus at the tip. (2) A new case of apospory in *Cystopteris montana*: C. T. **Druery**.—The International Botanical Congress at Vienna in June last: Dr. A. B. **Rendle**. A report was given on the work of the congress, and in particular on the proposals of the conference on botanical nomenclature (see NATURE, vol. lxxii., p. 272, 1905).—Cyrtandreæ Malayæ insularis novæ: Dr. F. **Kränzlin**.—On Characeæ from the Cape of Good Hope collected by Major A. H. Wolley-Dod, R.A.: H. and J. **Groves**.

Mathematical Society, January 11.—Prof. Forsyth, president, in the chair.—On the monogeneity of an algebraic function: Dr. H. F. **Baker**.—On the diffraction of sound by large cylinders: J. W. **Nicholson**.—On the expression of the so-called biquaternions and triquaternions by quaternary matrices: J. **Brill**.—Dr. E. W. **Hobson** made an informal communication On the representation of functions of real variables.

PARIS.

Academy of Sciences, January 8.—M. Poincaré in the chair.—On a method allowing of the determination of the constant of an absolute electrodynamometer with the aid of an induction phenomenon: G. **Lippmann**. In the determination of the constant of an absolute electrodynamometer, the conditions imposed by the calculation if accuracy of measurement is aimed at are the opposite of the conditions for sensitiveness. In the method proposed in the present paper, the experimental measurement is reduced to finding the equilibrium position of a galvanometer, and measuring either an angle or a length.—On comets, and the curvature of their solar trajectory: Émile **Belot**.—On plane transformations: M. **Hadamard**.—On the non-stationary motion of a fluid ellipsoid of revolution which does not change its figure during the motion: W. **Stekloff**.—On the stability of aëroplanes and the rational construction of supporting planes: Edmond **Seux**.—On the variation of the emission spectra of some electric lamps with temperature: P. **Vaillant**. The lamps studied were the Cooper-Hewitt mercury lamp, the tantalum filament, the Nernst, and the ordinary carbon filament lamps. Figures are given showing the variations in the composition and intensity of the light with the number of watts consumed by each lamp.—On a new type of compound in the group of rare metals: C. **Matignon** and E. **Cazes**. At a high temperature samarium chloride, $SmCl_3$, is slowly reduced in a current of hydrogen to a lower chloride, the analyses agreeing with the formula $SmCl_2$. This lower chloride was obtained by other methods, the complete absence of moisture being the one condition essential. The chlorides of praseodymium and neodymium do not undergo a similar reduction by hydrogen.—The electrolytic preparation of spongy tin: D. **Tommasi**. The electrolytic solution is made up of stannous chloride (10), hydrochloric acid (1), and water (50), and the tin is deposited on a rotating kathode.—On cuprous-silicide: Em. **Vigouroux**. The author has repeated and confirmed his earlier experiments on this subject, and shows that in pure silicides of copper the amount of combined silicon is about 10 per cent.; the crystallised cuprous silicide, Cu_4Si, has been isolated and its principal properties determined.—The reduction of the chlorides of silver and copper by calcium: L. **Hackspill**. The reduction of silver chloride by calcium gives rise to a series of alloys of calcium and silver varying according to the proportion of calcium used. The reduction of cuprous chloride gave similarly a copper-calcium alloy.—Asymmetrical derivatives of 1:6-hexanediol; the diethyl ether and di-iodide of 1:7-heptanediol: R. **Dionneau**.—On the conditions of hydrogenation of some halogen derivatives of fatty hydrocarbons by the metal ammoniums. The preparation of ethylenic and acetylenic hydrocarbons: E. **Chablay**. Sodium, dissolved in liquid ammonia, acts

