THURSDAY, FEBRUARY 8, 1906.

## A NEW INTEGRAL CALCULUS.

*Integral Calculus for Beginners.* By Alfred Lodge, M.A. Pp. xiii+203. (London: George Bell and Sons, 1905.) Price 4*s.* 6*d.*

"THIS is a sequel to the author's 'Differential Calculus,' and is intended for students of physics and mechanics who require a good working knowledge of integration and its more simple applications." Such is the claim put forward by Prof. Lodge in his preface. We naturally expect a book in which simple useful applications figure more prominently than lengthy theoretical investigations, and in this we are not disappointed. Moreover, a number of interesting features strike us as being particularly good, although a few others are capable of improvement.

The first of the good features is the insertion of the integration constant C in the elementary worked-out examples on integration. Its omission frequently leads a beginner astray. Another feature possessing many advantages is that the chapter on rational fractions is reduced to a minimum. The process of integrating a rational fraction with a denominator of high degree is not often required in actual practice. Moreover, the graph of such a fraction has infinite branches corresponding to the real factors of the denominator, so that unless the areas of these infinite branches are carefully discussed, by introducing the notion of the "principal value" of a definite integral, the result only enables us to find the areas of limited portions of the curves, for which approximate methods of quadrature would in many cases suffice. On the other hand, the mode of introducing the connection between integration and summation—a point on which Prof. Lodge rightly lays special stress (§§ 2, 43, 48)—will probably be regarded by most readers as not so satisfactory as it might be. Thus, to go no further, a relation on p. 4 is stated to be true to the first order which on p. 62 is shown to contain an error of the first order. This is the greater pity as the investigation of § 48 would, with the addition of a couple of lines, contain all that is necessary for a rigorous graphical proof, far shorter than that given in § 2; we hope this point will receive attention in future editions.

In reading the sections dealing with Simpson's rule and its modifications, one is surprised at the conservatism that prevails in the retention of a formula in which odd and even ordinates have unequal weight—a conservatism quite independent of the present book. When it is recollected that cutting off the first and last strips of a curvilinear area reverses the weights of the ordinates it will be seen easily that the trapezoidal rule, modified by suitable corrections for the two ends, may be made to give results quite as accurate as those of Simpson's rule.

Under applications of the calculus, we find areas, centres of mass, volumes and surfaces of revolution, and moments of inertia with especial reference to plane areas and their centres of pressure. The sections on differential equations contain what has for some time past been regarded as a standard elementary course on the subject, namely, the simpler equations of the first order and linear equations with constant coefficients. The study of the first integral of the equation $d^2y/dx^2=f(y)$ in connection with its kinematic interpretation, and the discussion of small oscillations in connection with the equation of harmonic motion, are good features. Finally, the chapter on the Gamma function has given Prof. Lodge an opportunity of saying something he wanted to say, and of saying it in his own way instead of cutting or drying it down to the requirements of a syllabus. It contains an interesting discussion of the extension of the conception of a factorial to negative and fractional arguments. It is much to be hoped that this chapter will encourage other writers of text-books to launch out into something new and original. This might to some extent help to save English mathematical teaching from sinking down to a uniform dead level of mediocrity, reminding one of an open, barren *veldt*, in which all the smaller hills have been levelled down by the steam-roller of the examination and the syllabus, and all high eminences have crumbled to the ground as a result of the starvation salaries paid to really competent mathematical teachers.

G. H. BRYAN.

[Since the above was written I have had some correspondence with Prof. Lodge quite independently of the present review. The treatment of the summation of infinitesimals contemplated by him in the articles criticised above may be stated more clearly somewhat as follows:—Let $y=f(x)$, and let $x$ increase from $a$ to $b$ by a series of increments $dx$. Then if $dy$ denote the corresponding increment of $y$, the sum of the increments $dy$ is *exactly* equal to $f(b)-f(a)$. Moreover, the "exact differential" $dy$ becomes equal to the "differential product" $f'(x)dx$ when $dx$ is infinitesimal, and *under this condition* we may put $f(b)-f(a)$, equal also to the sum of the differential products $f'(x)dx$. Also in all practical applications Prof. Lodge contends that what we really want is the sum of the exact differentials $dy$ rather than the sum of the corresponding differential products $f'(x)dx$. This contention I believe to be correct, and if Prof. Lodge can re-write the articles once more—for he says that he has already repeatedly re-written them—and make it more clear that he is not merely giving an inaccurate reproduction of Todhunter's rigorous proof, but something quite different, his treatment may be made one of the many valuable features of his book. The method interests me greatly, and appears to be of sufficient general interest to justify the present explanatory note.—G. H. B.]

## STIMULUS AND MEMORY.

*Die Mneme als erhaltendes Prinzip im Wechsel des organischen Geschehens.* By Richard Semon. Pp. xiv+353. (Leipzig: Wilhelm Engelmann, 1905.) Price 6*s.* net.

LITTLE as it may appear from the title, this work is really an inquiry into some of the remoter effects of stimulation. Thus, every stimulus applied to organic substance—whether that substance be nervous, or not nervously differentiated—produces not only its appropriate reaction, but also an altered condition of the substance itself, so that even when the immediate effect of the stimulation has subsided, the second "condition of indifference" is different from the first. The substance may now, for example, readily react to stimuli which before were insufficient to produce any appreciable effect, or it may respond to a stimulus connected only by association with the stimulus usually necessary. It pleases this author to read and group these facts anew, and to apply to them a terminology that will correspond with the novelty of the grouping. Hence he calls the enduring effect of the stimulus an *engramm*; the stimulus is said to operate *engraphically* on the substance, or to produce an engraphic alteration. Again, when stimulus B, differing in quality or quantity from stimulus A, still succeeds with the aid of the *engramm* in producing a reaction appropriate to A, it is said to operate *ecphorically*, or the new state of excitation is said to be produced by the *ecphory* of the *engramm*. Obviously ordinary memory may be brought under this wide class of phenomena, and the author might have used the term memory to describe these facts; but, to avoid misunderstanding, he has chosen the term *mneme* instead. Hence we read of such things as *mnemic* excitation, *e.g.* in the case mentioned above when stimulus B is applied.

The situation is well summed up on p. 89:—

"We recognise the presence of an engramm by the circumstance that for the discharge of the appropriate reaction the appearance of the original unaltered stimulus is no longer necessary, but the appearance either of the original stimulus altered quantitatively or qualitatively, or of a stimulus which works ecphorically on an associated engramm, or the expiration of a definite period of time (chronogenous ecphory), or finally the appearance of a definite phase of development in the continuous series of successive generations (phasogenous ecphory)."

Herr Semon on these lines proceeds to discuss the facts of acclimatisation and instinct, the inheritance of acquired characteristics, and the like, and to translate them into his peculiar language. Thus, when according to Mr. Claypole (as reported by Prof. Lloyd Morgan) young ostriches hatched in an incubator pick up food thrown before them only after someone has "dabbed" with his finger on the ground in their presence, our author's interpretation is that we have here the ecphory of an inherited engramm, an engramm the appropriate reaction of which is pecking; the ecphoric stimulus in this case is the return of the primary stimulus (pecking on the part of the mother hen) altered to some extent qualitatively.

The limits of space forbid a full account or discussion of many interesting questions raised by Herr Semon. In the second part of the book he deals with the mutual relations of engramms, their localisation, the mnemic conditions of excitation, and mnemic homophony. By mnemic homophony is meant "the process by which mnemic excitation and fresh original excitation are, so to speak, made to coincide, and by which each disagreement between the two produces a perceptive reaction." The third part discusses the reality of mnemic processes in "ontogenesis." In the fourth the author deals with various objections, and claims for *Mneme* that it is a necessary preservative principle which protects the transformations continually produced by the external world. He claims, also, that it helps us to an understanding of the law of which Haeckel is the unwearying exponent, viz. that the individual passes through the same stages of development as the whole species to which it belongs.

The author seems a competent reasoner and observer. His work is interesting and suggestive, and opens a fruitful field for discussion.

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## ECONOMY IN THERMAL POWER PLANTS.

*Commercial Economy in Steam and other Thermal Power Plants as Dependent upon Physical Efficiency, Capital Charges, and Working Costs.* By Prof. Robert H. Smith. Pp. xxiv+291; with numerous diagrams by H. Malcolm Hodson. (London: Constable and Co., Ltd., 1905.) Price 24*s.* net.

THE aim of this work is to deduce sufficiently accurate laws for determining the most efficient power plant when all-round economy is taken into account. For this purpose it is necessary to determine a standard of economy, and this is fully discussed in the opening chapter, where a coefficient is defined depending upon the value of the product directly and on the cost and time inversely. The application of this standard to measure the efficiency of production is applied to some examples, and the results of the analyses are considered in detail. After a discussion of the properties of steam, the efficiencies of engines and boilers, and questions of a kindred nature, the author proceeds to deal with the interesting question of the cost of various forms of thermal power plant.

The data for this chapter have been drawn from various sources, principally from makers' catalogues, and are exhibited in graphical form for heat engines by plotting capital or annual costs as ordinates against final cylinder volumes or brake horse-power as abscissæ. In this way very interesting relations are established, which can generally be approximately represented by straight-line laws with sufficient accuracy to form a fair estimate of cost. Thus for Crossley gas engines up to 500 horse-power with Dowson gas producers, the capital cost, including the building, is given as $300+10.8\,T$, where T is the

brake horse-power, while for a corresponding plant using Diesel oil engines the formula is 300+10 T. The annual costs for a year of 2700 working hours for these are stated as 200+3·7 T and 110+2·9 T respectively.

Steam engines are treated in like manner; thus in the case of a high-speed tandem compound engine the price is found to be represented by

$$140+0.05\,S-\frac{30,000}{240+S},$$

where S is the final volume of the steam in cubic inches swept out by the low-pressure piston per stroke. Formulæ are developed for boilers in terms of E, the evaporative power in pounds of water per hour, and the pressure, $p$, in pounds per square inch; thus the price of Lancashire boilers in pounds sterling is expressed by $110+(0.016+0.0003p)E$.

The information brought together in this section has evidently involved much labour, and it should prove extremely useful. The remaining half of the book is devoted to questions involving a considerable acquaintance with thermodynamics, in which the author introduces several new terms, such as "transpower" (p. 155), to signify the time rate of transmission of energy, "dynothermic coefficient" (p. 229), defined as the "ratio of resilience to heat transmission creating it."

Great stress is laid on the irreversible character of practical heat-engine cycles, and the author's views may be judged by his remarks on p. 178, where he says:—

"The conditions of life require rapid work, so that the sooner we give up worshipping reversibility as a fetish worthy to be aspired after and approximated to, the better will we succeed in engineering."

The dependence of maximum economy upon size, indicator diagram, initial and back pressure, working speed, and furnace temperature are all dealt with in detail, and combinations of the best values for effecting economy are considered by graphical methods.

The complex nature of the problems attacked make this part of the book decidedly hard reading, and the difficulty is much increased by the author's notation. The book is well illustrated by diagrams drawn by Mr. H. M. Hodson. E. G. C.

## MATERIA MEDICA.

*A Text-book of Materia Medica for Students of Medicine.* By C. R. Marshall, M.D. Pp. xi+635. (London: J. and A. Churchill, 1905.) Price 10*s.* 6*d.* net.

THE compilation of a satisfactory text-book of materia medica is a somewhat difficult task, since the author should, at least in an ideal text-book, be equally conversant with the chemistry of drugs, the botany of those which are of vegetable origin and the therapeutics of all. Dr. Marshall has been singularly successful in preserving in this book an even balance between these various divisions into which the subject naturally falls.

The arrangement adopted, which differs somewhat from those commonly employed in text-books or materia medica, is to be commended. The first portion deals with the inorganic substances used in medicine, then a chapter is devoted to the synthetic products which have of recent years assumed so important a position as remedial agents, including antipyrine, phenacetin, sulphonal, &c., and finally about 300 pages are occupied with the description of drugs of vegetable or animal origin. The method of grouping these drugs is roughly that of the nature of the "active principles" they contain, so that the subject appears as a fairly coherent whole instead of as a set of isolated groups of facts, which is the case when the method of treatment adopted is that of the botanical relationships of the plants from which the drugs are obtained. The descriptions given of the various drugs of vegetable origin are clear, and though concise are sufficient for purposes of recognition, especially when used in conjunction with the carefully executed illustrations, which are one of the best features of the book.

In spite of the care which has evidently been taken, both in the actual compilation and in the "proof" reading, there are a few inaccuracies and doubtful statements still existent in the text to which reference may be made. It is not quite accurate to say that "no authentic case of antagonistically-acting alkaloids occurring in the same plant is at present known" (p. 6), since aconitine and aconine, which are stated (p. 330) both to occur in the root of *Aconitum Napellus*, have been shown to possess opposed physiological activities. Podophyllin is not, as suggested (p. 8), a "neutral principle," which, when used in the ordinary sense, means a single definite substance, but is a mixture of resins. The reference to the "theoretically possible number of terpenes" (p. 11) is misleading, since the number cannot be computed with our present knowledge of these bodies. Gums are not, as stated (p. 15), carbohydrates, and this statement does not harmonise with that given later (p. 16), that arabin, the chief constituent of gum arabic, is a mixture of salts of organic acids. Potassium hydroxide "can be handled with safety" (p. 111) is, to say the least, not a wise saying to place before students. Milk sugar (lactose) is wrongly described (p. 233) as not fermentable.

On general grounds exception may be taken to such a loose and carelessly worded statement as "on the differences in solubility of alkaloids is based the *principle* of standardisation" (*i.e.* of drugs and galenical preparations of these), and to such a sentence as "hyoscine and scopolamine have a somewhat *different* constitution *to* atropine and hyoscyamine."

Such blemishes as are referred to in the preceding paragraphs do not, of course, seriously detract from the excellence of the book taken as a whole, and it may be recommended to students as a safe guide to modern materia medica, at least in so far as this has received official recognition by the British Medical Council. T. A. H.

## OUR BOOK SHELF.

*Die neuere Entwickelung der Kristallographie.* By Dr. H. Baumhauer. Pp. viii+184; 46 plates. (Brunswick: Vieweg and Son, 1905.) Price 4 marks.

THOUGH this sketch of the more recent developments of our knowledge of crystals will be of service to the crystallographic student, it is primarily intended for those physicists and chemists who require to make use of crystallographic methods in their own researches; detailed explanations of technical expressions and crystallographic ideas are therefore given.

The work is divided into six chapters. The first treats of the definition of a crystal, the law of zones, the law of rationality of indices, and the methods of crystallographic projection; an account is given of various fluid and viscous bodies which must now, according to the researches of Lehmann, Schenck, and others, be included in the same group with solid crystals. The second chapter shows that crystals may be distributed into thirty-two classes capable of reference to six systems, each class differing from the others in the elements of its symmetry. The third chapter explains the various methods by which the class of symmetry to which a crystal belongs may be ascertained, and thus treats of the determination of facial distribution by means of one-circle, two-circle, or three-circle goniometers, and the investigation of the physical or chemical properties, more especially optical anomalies, circular polarisation, pyroelectric behaviour, and the etch-figures developed on crystal faces as a result of solvent or chemical action; the last mentioned is a branch of crystal research to which Dr. Baumhauer has himself given much attention. The fourth chapter gives a discussion of the regular growths met with in crystals, and in this connection a detailed account is given of mimetic growths such as are observed in the case of the felspars. In the fifth chapter is a description of the development of crystal faces; an account is given of Goldschmidt's "law of complication" and of nodal points. The sixth and last chapter deals with isomorphism, morphotropy, topical axes, polymorphs, and the relations between the chemical formula and the crystal system of a substance. The observations of Prof. Miers relative to the vicinal faces of alum crystals, and the researches of Dr. Tutton on the relation between the chemical composition and the morphological and physical properties of a substance are specially mentioned. Prof. Baumhauer's long experience as a teacher has enabled him to give an account which is at once well up to date and of a readable character.

*La Théorie moderne des Phénomènes physiques. Radio-activité, Ions, Electrons.* By Prof. Augusto Righi. Pp. iv+125. (Paris: L'Éclairage Électrique, 1906.)

THIS is a translation from the Italian. The book is a good semi-popular account of recent physical developments, and is likely to be useful to those desirous of gaining a first acquaintance with them. Even original investigators will here and there glean useful hints or ideas.

Prof. Righi, we are interested to note, prefers the use of an electroscope of almost microscopic dimensions for detecting minute radio-active effects. A systematic inquiry into the best dimensions for these instruments is very desirable, and might be advantageously made either from a mathematical or from an experimental standpoint.

In one or two cases Prof. Righi quotes investigations of which the soundness may perhaps be doubted—for instance, the alleged occurrence of radiations from phosphorescent zinc sulphide capable of penetrating opaque bodies, and the determination of the velocity of Röntgen rays made by M. Blondlot. This last experiment depended on the action of the Röntgen tube on a minute electric spark. This action was afterwards attributed by M. Blondlot to the *n*-rays, and the objective existence of the *n*-rays is now generally discredited.

We have seen an English translation of Prof. Righi's book. The French translation is not, therefore, of special interest to English readers.

R. J. S.

*Modern Lightning Conductors.* By Killingworth Hedges. Pp. viii+119. (London: Crosby Lockwood and Son, 1905.) Price 6*s.* 6*d.* net.

THE subject of lightning protection is one of considerable importance to architects, and a book in which the existing information thereon is conveniently collated is therefore to be welcomed. Mr. Killingworth Hedges's long association with this very special branch of electrical engineering enables him to write with authority. The book may be regarded as a very useful work of reference on the subject, as it contains a summary of the recommendations of the lightning research committee of 1905, together with numerous extracts from the observers' reports on buildings which had been struck by lightning, which served as the basis on which the committee drew up its suggestions. These extracts are copiously illustrated and the faults in the details of the protection in each case are clearly pointed out. The book is enlivened by the last chapter, which gives several instances of peculiar results of lightning strokes.

## LETTERS TO THE EDITOR.

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

### The Inventor of the Nicol Prism.

CAN any of your readers supply me with the dates of birth and death of William Nicol, the inventor of the Nicol prism? There is a tablet to his memory in the Wariston Cemetery, in Edinburgh, bearing an inscription drawn up by the late Prof. Tait. Strange as it may seem, though his fame is world-wide in optics, he is not even mentioned in the "Dictionary of National Biography," nor do I know of any memoir of him elsewhere.

SILVANUS P. THOMPSON.

Technical College, Finsbury, London, E.C., February 6.

### Result of War affected by Soldier's Stature.

THE Japanese had an unquestionable advantage in the recent war as being smaller than the Russians; they were smaller targets for fire-arms. I wish to point out that it is possible to express this advantage quantitatively on the assumption, justifiable in modern war, that bullets are, on the average, uniformly distributed over the target presented by a man's body, also that a man presents a target proportional in area to the square of his height. The Anthropological Institute has kindly given me figures for the purpose; the average height of 2500 Japanese, 1260 of them being soldiers, was 1585 millimetres as compared with an average of 1642 millimetres for the average of 177,948 European Russian conscripts. The average Russian height thus exceeds that of the Japanese by about 3·47 per cent. The squares of the two average heights, representing, as I have said, the average targets offered by each to an enemy, differ therefore approximately by 7 per cent., so that the Russian fire was relatively ineffective to that extent. JOHN H. TWIGG.

The Hydro, Ben Rhydding, Yorkshire, February 1.

### Scintillations produced by the Electronic "β-Rays" emitted by Radium.

As the β particles emitted by the radio-active elements are analogous to the α particles, inasmuch that they may be considered as parts of the disintegrated atom, and not in any sense true rays, I have been conducting some experiments with the view of ascertaining if, in any circumstances, their action upon fluorescent screens caused recognisable scintillations. It will be obvious that if the radium used be placed too near the screen, the effects of the combined β and γ rays will produce a fluorescence sufficiently vivid to mask any scintillations due to the individual electrons which compose the β stream. In order to diffuse this action and allow the β particles to separate to such a degree that the flashes produced shall not overlap, recourse may be had to three methods :—

(1) Increasing the distance between the radium and the screen.

(2) Making the stream pass through material offering resistance to its passage.

(3) Reducing the quantity of radium used and "diluting" the action by mixing it with non-active substances.

I have tried these methods separately, and in each case have obtained results which were fairly satisfactory considering the difficulties attending this class of observation.

In these circumstances the screen, when viewed with a lens having a focus of about half an inch, was seen to be fluorescing with a faint glow, which was, without doubt, of an unsteady and flickering character.

The phenomena involved are delicate and difficult to observe, requiring the best possible conditions. It is very important that the eyes are thoroughly rested before the observation is made, but the fact that the glow is flickering and strongly suggestive of scintillations is, in my opinion, beyond dispute. After trying various combinations of the above methods, I have obtained results sufficiently decided to justify the statement that the screen was lit up by scintillations properly so called. A screen of zinc sulphide, so very excellent for viewing the scintillations produced by the α particles, does not give satisfactory results for the β stream.

Willemite and barium-platino-cyanide are both fairly good, the latter being rather the better of the two. I have obtained the best results with an ordinary X-ray screen. Having enclosed about 15 or 20 milligrams of radium-barium-bromide (1 per cent.) in a small glass tube, I placed over it a sheet of mica. Over this was placed a sheet of cardboard, and above this again, at a distance of about half an inch, was the screen. When the lens was focused on the screen, a dim fluorescence, due to the γ rays, was seen as a sort of background, on which were visible faint nebulous scintillations coming and going in a manner very similar to the scintillations produced by the α particles on a zinc sulphide screen. C. W. R.

February 2.

### The Effect of Food on the Colour of Moths.

In a very interesting paper published in the *Journal of Economic Biology* (1905, No. 1), Mr. W. E. Collinge describes and figures a remarkable series of specimens of the magpie moth (*Abraxas grossulariata*, Linn.), obtained as the result of raising the larvæ on lettuce, the ordinary food being currant. The specimens all differed from the type in the direction of great loss of markings, the most extreme one representing the aberration known as *dohrni* or *deleta*. The same sort of effect has been produced on the tiger moth by G. Koch, as a result of feeding the larvæ on lettuce; and a good account of various experiments of the same kind is given by Dr. Vernon on pp. 288–9 of his work on "Variations in Animals and Plants" (1903).