upon ethylene chloride quantitatively according to the equation $C_2H_4Cl_2+2NH_3.Na=2NaCl+C_2H_4+2NH_3$. The homologues of ethylene bromide give unsaturated hydrocarbons similarly, but there are secondary reactions. With compounds of the type $R.CHCl_2$, the alkali-ammonium reacts differently, giving the paraffin $R.CH_3$.—On the retrogradation and composition of natural starch other than potato starch: Eug. **Roux.**—The action of invertin in a heterogeneous medium: Victor **Henri.**—On solid solutions: Fréd. **Wallerant.**—On the secretory canals in the wood of Dipterocarpus: P. **Guérin.**—On the respiration of the flower: M. **Maige.**—The composition of the fluids which circulate in the plant; variations of nitrogen in the leaves: G. **André.**—On hordenine, a new alkaloid extracted from the germs of barley: E. **Léger.** The alkaloid forms anhydrous crystals of the composition $C_{10}H_{15}NO$. It is a strong tertiary base, forming easily crystallisable salts.—Hordenine, its degree of toxicity and symptoms of poisoning: L. **Camus.** This alkaloid is not highly toxic; death, when it is produced by a large dose, is determined by an arrest of respiration.—On the echinoderms collected by the French Antarctic Expedition under Dr. Charcot: R. **Koehler.**—On the value of the magnetic elements at the observatory at the Val-Joyeux on January 1: Th. **Moureaux.**—Deep marine currents in the North Atlantic: A. **Chevallier.**

DIARY OF SOCIETIES.

THURSDAY, JANUARY 18.

ROYAL SOCIETY, at 4.30.—The Factors which Determine the Production of Intraocular Fluid: E. E. Henderson and Prof. E. H. Starling, F.R.S.—A Critical Account of some Anomalous Conditions of the Cerebrum in the Human Fœtus: Dr. W. L. H. Duckworth.—A Case of Regeneration in Polychæte Worms: A. T. Watson.—On the Infection, Histology, and Development of the Uredo Stage in certain Uredineæ: I. B. P. Evans.—On the Synapsis in Amphibia: J. E. S. Moore and Miss A. L. Embleton.—On the Constancy of Form among the Synaptic Gemini (Heterotype Chromosomes) in certain Animals: J. E. S. Moore and G. Arnold.—The Growth of the Oocyte in Antedon: a Morphological Study in the Cell Metabolism: G. C. Chubb.—Observations on the Life History of Leucocytes: C. E. Walker.—A Study of the Mechanism of Carbon Assimilation in Green Plants: F. L. Usher and J. H. Priestley.—Note on the Progeny of Chestnut Thoroughbred Horses: W. F. R. Weldon, F.R.S.

CHEMICAL SOCIETY, at 8.30.—The Refractive Indices of Crystallising Solutions with Especial Reference to the Passage from the Meta-stable to the Labile Condition: H. A. Miers and F. Isaac.—The Determination of Available Plant Food in Soils by the Use of Weak Acid Solvents. Part II.: A. D. Hall and A. Amos.—The Action of Ammonia and Amines on Diazobenzene Picrate: O. Silberrad and G. Rotter.—The Preparation of *p*-Bistriazobenzene: O. Silberrad and B. J. Smart.—Gradual Decomposition of Ethyl Diazoacetate: O. Silberrad and C. S. Roy.—Studies on Nitrogen Iodide. Part III. The Action of Methyl and Benzyl Iodides: O. Silberrad and B. J. Smart.—Silicon Researches. Part X. Silicon Thiocyanate: J. E. Reynolds.—The Relations between Absorption Spectra and Chemical Constitution. Part I. The Chemical Reactivity of the Carbonyl Group: A. W. Stewart and E. C. C. Baly.—Halogen Derivatives of Substituted Oxamides: F. D. Chattaway and W. H. Lewis.—The Effect of Constitution on the Rotatory Power of Optically Active Nitrogen Compounds. Part I.: Miss M. B. Thomas and H. O. Jones.—Menthyl Benzene Sulphonate and Menthyl-β-Naphthalene Sulphonate: T. S. Patterson and J. Frew.—An Apparatus for the Continuous Extraction of Liquids with Ether: R. S. Bowman.—Action of Bromine on Benzeneazo-*o*-Nitrophenol: J. T. Hewitt and N. Walker.—Some Reactions and New Compounds of Fluorine. Part I.: E. B. R. Prideaux.—The Relation between Absorption Spectra and Chemical Reactivity. Part II. The Quinones and α-Diketones: E. C. C. Baly and A. W. Stewart.—The Relation between Absorption Spectra and Chemical Reactivity. Part III. The Nitroanilines and the Nitrophenols: E. C. C. Baly, W. H. Edwards, and A. W. Stewart.—Contributions to the Chemistry of the Rare Earths. Part I.: M. Esposito.—A Synthesis of Aldehydes by Grignard's Reaction: G. W. Monier Williams.—The Condensation of Dimethyldihydroresorcin and of Chloroketodimethyltetrahydrobenzene with Primary Amines. Part I. Monamines, Ammonia, Aniline, and *p*-Toluidine: P. Haas.

SOCIETY OF ARTS, at 4.30.—The City of Calcutta: C. E. Buckland.—At 8.0.—High Speed Electric Machinery, with Special Reference to Steam-Turbine Machines: Prof. S. P. Thompson, F.R.S.

LINNEAN SOCIETY, at 8.—The Life-history of *Margaritifera Panasesae*: A. W. Allen. On some Endophytic Algæ: A. D. Cotton.—Jacobson's Organ of Sphenodon: Dr. R. Broom.

FRIDAY, JANUARY 19.

ROYAL INSTITUTION, at 9.—Some Applications of the Theory of Electric Discharge to Spectroscopy: Prof. J. J. Thomson, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Behaviour of Materials of Construction under Pure Shear: E. G. Izod (*Resumed Discussion*): Worm Contact: R. A. Bruce.

MONDAY, JANUARY 22.

SOCIOLOGICAL SOCIETY, at 8.—Sociology as an Academic Subject: Prof. R. M. Wenley.

TUESDAY, JANUARY 23.

ROYAL INSTITUTION, at 5.—Impressions of Travel in China and the Far East: Prof. E. H. Parker.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Resumed Discussion*: The Elimination of Storm-water from Sewerage Systems: D. E. Lloyd-Davies.—On the Elimination of Suspended Solids and Colloidal Matters from Sewage: Lieut.-Colonel A. S. Jones and Dr. W. O. Travis.

MINERALOGICAL SOCIETY, at 8.—Studies in Crystallisation: Prof. M ers and Mr. Chevalier.—The Chemical Composition of Geikielite: Mr. Jones and Mr. Crook.

ANTHROPOLOGICAL INSTITUTE, at 8.30.—Annual General Meeting. President's Address: Copper and its Alloys in Antiquity.

WEDNESDAY, JANUARY 24.

SOCIETY OF ARTS, at 8.—The Planting of Waste Lands for Profit: Dr. J. Nisbet.

GEOLOGICAL SOCIETY, at 8.—The Buttermere and Ennerdale Granophyre: Robert Heron Rastall.—On the Igneous and Associated Sedimentary Rocks of Llangynog (Caermarthenshire): T. Crosbie Cantrill and Herbert Henry Thomas.

THURSDAY, JANUARY 25.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Experiments on the Chemical Behaviour of Argon and Helium: Dr. W. T. Cooke.—The Vapour Pressure in Equilibrium with Substances holding Varying Amounts of Moisture. Parts I. and II.: Prof. F. T. Trouton, F.R.S., and Miss B. Poole.—Note on Heusler's Magnetic Alloy of Manganese, Aluminium and Copper: Prof. A. Gray, F.R.S.—On the Overstraining of Iron by Tension and Compression: Dr. J. Muir.—On the Effect of High Temperature on Radium Emanation: W. Makower.—Observations and Photographs of Black and Grey Soap Films: H. Stansfield.—Artificial Double Refraction due to Æolotropic Distribution, with Application to Colloidal Solution and Magnetic Fields: T. H. Havelock.—An Electrical Measuring Machine for Engineering Gauges and other Bodies: Dr. P. E. Shaw.—The Relation between the Osmotic Pressure and the Vapour Pressure of a Solution: W. Spens.—The Elliptic Integral in Electromagnetic Theory: Prof. A. G. Greenhill, F.R.S.—On the Simple Group of Order 25920: Prof. W. Burnside, F.R.S.

SOCIETY OF ARTS, at 8.—High Speed Electric Machinery, with Special Reference to Steam Turbine Machines: Prof. S. P. Thompson, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Technical Considerations in Electric Railway Engineering: F. W. Carter.

FRIDAY, JANUARY 26.

PHYSICAL SOCIETY, at 5.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Prince of Wales Pier, Falmouth: T. R. Grigson.—Ferro-Concrete Pier at Purfleet: H. O. H. Etheridge.

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