The effect produced in the cases cited may be regarded as a sort of compulsory mutation, though we do not know whether it could in any case be inherited in such a manner that it would remain constant under different conditions. If the normal maculation, which has existed for countless generations, can be transformed in a single one by a new food-plant, it is not likely that the alternate type can be any better fixed.[1] The species must be regarded as potentially dimorphic, indeed, polymorphic, for other quite different aberrations occur. There arises, however, an interesting possibility. Mr. Collinge found that the insects were raised with difficulty on lettuce, and he doubted whether it would be possible to raise three successive generations exclusively on that plant. Suppose, however, that among many which fed on lettuce (or any unwonted food) a few were able to survive, and consequently a lettuce-feeding race became firmly established. Such a race would show the same marked differences from the type which appeared in the first generation, and it is not unlikely that at length it would be as difficult to get its members to live on currant as it originally was to get the currant-feeders to survive on lettuce. We should then have a lettuce-feeding form, very easily distinguished from the currant-feeding one, and nobody would hesitate to call it a distinct species. If it absolutely refused to feed on currant, the peculiar markings would be as fixed as in any species known.[1]

These suggestions appear to have the more force from the fact that some of the lettuce-fed examples strongly recall *Abraxas sylvata*, which feeds on elm, and is universally considered distinct. This *A. sylvata* and its allies form a group of closely allied races in the Palæarctic and Oriental regions, and it would be extremely interesting to ascertain whether these several forms have different food-plants, and whether by changed conditions they can be derived from one another. Many years ago I had occasion to tabulate these forms, using the material in the collection of the British Museum, and in the hope that the matter may be taken up by some eastern entomologist I give here the brief table I made :—

A.—*Markings strongly developed.*

(*a*) Expanse about 34 mm.; Europe, Siberia, &c. . . . *sylvata*, Scopoli.

(α) Markings stronger than type or darker; brown anal blotch more reduced; Japan, &c. . . *sylvata* var. *intensa*, Warren.

(*b*) Larger; nearly always more than 40 mm. expanse.

(α) Markings strong and dark. China and Japan . . . *miranda*, Butler.

(β) Markings paler. India . . . *leopardina*, Kollar.

(*c*) Still larger; expanse more than 50 mm.; markings rather pale.

(α) Markings more suffused. N. China . . . *plumbeata*, Warren.

(β) Markings less suffused. Silhet . . . *illuminata*, Warren.

B.—*Markings much reduced, but the brown blotches remaining well developed.*

(*a*) Expanse more than 40 mm.; markings rather more developed than in *pantaria*. India . . . *paucinotata*, Warren.

(*b*) Expanse more than 35 mm.; Europe . . . *pantaria*, Gn.

(*c*) Expanse about 30 mm.; markings still more reduced. Europe . . . seasonal form *calaria*, Gn.

Since the physiological adaptation to the new food-plant is not really connected with the change of colour or maculation, it may frequently take place without any externally visible signs, or such signs may only arise after a long period. In this way we get "physiological species," which are no doubt more numerous than is generally supposed. T. D. A. COCKERELL.

University of Colorado, Boulder, Colorado, U.S.A., January 18.

### A Correction.

In the review of Prof. Fr. Czapek's "Biochemie der Pflanzen" (NATURE, vol. lxxiii. p. 192) I mentioned that I missed a certain paper by Schjerning. The author's name should have been Weis.

I also overlooked the reference to a paper by Cornevin.

An index of authors' names would enhance the utility of the book. F. ESCOMBE.

[1] In this connection, *cf.* "The Principles of Heredity," by G. Archdall Reid, 2nd edition, Appendix A, pp. 355–356.

[1] Pictet, quoted by G. A. Reid, reported that after several generations on a new food-plant, certain butterflies which had at first been modified reverted to the original type. Of course, the case I have imagined is one in which this does not take place, but experiment is needed to test the possibilities indicated.

## A METRICAL AND PICTORIAL RECORD OF THE EARTH'S HISTORY.[1]

THE author of this curious book tells us that it is an attempt to present a sketch of the evolution of the earth on the nebular hypothesis, to note also subsequent sea and land movements, and successive appearances of life as revealed by the geological strata. The geological record of past life remains very imperfect; still, many additions, notably from strata in Egypt and North America, have been made in recent years, and studied in the light of the doctrine of evolution its revelations have become more intelligible.

Why the author should imagine that to describe in rhyme the history of our planet and its inhabitants, from the earliest times to the present day, would render the subject simpler and more attractive to the general reader it is hard to imagine; but still, precedents are not wanting in such works as Dr. Darwin's "Temple of Nature," Pope's "Iliad," Henry's "Latin Grammar," and a poetic history of England, to justify the author's contention that it is an appropriate form in which to present a cosmical and palæozoological work to the public.

We fully agree with him that the theme is deserving of a much higher form of treatment, and that some day a great poetic genius may take it in hand. We cannot help feeling, however, that prose would have best befitted the aim of the present work. The author has had both an academic and geological training, and knows, from the study of text-books, museums, and extensive travel, a great deal about the subject on which he rhymes, and he has had the advice and assistance of a great number of learned scientific men whose names are duly recorded in prose in the preface. But the feature which renders this work of special interest is its fine series of illustrations, fourteen being executed in colour-processes by E. Bucknall, L. Speed, C. Whymper, and others, and seventy-seven by tint process reproduction. These give animation and attractiveness to the work, and will doubtless induce many purchasers by the beauty or the weirdness of the subjects pourtrayed.

Commencing with the astronomical aspect of the earth, there is a very fine plate of "the great Nebula of Orion" (from the Yerkes Observatory, Wisconsin, U.S.A.), and of "a Spiral Nebula in *Canes venatici*," from the Lick Observatory, California.

There is a charming Cambrian marine scene with crinoids, star-fish, trilobites, and medusæ, drawn by Alice B. Woodward, and an equally attractive Silurian (submarine) view by the same artist. No fewer than thirty plates have been executed by J. Smit, who illustrated two little books by the Rev. H. N. Hutchinson called "Extinct Monsters" and "Creatures of Other Days." But having become accustomed to the life-like restorations of Mr. Chas. R. Knight, made under the direction of Prof. H. F. Osborn, of the American Museum of Natural History, New York, we feel that Mr. Smit's extinct animals are tamer and somewhat lacking in that high artistic merit which Mr. Knight's drawings possess. The coloured plates by E. Bucknall, L. Speed, and Charles Whymper are of a different order. E. Bucknall's cave-men carving on bones by firelight (p. 200), the "Neolithic Farmstead" (p. 214), the landscape in the Carboniferous period (p. 35), or his excellent conception of Sivatherium, a huge horned Pliocene giraffe, with a dappled hide like its long-necked modern descendant are most admirable. Lancelot Speed's primitive man and woman, although a clean shaven and washed, and intellectual looking couple, make a very good frontispiece. His Devonian, Triassic, and Eocene landscapes are also excellent and original. There is much merit and ability displayed in Chas. Whymper's Jurassic landscape with pterodactyls and a gavial hunting the duck-billed Ornithorhynchus, but we do not remember this monotreme occurring in any Jurassic rocks. The other novelties afforded by the book illustrations are from the facile pencil of Alice Woodward, as the Jurassic period (p. 62), with its ammonites and crustaceans; the restoration of *Diplodocus carnegiei* (p. 72); the Cretaceous sea-beasts (p. 83); Polacanthus, a reptile from the Isle of Wight reconstructed by Dr. Francis Baron Nopcsa (p. 88); restorations of various ancestral forms of elephants lately unearthed in Egypt; Mœritherium (p. 114); Palæomastodon (p. 114); and Tetrabelodon (p. 125); most remarkable of all those lately come from the land of the Sphinx is the Arsinoitherium (p. 120), a weird-looking herbivor, with quadricorn defences on its frontal bones and a full dentition of 44 teeth in its jaws—not, however, in the ancestral line of elephants, nor perhaps of any living group, but *sui generis*. This, and the ancestral forms of elephants, are about to be published by the Trustees of the British Museum, as a monograph on the fossil mammalia, &c., from the Fayûm, Egypt, prepared by Dr. C. W. Andrews.

The only other extremely novel restoration is that of the huge marsupial, Diprotodon (p. 172), the remains of which have been found in such profusion in the interior of South Australia by Dr. Stirling. The pic-

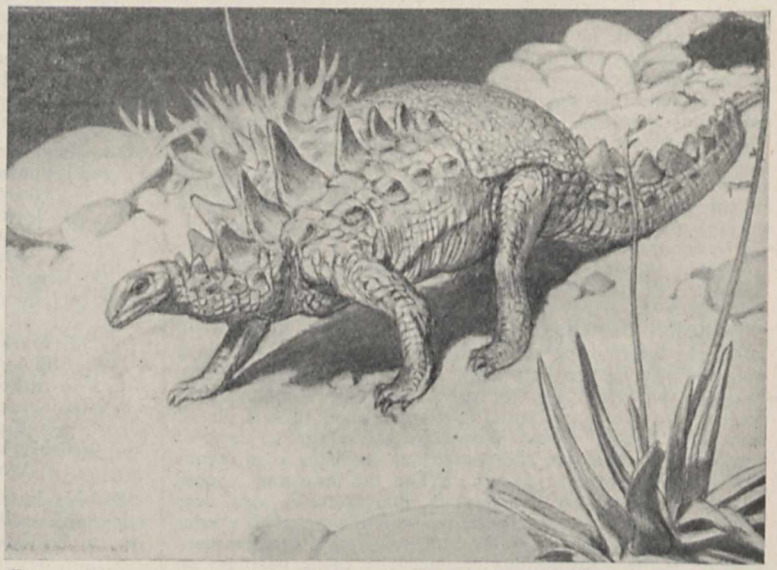

FIG. 1.—Polacanthus restored from skeleton found in the Isle of Wight, and now in the British Museum (Natural History). Total length probably about 25 feet. Reduced from "Nebula to Man."

[1] "Nebula to Man." By Henry R. Knipe. With Illustrations by Ernest Bucknall, John Charlton, Joseph Smit, Lancelot Speed, Charles Whymper, Edward A. Wilson and Alice B. Woodward. Pp. xvi+252; with 16 coloured page illustrations and 57 tinted page illustrations. (London: M. Dent and Co.) Price 21*s.* net.

ture of Pliocene horses by J. Charlton should also be noticed as a very spirited and excellent composition (p. 167).

FIG. 2.—Arsinoitherium (probably from 8 to 9 feet in length). From remains found in the Upper Eocene of Egypt. Preserved in the British Museum (Natural History) and in the Survey Museum, Cairo. Reduced from "Nebula to Man."

The following is Mr. Knipe's dedication of his work :—

TO NATURE.

How fair, O Nature, are thy looks
In these thy matron days :
And with what light a heart thou seem'st
To tread thy thorny ways.
Man sees thee joying in thy life,
So full, so fresh, so free,
As if thy toil in ages past
Had nothing been to thee.
And well may he beneath thy spell,
Forget thy inner life,
The waste and suffering in thy breast,
And never ceasing strife.
Or if so be he needs must think
Of all the tumult there,
He knows at least one end it has,—
To make thee grow more fair.

It is not so much a matter of serious importance whether one reads patiently the carefully executed text in verse or turns with a disdainful smile from such lines as :—

"The whale-like Zeuglodonts that off these coasts,
In Eocene times pursued the finny hosts,
Are seen no more : but forms in tooth allied,
Though skulled more as the Dolphin, swim the tide."

* * * * * *

Suffice it to say that the book, as a whole, is admirably illustrated and must have cost the author a very large sum to produce. The pictures alone form an excellent guinea's worth, and will prove a real joy to the younger generation as well as to some of the elder, and there is no single picture in the book which has not been drawn expressly for the present work.

## *SOME MAMMALIAN TYPES.*[1]

MR. RENSHAW, whose pleasant essays on African mammals are fresh in our memories, has in his new volume taken a wider field, and selected his types from the fauna of the whole world. They are still confined to mammalian forms, and this being the case it would perhaps have been possible to give these volumes a more original title than that adopted by Waterton for his famous essays published in the first half of the last century. But Mr. Renshaw's essays are decidedly original in the treatment of the subject. They deal not merely with the natural history of animals, but also with the history of our knowledge of them. Thus the history of the Addax antelope, inhabiting the great desert, is traced from the time of the ancient Egyptians and of Pliny to its modern re-discovery early in the last century; and that of the extinct northern sea-cow in connection with the adventures of the searchers after the North-west Passage.

Never before, indeed, has the history of mammalian forms been more attractively presented to the public. The history of the discovery of some of these grand forms of life is often a true romance of natural history, which, appealing strongly to the author, is graphically re-told by him; and his enthusiasm enables him to carry the reader with him to see in his mind's eye the country inhabited by the beasts he describes, and to feel some of the keen delight experienced by the hunter-naturalist when some such beautiful trophy as the sable antelope rewarded him for all his toil. He excels in describing the natural scenery—the setting—of the subjects of his essays; and writing of the Malay tapir, of "antediluvian appearance," conjures up a most realistic mental picture of the home of the Palæotheres, their ancient representatives, when in far-off days they roamed over swamps covering the present site of Paris.

The misconceptions which hang about the vampire bat in the popular mind are here cleared away, and the statement that it is difficult to stop the bleeding set up by it suggests a search of the salivary glands for any ferment that might hinder the coagulation

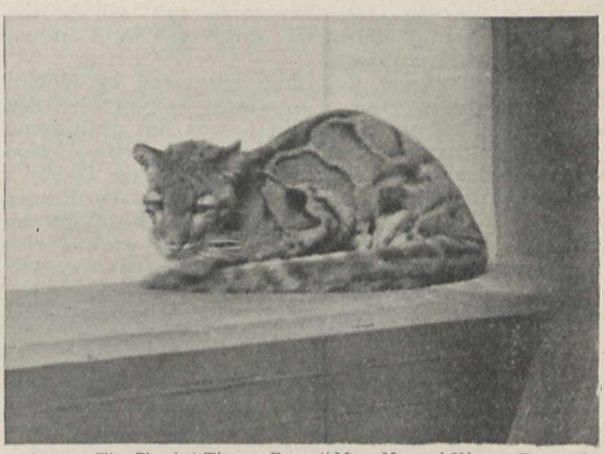

FIG. 1.—The Clouded Tiger. From "More Natural History Essays."

of blood, and some interesting remarks thereon. Although it was discovered by Columbus, few people perhaps realise that a seal inhabits the warm waters

[1] "More Natural History Essays." By Graham Renshaw, M.B., F.Z.S. Pp. 243; illustrated. (London and Manchester : Sherratt and Hughes 1905.) Price 6*s*. net.

of the Caribbean Sea. The account of the Jamaican seal is all the more interesting because it seems likely to become extinct, possibly partly because it is one of those animals which, to preconceived ideas at all events, seem out of place. But in this connection we are reminded that there is also a Mediterranean seal, and that the leopard is actually as European as the brown bear. Another extinct animal which we are glad to have an account of is the Antarctic wolf of the Falkland Islands, finally exterminated by the sheep-farmers in self-defence; its possible introduction to the Falklands is discussed, and the question whether it was really distinct or merely a modified form.

These extracts will serve as a fair sample of the score of essays in the new volume. In the case of rare or extinct forms there is an indication of the known specimens now or formerly in collections. The value of photographs from life of rare, and especially of "threatened," species is emphasised by the author, who illustrates his essays with eighteen photographic plates. Even in the London "Zoo" it is not always easy to photograph an animal. The clouded tiger was under observation for five years before a satisfactory picture (which we are enabled to reproduce) could be obtained. O. V. A.

## *MINERS' WORM.*[1]

THE dreadful disease known as ankylostomiasis, "tunnel disease," "cachexia of miners," or "miners' worm," is definitely known to be caused by the nematode worm *Ankylostoma duodenale*. The alarming spread of the disease in the mines of Hungary, France, Germany, and Belgium, and its recent introduction into some of the mines of this country, have necessitated a thorough investigation of the anatomy, development, and life-history of the worm. Already some 750 papers treating of the disease have been published, but only a few of these deal with the parasite itself, and still fewer with the details of its anatomical structure.

The splendid work before us now gives in full detail the gross and minute structure of the adult worm, but a second part is yet to come from the pen of the same distinguished parasitologist in which the development and life-history will be described. If the second part is as full of detail and as well illustrated as the first, the monograph will be the most complete account of any single species of animal that the world possesses.

The Ankylostoma was first discovered by Dubini in 1838 in the intestine of a peasant woman who died in the hospital at Milan, but it was not until some years later that he associated the worm with disease and published an account of it. Soon after Dubini's discovery the worm was found in Egypt by Pruner and by Bilharz. Dr. Looss considers carefully the suggestion that has been made that the worm Heltu mentioned in the Ebers papyrus of *ca* 1550 B.C. was Ankylostoma, and that the disease was known to the ancient Egyptians, but he comes to the conclusion that there is not sufficient evidence to support this suggestion.

The discovery of Ankylostoma in Brazil by Wucherer, and in other warm and tropical places, led to the belief that ankylostomiasis was peculiar to such climates, but the epidemic of "tunnel disease" among the workers in the St. Gothard Tunnel, and the recognition by Perroncito of its identity with ankylostomiasis, was the first indication of the serious part this worm was to play in the medical history of the present day.

Dr. Looss devotes some pages to a full discussion of the systematic position of the species and of the generic characters of this and the other genera of the family Agchylostominæ. I must confess to some disappointment that, influenced by the writings of Stiles, of Washington, the author has come to the conclusion that the genus must be written Agchylostoma.

"I freely confess," he writes, "that I find the term *Agchylostoma* abominable," and throughout the monograph he uses the spelling Ankylostoma in roman letters and Agchylostoma in italics. It is extremely inconvenient, in any case, to restore an ancient and "abominable" spelling of a generic name, and it is to be especially deplored in a monograph of such value and importance as this one; but no rules of nomenclature can justify the course adopted of spelling a generic name in two distinct ways on almost every page.

The text consists of 140 pages of elaborate details of microscopic anatomy and histology, and the illustrations consist of ten plates of very beautiful drawings by the author, lithographed by Werner and Winter, of Frankfort.

The monograph was originally written in German, but has been translated with very great skill into English by Mrs. H. M. Bernard.

SYDNEY J. HICKSON.

[1] "The Anatomy of *Agchylostoma duodenale*, Dub." By A. Looss. Records of the Egyptian Government School of Medicine. Vol. iii. (Cairo: National Printing Department 1905.)

## *THE ROYAL COLLEGE OF SCIENCE.*

MR. HALDANE and the other members of the departmental committee who for the last two years have been considering the important questions referred to them have earned the nation's gratitude. If the scheme they propose be carried out (and there is reason to believe that it will be, and at once) a great step forward will have been made towards providing that complete higher education the absence of which has made us the laughing stock of those countries the Ministers of which are more intelligent than our own. As the reporters are careful to show in their general review, many of our scientific industries are an easy prey in international competition as it is carried on to-day.

We give below extracts from the recommendations made in the final report, just issued, which will sufficiently indicate the proposals of the committee; many paragraphs have been omitted which deal with details.

The unification of the teaching which already exists or is already provided for at South Kensington, and the additional buildings, teaching and research suggested, will certainly provide an institution admirably designed to meet modern needs. But we are grateful to the reporters for more than this; they tell us with no uncertain sound that technical education must crown, and not replace, a general education, so the resources of the Royal College in the future will not be frittered away in trying to teach those who have not learned how to think and in turning out incomplete men. A sufficiency of professors is also postulated, so we may hope that researches as well as teaching will be intensified, both for professors and students.

Messrs. Wernher, Beit and Co. are happy endowers; it is not often that such munificence as theirs, which set the inquiry going, leads to such a rapid and satisfactory result. Their 100,000*l.* is now supplemented, roughly, by the interest of a million from the State, of another from the County Council, perhaps

almost another from the City Guilds, while the State and the Royal Commissioners for the Exhibition of 1851 provide between them some four or five acres of land to build on gratis!

Some paragraphs of the recommendations refer to a question which is academic in more senses than one—whether the new Royal College of Science shall be under the government of the University. Our own view is that the question should be left to settle itself. There certainly at present must be a special governing body to start it, and the one suggested seems all that can be desired. There certainly also at some future time must be a very close connection with the University; it is too early to define that time.

*Extracts from Conclusions and Recommendations.*

The conclusions at which we have arrived are :—

(1) That the position of this country makes further provision for advanced technological education essential.

(2) That the students, by whose advanced technological education the nation would profit, are not actually obtaining it to the extent which is desirable, and that this is due to :—

(*a*) The lack of facilities for instruction in certain important subjects.

(*b*) The absence of such coordination among existing institutions of technological education as would permit the concentration of the more advanced courses in a limited number of institutions.

(*c*) An insufficient appreciation, especially on the part of employers, of the value of such education.

(3) That the opportunities for research in our technological institutions are inadequate to the industrial needs of the Empire, owing not to any want of ability on the part of the professors, but to the fact that much of their time is frequently absorbed in the giving of comparatively elementary instruction in pure and applied science.

(4) That in any institution in which the highest technological education is given, the equipment should be adequate for the purpose, and the staff should include, at the head of the several specialised branches of the work, men of the first rank in their profession.

From this point of view the recommendations which we have the honour to submit in reply to our terms of reference may be summed up as follows :—

That the present combination of conditions at South Kensington points to the desirability of so utilising the resources there available, and of making additions to these, as to form on that site an institution of the highest standing, an institution which, with the staff, equipment, and students that it will command, would go far towards remedying the above mentioned defects.

In a preliminary report we inquired whether the Board of Education were in a position to inform us (1) that, if it were found possible to establish a scheme such as we had sketched in outline, they would be willing to allow the Royal College of Science (including the Royal School of Mines) to be brought into it under a common government and administration; and (2) that the existing Government contribution to the support of these institutions would be continued under the new conditions on the scale already made necessary by the provision of the new laboratories of the Royal College of Science.

The Board have replied to the first of these questions in the affirmative, and, in reply to the second, the Government have intimated that they will be prepared to bring the Royal College of Science and Royal School of Mines, including the new laboratories, into a scheme framed on lines approved by the Board of Education, in accordance with this report, and to make a grant of 20,000*l*. per annum in respect of the cost of staff and of the laboratory expenses, with provision in addition for certain other minor expenses.

The favourable disposition of the Government has greatly strengthened our position, and enabled us to obtain the support and cooperation which we consider necessary to ensure the success of the scheme described generally in our preliminary report.

The gift of a capital sum in excess of the minimum referred to (100,000*l*.) in the preliminary report has been secured.

The commissioners of the 1851 Exhibition are prepared, if satisfied with the scope and constitution of the new institution, to place at the disposal of its governing body the unoccupied portion of their estate at South Kensington.

The council of the City and Guilds of London Institute have indicated their willingness to bring the Central Technical College into a scheme to be framed to their satisfaction on the general lines we are able to recommend in this report.

The London County Council, on July 27, 1903, received a report from its General Purposes Committee upon the proposal contained in the letter which Lord Rosebery had a short time previously addressed to the chairman of the Council, and resolved to place on record its opinion that, subject to certain conditions being fulfilled (about which we may say we do not anticipate any difficulty), the Council would be well advised, when the time came, to contribute a sum not exceeding 20,000*l*. per annum towards the maintenance of the institution.

In our opinion a sufficient maintenance fund is assured, at any rate, to justify a commencement, if not to carry out the scheme we have in view as fully as we hope may be possible hereafter.

The main object is the establishment, at South Kensington, of an institution or group of associated colleges, of science and technology, where the highest specialised instruction should be given, and where the fullest equipment for the most advanced training and research should be provided, in various branches of science, especially in its application to industry, for which no sufficient provision already exists elsewhere. The number of the departments will be limited by the resources available, and at first a selection will have to be made among them. The scale on which the departments are established should be capable of gradual expansion with the increase in the number of students, fitted by preliminary education, to take advantage of the teaching and training contemplated.

The scheme should, in the first instance, and subject to necessary adjustments, include the work of the Royal College of Science, the Royal School of Mines, the Central Technical College, and departments to be established on the additional site at South Kensington.

Such being the scope of the new institution, it is necessary that we should make recommendations with regard to the composition and functions of its governing body. Of the relation of the new institution to the University of London, it is necessary to premise that we are agreed that it is desirable that the new institution should be established immediately, and that its organisation should proceed without delay, and there is substantial agreement among us that for this purpose a governing body of the character sketched in a subsequent paragraph should be at once appointed with power to take immediate action. We wish, however, to put in the forefront of our recommendations under this head a proviso that they should not be regarded as in any way intended to prejudice the future settlement of the question of the relation between the new institution and the University. This is a question on which divergent views are held.

We do not consider that the establishment of the new institution should be delayed pending a decision between these two views, or that the general lines of its organisation (except, possibly, as respects the governing body) should be regarded as other than permanent.

Subject to the proviso we have already made, we recommend that a governing body should be established consisting of forty members appointed as follows :—

Six by the Crown.

Four by the Board of Education.

Five each by the University of London, the London County Council, and the council of the City and Guilds of London Institute.

Four by the teaching staff of the new institution.

Two by the commissioners of the Exhibition of 1851.

One each by the Royal Society, the Institution of Civil Engineers, the Institution of Mechanical Engineers, the Institution of Electrical Engineers, the Iron and Steel Institute, the Institution of Naval Architects, the Society of Chemical Industry, the Federated Institution of Mining Engineers, and the Institution of Mining and Metallurgy.

For the purposes of the new institution the governing body should have the entire disposal of the accommodation provided by the Royal College of Science, including the buildings in course of construction at South Kensington, the Central Technical College, and all buildings which may be erected on the additional site at South Kensington.

The site and buildings of the Royal College of Science, including the buildings in course of construction, should either remain the property of His Majesty's Government or be transferred to the governing body of the new institution, as His Majesty's Government may determine.

The site and buildings of the Central Technical College should, if and so long as they desire it, remain the property of the City and Guilds of London Institute, who should provide for their maintenance and repair.

The governing body should be incorporated, and subject to such special provisions as may be made by their instrument of incorporation they should receive and expend fees and other funds which may be assigned to the purposes of the new institution, they should appoint the professors and the other members of the staff, they should determine the departments and subjects of instruction, they should control the arrangement of the courses of instruction, and the award of diplomas, and they should make provision for the protection of students now in the constituent institutions and of the existing diplomas. Further, in each of the departments of the new institution the governing body should appoint a board, not necessarily consisting of members of their own body, and including members of the teaching staff and persons with practical experience of industrial requirements, to give expert advice with regard to such particulars connected with that department as the governing body may refer to them.

We recommend that it be an instruction to the governing body to enter into negotiations with the University of London, with King's College, and pending its actual incorporation, with University College, with regard to the coordination of the engineering work of these colleges with that of the new institution. We recommend that instruction in the higher branches of technology should, as far as possible, be concentrated at South Kensington. In the establishment of new departments we do not think it will be possible at present to go much beyond the various branches of engineering, with mining and metallurgy, though we hope provision may be made later for other subjects. We think the principal technical and engineering societies should be consulted as to the departments most requiring development and expansion, and as to the number of students for whom it is desirable to make provision in each department. In view of the character of the subjects which will, it may be expected, predominate on the South Kensington site, it must, we think, before long become a question whether the biological department of the Royal College of Science shall be retained there. As soon as this question becomes ripe for settlement, the provision to be made for that department will be a matter for negotiation.

We think that it may be found possible, even in the immediate future, to make arrangements for the establishment of departments dealing adequately with the greater number of special sections of applied science named. Thus it would seem that certain of these departments might be accommodated in the buildings of existing London institutions, while, for others, special accommodation would fall to be provided at once in the first additions to the buildings already available on the South Kensington site. For example, in view of the character and standard of the work now carried out by the Central Technical College, we think prominence should be given in the new institution to certain specialised developments of mechanical and electrical engineering.

We have already reported that we think a fully equipped central school of mines should be maintained, providing a full course of instruction in mining and metallurgy, especially in the mining and metallurgy of metals produced in India and the Colonies, but not found in workable quantities in the United Kingdom.

It should be borne in mind that the traditions and prestige of the Royal School of Mines and the associateship of that school are valuable assets, and we think care should be taken to preserve those traditions and that diploma.

In our opinion, accommodation should be provided in this department for 100 to 120 fully qualified students, *i.e.* fifty or sixty entries in each of the two years contemplated, so that forty to fifty students might be expected to pass out each year after successfully completing the course.

Vacation work under the guidance of school authorities, in districts where practical work is conducted, is a great and valuable feature of American and Canadian schools of mines. We think it would be advantageous for students of the Royal School of Mines to have one short period of practical mine surveying and of mining work generally, in a metalliferous mine, and another similar period of experience of the work of a coal mine.

No student should be admitted to any specialised technical department who has not received, either in the new institution itself or elsewhere, an adequate training of a technical and scientific character such as should be common to every branch of engineering. He should have spent two years on a course of instruction in science, such as he could obtain in a well organised college or technical institution, after having reached the standard of general education usually marked by university matriculation. An examination test should be imposed on all candidates for admission to the higher departments, except in the case of students who show, by some recognised qualification, that they have received the necessary preliminary training, and when there are more candidates for admission to a particular department than can be received, the best should be selected on a competitive basis.

The preliminary training to be given in the new institution should be of the kind which has just been referred to. It should consist of a course of two years' instruction in science, technology, and engineering, of such a character as the governing body consider the most suitable preparation for the specialised courses, and it should be, in the main, common to all students proceeding to advanced instruction in any department. We have already indicated our opinion that students who have not attained a certain standard of general education are not fitted to obtain the fullest advantage from the specialised instruction of the higher departments. We therefore think that evidence of this should be required before admission to the preliminary department.

## *NOTES.*

SIR ALEXANDER B. W. KENNEDY, F.R.S., has been elected a member of the Athenæum Club under the provisions of the rule which empowers the annual election by the committee of three persons "of distinguished eminence in science, literature, the arts, or for public services."

PROF. ALBRECHT PENCK, of Vienna, has accepted the professorship of geography in the University of Berlin, vacant by the death of Prof. von Richthofen.

THE Nichols medal of the American Chemical Society for the year 1905 has been awarded to Prof. Marston Taylor Bogert, of Columbia University, for his researches on the quinazolines.

*Science* announces that Dr. C. D. Walcott has resigned the secretaryship of the board of the Carnegie Institution at Washington, and is succeeded by Mr. Cleveland H. Dodge.

A MEMORIAL tablet has been unveiled on the house, in Eisenach, in which the late director of Zeiss's works, Prof. Abbe, was born.

ARRANGEMENTS have been made to hold a hygiene exhibition in Dresden in the year 1909 under the directorship of Dr. Lingner.

FROM Tübingen the death is announced, on January 25, of Prof. W. Mayer, the director of the university pharmacological museum, and a member of the pharmaceutical examinations commission.

WE learn from *Science* that, in accordance with the recommendations of Prof. John B. Smith, a Bill has been introduced into the New Jersey Legislature appropriating 14,000*l.* a year for five years for the extermination of mosquitoes.

A REUTER message from Naples states that Vesuvius is still active. The lava has reached three places on the Vesuvian railway line, covering about 100 yards of the line at each point. The lava threatens the line at a fourth point, as well as the station of the funicular railway, which is no longer working.

THE Friday evening discourse at the Royal Institution on February 16 will be delivered by Mr. W. C. D. Whetham on "The Passage of Electricity through Liquids," and on February 23 by Prof. J. O. Arnold on the "Internal Architecture of Metals."

A GREAT mass of rock having a weight estimated at 70,000 tons at the lowest, and placed by some at half a million tons, fell at Cheddar Cliffs on Sunday night. The fall took place on the face of the cliff, and the disaster is attributed to quarrying operations.

THE *Electrician* states that the forty-fourth Congrès de Sociétés savantes will be opened at the Sorbonne on Tuesday, April 17. The congress will continue until Friday, April 20, and on the following day it will be concluded by a meeting in the great amphitheatre of the Sorbonne, presided over by the Minister of Public Instruction and the Fine Arts.

DR. LEWIS GOUGH has been appointed to assist Dr. Gunning in the management of the museum at Pretoria. The department for which he will be responsible will be that containing the fishes, the amphibia, and reptiles—groups of animals which were especially under his charge when he was an assistant in the museum at Strasburg. Recently Dr. Gough has been working at Plymouth on the plankton of the British Channel in connection with the British Marine Biological Association.

A SECTION of the Swedish Government is again anxious to impose an export duty on outgoing Swedish iron ores. A suggested duty of 20 öre per ton is desired, whilst the revenue accruing therefrom is to be applied to furthering the cause of the Swedish iron industry.

ON January 30 Mr. W. H. Cope, librarian to the University of Birmingham, was presented with an oak clock and a cheque by Prof. J. H. Poynting, F.R.S., on behalf of a number of present and past members of Mason College and of the University, on the twenty-fifth anniversary of Mr. Cope's appointment as librarian.

THE friends and pupils of the late Prof. A. Hilger, professor of pharmacy in the University of Munich, have decided to perpetuate his memory in the university town of Erlangen, the seat of his activity for many years. It is proposed to erect a handsome monument to the deceased man of science in the palace garden in front of Hilger's former laboratory. Communications and contributions are to be addressed to Dr. Späth, chief inspector of the Royal Analytical Institute, Erlangen.

THE twenty-fifth anniversary of the foundation of the Berlin Agricultural High School was celebrated on January 25; among those present were a number of relatives of the late Albrecht von Thaers, who is regarded as the reformer of agricultural teaching and of the science of practical agriculture in Germany. The rector of the school, Prof. Orth, chose as the title of his address "Agriculture up to the Time of Thaers."

WE learn from the *Times* that Sir Robert L. Patterson, who died at his residence near Belfast on January 29, was the second son of the late Mr. Robert Patterson, F.R.S. He was a member of the British Ornithologists' Union, and recognised as a high authority on Irish birds. For very many years he was associated with the Belfast Natural History and Philosophical Society, of which he was twice president for terms of two years each, in 1881 and 1894. He also took an active interest in the Ulster Fisheries Biology Association, of which he was a life member and a vice-president. He was a Fellow of the Linnean Society of London.

WE regret to record the death, in his forty-seventh year, of Mr. C. J. Cornish on January 30. Educated at Charterhouse and Hertford College, Oxford (of which he was a Fellow), Mr. Cornish at the conclusion of his college career was appointed an assistant master at St. Paul's School, a position he held until his death. He was the author of a number of articles in the *Spectator*, as well as of several books, bearing more or less closely on the popular side of natural history, and his innate love of nature, coupled with an agreeable style, made all his works a success. Among his best known books may be mentioned "Life at the Zoo" (1895), "Nights with an Old Gunner" (1897), and "The Naturalist on the Thames." In addition to these, he was editor of the "Living Animals of the World," published in parts by Messrs. Hutchinson, and was commissioned to write the "Life of Sir William Flower" by the relatives of that distinguished zoologist.

IN Natal, where a local committee has been formed to cooperate with the Imperial Cancer Research Fund (says the *British Medical Journal*), the question of the occurrence of malignant disease among such coloured races as inhabit the colony, and also among the lower animals, birds, fish, and reptiles, is being actively investigated. So far as is possible, the assistance of all practitioners of human and veterinary medicine has been secured, and endeavour has likewise been made to enlist the sympathies of naturalists and sportsmen. All specimens of suspected cancerous disease are being examined at the Government Laboratory, Pietermaritzburg, free of charge. The honorary secretary of the committee is Dr. W. Watkins-Pitchford.

SIR JAMES CRICHTON-BROWNE presided over the twenty-third annual dinner of the Sanitary Inspectors' Association on February 3. Sir W. Broadbent gave the toast of "Science and Art," and testified to the zeal with which sanitary inspectors discharged their duties in the battle against disease. The president, in proposing the toast of the "Sanitary Inspectors' Association," referred to the recent suggestions of Sir F. Treves that disease is beneficent, and passed on to consider the important work carried out by sanitary inspectors. The ravages of tuberculosis were particularly referred to as an example of the striking effects of sanitary reform. Sixty-seven years ago pulmonary consumption was annually killing 68,000 persons in England and Wales, or 3800 per million living. Since then there has been a gradual diminution in this death-rate, until now the number of deaths is 40,000 per annum, or a death-rate of 1200 per million. It has been estimated that by 1930 the disease may be almost unknown. It is necessary to have compulsory notification, universal disinfection of houses in which cases of consumption have occurred, and isolation and sanatorium treatment on a large scale.

THE inaugural meeting of the Mining and Geological Institute of India was held at Assansol on January 16. A brief account of the origin and objects of the institute was given by Mr. W. H. Pickering, chief inspector of mines, to whom, with Mr. T. H. Holland, F.R.S., director of the Geological Survey, the institute owes its inception. The object of the new society is the promotion of the study of all branches of mining methods and of mineral occurrences in India, with a view to disseminate information obtained for facilitating the economic development of the mineral industries of the country. Mr. Holland was elected president, and in his presidential address, we learn from the *Pioneer Mail*, he pointed out the true relations between the science of geology and the art of mining. He dwelt upon the advancement made in recent years in scientific mining, particularly emphasising the need of cooperation in publishing the results of practical and scientific investigations. On the following day the meeting was closed by a banquet, when Sir Andrew Fraser expressed the hope that the institute would succeed in bringing the officers of the geological department, inspectors of mines, and also *ex officio* honorary members, into touch with the practical men belonging to the mining community.

DURING his Administratorship of Dominica and of the Leeward Islands, Mr. Hesketh Bell has been very actively engaged in an inquiry which has served to show that the West India islands are not so frequently visited by disastrous hurricanes as has been generally believed, and that the Press reports of the occurrences are almost invariably greatly exaggerated. Tropical hurricanes are annual phenomena in the south-western portion of the Atlantic, but it is only when the centre of one passes over or close to an island that much damage is done on land. Mr. Bell has found that between 1800 and 1875 the British islands in the Leeward group were visited by only seven hurricanes. As the popular error on this subject, and the highly coloured accounts of the disasters, militated seriously against agricultural enterprise in the islands—having proved powerful factors against the investment of capital, and rendering it difficult for landowners to raise loans, save on very onerous terms—Mr. Bell has submitted the whole of the facts to a leading London firm of insurance brokers, and the result has been the completion of a scheme of hurricane and volcanic eruption insurance for the West Indies, the rates quoted being 30*s*. per cent. on buildings, cultivations, and crops of all kinds, except bananas (the ratio of risk in this case not being yet ascertained), and 10*s*. extra per cent. for risks against volcanoes. The huts and small tenements of the very poor are not included in the scheme. These fragile structures, naturally, are the first to go down before the storm, but they are easily re-erected. Properly worked and supported, the scheme should result in a decided reduction in the loss from hurricanes, and the islands generally should benefit from the greater confidence and sense of security of investors.

MR. L. M. LAMBE has sent us a copy of a paper on new species of tortoises, referable to the living genus Testudo and the extinct Bäena, from the Oligocene of the Cypress Hills, Assiniboia. The original paper is published in the *Ottawa Naturalist* for January.

THE two articles forming the contents of the third part of vol. lxxx. of the *Zeitschrift für wissenschaftliche Zoologie* are of a nature which appeals to the specialist, and are too technical even to be summarised in our columns. In the one Mr. D. Tretjakoff treats of the front half of the eye of the frog and its development, while in the second Messrs. Otto and Tönniges discuss the development of the pond-snail commonly known as *Paludina vivipara*.

WE have received an advance copy of the report of the Yorkshire Naturalists' Union for 1905, in which the appointment of Mr. W. E. Clarke, of the Edinburgh Museum, as president for the current year is announced. The union is in a flourishing condition, and carrying on its work with the usual vigour. Ornithologists will be pleased to learn that arrangements have been made for the publication, in two volumes, of a work on the birds of Yorkshire, at the price of one guinea to subscribers.

IN a pamphlet issued by the Government Press at Calcutta, Mr. E. P. Stebbing describes certain bark-boring beetles which are inflicting much damage on the pine-forests of the Zhob district of Baluchistan. Chief among these is a species of the genus Polygraphus, which is described as new under the name of *P. trenchi*. Large numbers of dead and dying pines are to be seen in the forests, and it is considered probable that they are on the increase.

THE mode in which lungless (and gill-less) salamanders breathe forms the subject of investigations undertaken by Miss Seelye on *Desmognathus fuscus*, the results of these being published in a recent issue (vol. xxxii., No. 9) of the *Proceedings of the Boston Society of Natural History*. From this it appears that respiration is effected by means of the combined action of the mucous membrane of the pharynx and œsophagus, regulated by breathing movements of the nose and mouth, and of the skin.

A COPY of the "Naturalists' Directory" for 1906–7 has been received. While its usefulness cannot be denied, this little work stands in sore need of editing. To mention only a few instances, we find the names of the late Lieut.-General MacMahon, Dr. W. T. Blanford, and Mr. H. B. Medlicott figuring in the list of geologists (Dr. Blanford also in the zoological list), while the Duke of Bedford is referred to merely as an "F.L.S.," instead of as president of the Zoological Society. Expert assistance should be engaged before another edition is issued.

THE habits and distribution of the "false scorpions," Pseudoscorpionidæ, and more especially those of the species *Chelanops oblongus*, are discussed by Dr. Berger in vol. vi. of the *Ohio Naturalist*, the paper being reprinted as a Bulletin of the Ohio University. A figure and description of the curious "moulting-nests" of Chelanops are given. These, it seems, are not constructed by the female parent for her entire brood, but are made singly by each immature individual when the time for changing its coat arrives.

DEVELOPMENT and embryology from the evolutionary standpoint form the key-note of the contents of the first number of *Biologisches Centralblatt* for the current year, Mr. F. Dahl contributing a paper on the physiological importance of breeding-selection in its widest sense, as exemplified by spiders of the family Lycosidæ, while Mr. R. Kossmann emphasises the importance of favourable variations in influencing breeds and species, and Mr. Henriksen, in the first part of a dissertation on development from the functional point of view, urges that everything in nature tends towards a state of equilibrium peculiar to itself. In the last named article the author states he will "endeavour to show that the theory of the structure of germ-plasm [proposed] by Weismann is un-

necessary, and when worked out in details is quite absurd, and that we have no right to claim that the egg is some kind of a microcosm of the ontogeny and a short recapitulation of the phylogeny of the organism into which it develops.'

IN the course of a paper on phosphorescent marine animals, published in the January number of the *Zoologist*, Prof. McIntosh states that there are four distinct modes in which the light is produced. First, there may be special cells which secrete, in certain circumstances, phosphorescent mucus. Secondly, special cells may be phosphorescent without the emanation of any visible secretion. Thirdly, light may be emitted without any differentiation of tissue under nervous action. Fourthly, the phosphorescence may be due to light-emitting bacteria. One of the most striking features connected with phosphorescence is the simplicity of the mechanism by which it is produced and the entire absence of heat. "Thus," writes the author, "the light of a firefly, or a Pholas, has no sensible heat, whereas a temperature approaching 2000° F. would be necessary to make it by the usual processes, except the Geissler tube. So impressed were Prof. Langley and Mr. Very with this feature that they contrast it with the enormous waste in all industrial methods of producing light. . . . The authors, in view of this remarkable light without heat of the animals just considered, are of opinion that there is yet hope of obtaining an enormously greater result than we do now in the production of light."

BULLETINS Nos. 31, 32, and 33 (May and June, 1905) of the Bureau of Government Laboratories, Manila, have reached us. Bulletin No. 31 contains notes on a case of hæmatochyluria with observations on the embryo nematode, *Filaria nocturna*, by Drs. Wherry and McDill, and a research on the indol and cholera-red reactions by Dr. Wherry. Bulletin No. 32 deals with amœbic dysentery and amœbiasis, three articles being contributed by Drs. Strong, Thomas, and Woolley and Musgrave. Bulletin No. 33, by Dr. Herzog, records further observations on fibrinous thrombosis in the renal vessels in bubonic plague. The bulletins are well printed and well illustrated, and contain contributions of importance to medical science.

THE *Bulletin of the Johns Hopkins Hospital* for January (xvii., No. 178) is an excellent number. Dr. Harvey Cushing contributes an interesting and well illustrated article on Dr. Garth, the "Kit-Kat" poet. Garth was the single medical member of the famous Kit-Kat Club, and besides being distinguished in his profession and delivering the Gulstonian lectures and Harveian oration at the Royal College of Physicians, London, published many poems, the most important of which is "The Dispensary." Born in 1661, he died in 1718, and is buried at Harrow. Other articles are the relationship of the State to the tuberculosis question, by Dr. John Foster; a method of estimating the opsonic content of the blood, by Drs. Simon and Lamar; tropical splenomegaly, by Drs. Musgrave, Wherry, and Woolley; reports of societies, reviews, notes, &c.

THE Bulletin of the Department of Agriculture, Jamaica, for December, 1905, contains articles on rubber cultivation relating the progress made in Ceylon and south India, also a caution to planters with reference to the appearance of a cocoa disease caused by the fungus *Phytophthora omnivora*.

FROM the review of the teak timber trade in Burma, contributed by Mr. T. A. Hauxwell to the *Indian Forester* (November, 1905), it is seen that in the last fifteen years imports from Burma into Europe have diminished about 50 per cent., and prices have risen from 11*l*. to 15*l*. per ton; imports to India, where the standard of requirement is lower, show only a small decrease. The timber is extracted either by Government agency or by private lessees, the advantages in the latter case being that all marketable produce is extracted, and that the lessees have to share the risks, in connection with which the cost of elephants is a serious item.

IN the British West Indies, Jamaica easily leads the way in the cultivation of tobacco, but Trinidad also received an award at the recent Colonial and Indian Exhibition, and it is probable that good results may be obtained in certain parts of the other islands. A useful handbook to the cultivation and curing of tobacco has been issued by the Imperial Department of Agriculture as No. 38 of the pamphlet series. Mr. T. J. Harris gives a detailed and practical account of cultivation in the open and of curing the leaf, based on his former experience at the Hope Gardens, Jamaica, and Mr. W. N. Cunningham, who succeeded him, writes on tobacco-growing under shade.

OUR knowledge of the manner in which plants can receive external stimuli has been greatly extended by recent work, notably by the researches of Prof. Haberlandt. It is interesting to find that Prof. Schwendener has recorded his views on the subject in *Naturwissenschaftliche Wochenschrift* (January 2). In connection with the statolith theory of geotropism, a neat experiment is adduced as proof that can easily be put to the test. Ordinarily, if the root of a seedling is placed horizontal, curvature will ensue only after a definite lapse of time; assuming that starch grains take some time to react, it may be possible to reduce the interval by shaking or tapping the root. *Fiat experimentum*. The article also discusses the focusing action of certain epidermal cells of the leaf, and the mechanical feelers in the shape of hairs or papillæ that are possessed by insectivorous plants, the stamens of Berberis, and of the Cynareæ.

IN the *Proceedings of the American Academy of Arts and Sciences* for December, 1905, Mr. A. L. Rotch gives an account of the first observations with registration balloons in America. Although the successful experiments at Blue Hill led to the extensive use of kites for meteorological observations in other countries, unmanned balloons were not employed in America until 1904, when the author was enabled to make a series of four ascents at St. Louis in September of that year; at the maximum height, 10½ miles, a temperature of −62°·5 F. was recorded. Another series of ten ascents was made in the latter part of November and the first part of December, mostly after sunset, to avoid possible effects of insolation. Two of these balloons travelled with a mean velocity of more than a hundred miles an hour. An extreme height of nearly 10 miles was attained, with a temperature of −72°·4 F.; and a reading of −76°·2 was once recorded somewhat below 7 miles. In order to continue these observations during the winter, Mr. Rotch made a further series of nine ascents during the latter part of January, 1905. On January 25 the extraordinarily low temperature of −111° F. was registered at the height of about 9 miles, during the prevalence of a high barometric pressure at the ground. A complete publication of the results will be made in the Annals of the Astronomical Observatory of Harvard College.

An interesting pamphlet on the climate of St. Moritz has been published by Dr. A. Nolda, resident physician, with the collaboration of Mr. C. Bührer, director of the meteorological station at Montreux. The object of the paper is to show the claim of St. Moritz to be considered as a desirable health resort, and the meteorological statistics in support of this view are taken from those published by the Swiss Meteorological Institute in 1890–1 and 1900–4 inclusive; they are therefore entirely trustworthy. The village of St. Moritz is in the valley of the Upper Engadine, and the meteorological station has an elevation of 6040 feet. The characteristic features claimed for the station are:—a dry air, clear sky, high solar radiation, low humidity and rainfall, and almost complete immunity from summer and winter fogs; these advantages seem to be fully borne out by the official meteorological reports. The mean monthly temperatures are:—January, 19°·7 F.; July, 53°·8; the mean monthly extremes are:—January, −2°·5, 39°·7; July, 39°·9, 72°·7; the absolute extremes:—January, −15°·1, July, 76°·8. The mean annual humidity is 67 per cent.; on some days the atmospheric moisture falls to a point unknown in the lowlands of temperate latitudes; in 1900–4 instances are recorded of 10 per cent. to 16 per cent. The mean annual rainfall is 35·2 inches; rain and snow fall on an average on 128 days, and if we deduct the days when less than 0·04 inch fell, only 104 really rainy days remain. Compared with other places this is a very small number.

A copy of the *University of Colorado Studies* (vol. iii., No. 1), has reached us, containing brief historical, literary, psychological, and sociological articles by members of the university staff, a paper on extinct glaciers of Colorado by Mr. Henderson, and contributions to the natural history of the Rocky Mountains by Prof. T. D. A. Cockerell, in which several new insects and plants are described.

We have received reprints, from the Bulletin of the Museum of Comparative Zoology at Harvard (Geological Series, vol. viii., Nos. 1 and 2), of two papers by Prof. W. M. Davis. One, on the Wasatch, Canyon, and House Ranges, Utah, is a continuation of a paper on the mountain ranges of the Great Basin. The other deals with the glaciation of the Sawatch Range, Colorado.

The *Engineering and Mining Journal* of New York for January 6 contains carefully estimated statistics, compiled by prominent authorities, of production of the more important ores, minerals, and metals in the United States during 1905. The productions of iron, copper, lead, zinc, gold, and silver have all increased over 1904, and the outputs have been the highest recorded.

The introduction of reinforced cement marks a new epoch in the history of building, and an interesting account of some of the results achieved is given in the *Journal of the Franklin Institute of Philadelphia* for January. One of the most remarkable applications is the use of reinforced cement for the construction of dams. This method of building a permanent masonry dam at a comparatively low cost has already rendered financially practicable the utilisation of many water-power sites which otherwise would have been neglected.

In the *Bulletin de la Société d'Encouragement* of December 31, 1905, Dr. L. Guillet gives the results of a careful study of the nickel-vanadium steels. He prepared at the Imphy Steel Works nickel-steel alloys containing 0·2 per cent. and 0·8 per cent. of carbon, and of each series he selected a pearlitic steel, a martensitic steel, and a γ-iron steel, to which he added vanadium in proportions varying from 0·2 per cent. to 7 per cent. The effect of the addition of vanadium is to increase the elastic limit, very considerably in the case of the pearlitic steels. In other cases the increase is insignificant.

We have received from Mr. C. F. J. Galloway a useful paper contributed by him to the *Proceedings of the South Wales Institute of Engineers* (vol. xxiv., No. 6). It describes an application of the Brandt carriage and hydraulic column, successfully employed with hydraulic rock drills in the Simplon Tunnel, at a colliery in South Wales in conjunction with compressed-air rock drills. It proved one of the simplest and best forms of carriage for rock drills hitherto used. Full details of the work done and of the cost of the whole equipment are given.

In the *Transactions of the Institution of Engineers and Shipbuilders in Scotland* (vol. xlix., part iii.) there is an interesting paper by Mr. R. M. Neilson on the evolution and prospects of the elastic fluid turbine. Steam is not the only possible elastic fluid for a turbine; and the much greater ranges of temperature with the same range of pressure obtainable by the employment of other fluids instead of, or in conjunction with, steam deserve serious consideration. Much time has been spent on matters relating to elastic fluid turbines, and a large proportion of it has been devoted to inventions intended to be of a revolutionary nature with little knowledge of what had already been tried by others. The historical sketch of elastic fluid turbines given by the author is consequently most instructive. After an account of the early machines deserving the name of turbine, he describes and illustrates the turbines of Kempelen (1784), Gilman (1837), Vilbrow (1843), Wilson (1848), Fernihough (1850), Wertheim (1877), and De Laval (1882, 1889). The descriptions given of the turbines at present constructed show that although they differ among themselves very considerably, there is a visible tendency of the different types to approach each other. The preliminary experimental stage of the gas turbine has not yet been passed, and it cannot at present be said whether or not it ever will. An efficient gas turbine, which is a turbine both as regards the motor and the pump, seems to depend upon the obtaining of an efficient turbine compressor, or other form of rotary pistonless compressor. In order to determine whether the gas turbine had any reasonable chance of success in the near future, experimental research was needed as to the losses in pneumatic compression to high pressures, the expansion of hot gases in divergent nozzles, the transference of heat from gases to metals at high temperatures and very high velocities, and the oxidation of turbine blades when exposed to the action of air, steam, and carbon dioxide at high temperatures.

In several notices in these columns attention has been directed to the necessity of investigating mathematically the motions of aëroplanes and aërocurves as affording the only effective method of dealing with the problem of stability. A remarkably complete investigation on these lines is given in the *Revue d'Artillerie* for October and November, 1905, by Captain Ferber, who has been assisted in some of the calculations by M. Maillet. The method of treating the problem of longitudinal stability by considering the small oscillations about a steady state had been previously worked at (Bryan and Williams, *Proc. Roy. Soc.*, vol. lxxiii.), but owing to the appointment of the second of these authors to a research studentship, want of time rendered further progress impossible. The problem was then taken up by Captain Ferber, of the French

Artillery, who has given a masterly discussion of not only longitudinal but also lateral stability, and has arrived at a large number of important simple and practical conclusions relating to both the conditions of stability and the trajectories of aëroplanes the motion of which is stable. The paper constitutes by far the most important recent advance in the study of artificial flight.

MESSRS. PERCIVAL MARSHALL AND CO. have published a popular essay entitled "Electric Power. What it is and what it can do," by Mr. Alfred W. Marshall. The price of the pamphlet is 3*d*. net.

MR. NASARVANJI JIVANJI READYMONEY has issued a revised edition of his "Nature-history Museum and Descriptive defining Nature-history Tables," the first edition of which was noticed in our issue for March 30, 1905. Several changes and additions have been made in this painstaking piece of work.

NOS. 16, 17, and 18 of "Materials for a Flora of the Malayan Peninsula," by Sir George King, F.R.S., and Mr. J. Sykes Gamble, F.R.S.—which Messrs. West, Newman and Co., of Hatton Garden, are reprinting from the *Journal of the Asiatic Society of Bengal*—have been received. In addition to an account of the rubiaceous genus Psychotria, the first fasciculus contains descriptions of the Malayan members of eleven natural orders, including 48 genera and 81 species, of which two genera and 17 species are new to science. The second of the present parts describes five natural orders, Myrsinaceæ, Sapotaceæ, Ebenaceæ, Styraceæ, and Oleaceæ. These five orders comprise 24 genera and 221 species. There are no new genera, but the number of new species reaches 103. The last of the three instalments deals with nine natural orders containing 53 genera and 150 species, none of which are described for the first time. Among the orders of which accounts are given may be mentioned Boragineæ, Convolvulaceæ, Solanaceæ, Scrophulariaceæ, and Lentibulariaceæ. When all the fasciculi are available, we hope to review the complete work.

THE Cambridge University Press is publishing, under the title of "Cambridge Tracts in Mathematics and Mathematical Physics," a series of short works on various topics in pure mathematics and theoretical physics. The chief purpose of the undertaking is to assist in the maintenance of a high standard in English mathematical teaching by the continued infusion of new methods and more accurate modes of treatment, and by the extension of knowledge of recent mathematical research. The first of the series, a tract on "Volume and Surface Integrals used in Physics," by Mr. J. G. Leathem, has already been published, and a second, on "The Integration of Functions of a Single Variable," by Mr. G. H. Hardy, will be issued very shortly. The Press has also ready for immediate publication a new and revised edition, in one volume, of Prof. A. E. H. Love's "Treatise on the Mathematical Theory of Elasticity," and a third edition of Prof. Horace Lamb's "Hydrodynamics."

THE fourth year-book, that for 1905, of the Carnegie Institution of Washington has been received. The titles alone of the publications bearing upon the work done under grants from the institution fill eight closely printed pages, and it is impossible here to do more than direct attention to a few of the researches of outstanding importance. Prof. G. E. Hale, as director of the solar observatory at Mount Wilson, California, provides an excellent illustrated account of the astrophysical work done at Mount Wilson under his supervision. Prof. Lewis Boss, director of the Dudley Observatory, Albany, New York, describes his investigations of stellar motion. Mr. Charles B. Davenport, who is in charge of the station for experimental evolution at Cold Spring Harbour, New York, classifies the work in progress there, which is largely what he describes as of the "time-consuming" order, and gives a full report, with illustrations and results, of the experiments conducted during the year. Marine biology is well represented in the year-book by Mr. A. G. Mayer's account of what has been accomplished in connection with the laboratory at Tortugas, Florida. This report includes contributions from the numerous experts working in the laboratory. Several investigators were at work in the Desert Botanical Laboratory, Tucson, Arizona, and substantial progress in numerous directions was made during the year. Prof. T. C. Chamberlin, of the University of Chicago, continues his contributions to solutions of the fundamental problems of geology, and gives a full discussion of the deformations of the earth and of climatic oscillations. Mr. Bailey Willis, of the U.S. Geological Survey, describes his geological studies in Europe, and his attempts to determine the geographical condition of each continent at successive geological epochs. The magnetic survey of the North Pacific Ocean, undertaken by the U.S. Department of Research in Terrestrial Magnetism, and carried out by Mr. J. E. Pratt's party in the *Galilee*, is described by Dr. L. A. Bauer. These annual reports should be a source of gratification to Mr. Carnegie, and it is to be desired that wealthy men in this country could be led to follow an excellent example in the direction of encouraging scientific research and providing for the publication of results.

## *OUR ASTRONOMICAL COLUMN.*

COMET 1905*c* (GIACOBINI).—The following is a continuation of the ephemeris published in No. 4067 of the *Astronomische Nachrichten* by Herr A. Wedemeyer:—

*Ephemeris 12h. M.T. Berlin.*

| 1906 | α (true) h. m. s. | δ (true) ° ′ | log *r* | log Δ |
|---|---|---|---|---|
| Feb 8 ... | 23 31 16 ... | −21 9 ... | 9·7704 ... | 0·0694 |
| 10 ... | 23 49 14 ... | −19 40 ... | 9 8058 ... | 0 0755 |
| 12 ... | 0 5 58 ... | −18 7 ... | 9·8379 ... | 0·0830 |
| 14 ... | 0 21 33 ... | −16 33 ... | 9·8672 ... | 0·0918 |
| 16 ... | 0 36 3 ... | −14 59 ... | 9·8942 ... | 0·1016 |
| 18 ... | 0 49 32 ... | −13 26 ... | 9 9192 ... | 0·1123 |

The accompanying chart shows, approximately, the apparent path of the comet among the stars from

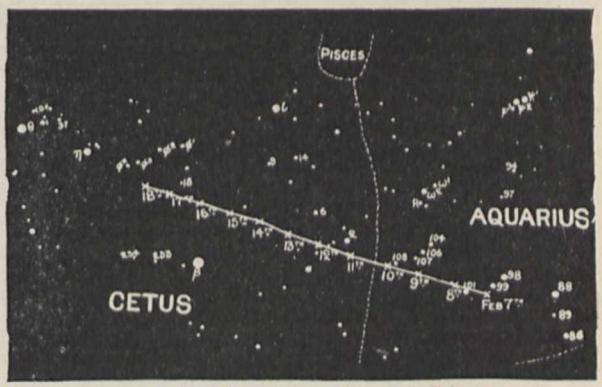


FIG. 1.—Apparent path of Comet 1905 *c* (Giacobini), February 7–18, 1906.

February 7 to February 18, according to the above ephemeris.

Although still fairly bright, the comet is a difficult object

owing to its close proximity to the sun, and should be looked for immediately after sunset in the south-west quadrant, near to the horizon.

COMET 1906a.—Numerous observations of the new comet discovered by Mr. Brooks at Geneva, U.S.A., have been made, and from the positions determined on January 28, 29, and 30, the following elements and an ephemeris, of which a part is given below, have been calculated by Messrs. Crawford and Champreux :—

*Elements.*

T = 1905 Dec. 19·47 G.M.T.

$$\left.\begin{array}{l} \infty = 86\ 22 \\ \Omega = 285\ 27 \\ i = 126\ 49 \end{array}\right\} 1906{\cdot}0$$

$q = 1{\cdot}2826$

*Ephemeris 12h. G.M.T.*

| 1906 | α h. m. | δ | Brightness |
|---|---|---|---|
| Feb. 8 ... | 15 50·4 ... | +70 37 ... | 1·04 |
| ,, 12 ... | 15 05·9 ... | +78 37 ... | 1·05 |

Brightness at time of discovery = 1·0.

Thus it will be seen that the comet is now travelling due north, and is easily circumpolar, but it is in a better position for observations after midnight (Kiel *Circular*, No. 85).

A NEW METHOD OF DETERMINING THE MOON'S POSITION PHOTOGRAPHICALLY.—The chief difficulty in photographically recording the moon's position among the stars, for the purpose of determining the errors in the ephemeris, arises from the fact that if the exposures be long enough to record the faint, surrounding stars, the moon's image is tremendously over-exposed, and the star images are lost in the light-fog caused by the prevailing moonshine. Several methods of overcoming this difficulty have been proposed, and Mr. Wade, of the Helwan Observatory, Egypt, now suggests another, which, from his preliminary experiments, promises to be successful.

In this method the camera is mounted so that its optical axis passes horizontally through the centre of an ordinary cœlostat, but the mirror of the latter, instead of being worked to a true plane, is figured as a prism, the two faces of which are inclined at an angle of 7½°, and the edge of the prism is arranged parallel to the polar axis. Thus the photograph obtained includes two fields which are, actually, separated by 15° in right ascension.

The cœlostat is arranged so that one face of the prism reflects the moon's image into the camera, whilst the other face reflects the field of stars situated about 1 hour in right ascension from the moon, and therefore beyond the range of strong moonlight. Then the reflected lunar image is intercepted whilst the reflected star images are exposed for 2½ minutes, when an instantaneous exposure on the moon is made. The operation is completed by exposing the star-field for a second 2½ minutes. By this method Mr. Wade has obtained a number of successful negatives with a 2-inch visual achromatic Dallmeyer lens and a cœlostat of 4 inches diameter (*Monthly Notices Royal Astronomical Society*, vol. lxvi., No. 2).

A CATALOGUE OF SPECTROSCOPIC BINARIES.—A novel and important catalogue, published by the Lick Observatory as Bulletin No. 79, has just been received. It contains all the known particulars of the orbits of the spectroscopic binary stars discovered prior to January 1, 1905.

On that date 140 of these objects were known, 72 of them having been discovered by the Lick observers and 41 at the Yerkes Observatory.

When one remembers that the first of these interesting objects, ζ Ursæ Majoris, was discovered by Prof. Pickering so recently as 1889, it becomes evident that this field of research is likely to contain ample scope for further work; therefore in order to simplify matters for future observers Prof. Campbell and Dr. H. D. Curtis have collected all the known results into the present catalogue. In addition to the positions, magnitudes, spectral types, and orbital details of the binaries, the catalogue contains a valuable column in which the name of the discoverer and references to the bibliography of each binary, together with brief notes, are given.

OBSERVATIONS OF THE LYRID METEORS, APRIL, 1904.—In No. 4067 of the *Astronomische Nachrichten* Dr. Jiří Kaván, of the Prag-Smichow Astronomical Institute, gives the results of his observations of the Lyrids on April 18, 19, 20, and 21, 1904.

Forty-five meteors were observed, twenty of them being recorded between 12h. 5m. and 15h. 25m. (M.E.T.) on April 19. From an analysis of the records, Dr. Kaván has deduced two radiant points for this shower as follows :—

(1) α = 278°·0 ... δ = +30°·5 (near β Lyræ)
(2) α = 247°·0 ... δ = +31°·5 (near ζ Herculis).

## *REPORT OF THE MEETING OF THE SOLAR COMMISSION AT INNSBRUCK.*

THE commission was constituted by the following action of the Southport meeting of the International Meteorological Committee thus reported :—

"Discussion of the relation of meteorology to astrophysics."

"The members of the Committee had previously taken part in a discussion of this subject at a meeting of Section A of the British Association; and Mr. Shaw proposed that a Commission should be appointed to review and discuss meteorological observations from the point of view of their connection with solar physics. Mr. Shaw's motion was adopted, and MM. Lockyer, Shaw, Pernter, and Angot were elected to serve on this Commission with power to add to their number and to elect their officers."

The following is the list of those who have been appointed members of this commission up to the present time :—

M. A. Angot, Bureau Central Météorologique, Paris.
Prof. H. J. Ångström, University, Upsala.
Geheimrat oberregierungs von Bezold, Berlin.
M. Teisserenc de Bort, Observatoire de Trappes, prés Paris.
Prof. F. H. Bigelow, Weather Bureau, Washington.
Prof. Birkeland, University of Christiania.
Rev. G. R. Cirera, S.J., Observatorio del Ebro, Tortosa, Spain.
Dr. W. G. Davis, Oficina Meteorologica Argentina, Cordoba, Argentine Republic.
M. H. Deslandres, Observatoire d'Astronomie physique, Meudon, Seine et Oise.
Sir John Eliot (secretary), 79 Alleyn Park, Dulwich, London; Bon Porto, Cavalaire, Var, France.
Mr. G. E. Hale, Solar Observatory, Mount Wilson, California, U.S.A.
Hofrat Prof. Dr. J. Hann, 19 Hohe Warte, Vienna, Austria.
M. M. S. Hepites, Institut Météorologique, Bucarest, Roumania.
M. Janssen, Observatoire d'Astronomie physique, Meudon, Seine et Oise.
Prof. W. H. Julius, Rijks Universiteit, Utrecht, Holland.
Hofrat. Prof. Dr. N. Thege v. Konkoly, k. meteor. Reichsanstalt, Budapest.
Prof. Dr. W. Köppen, Seewarte, Hamburg.
Mr. S. P. Langley, Secretary of the Smithsonian Institution, Washington, U.S.A.
Sir Norman Lockyer (president), Solar Physics Observatory, South Kensington, London.
Dr. W. J. S. Lockyer, Solar Physics Observatory, South Kensington, London.
Captain J. H. Lyons, R.E., Survey Department, Cairo, Egypt.
M. E. Marchand, Observatory, Pic du Midi.
Prof. H. Mohn, Meteorologische Institut, Christiania.
Hofrat. Prof. Dr. J. M. Pernter, Hohe Warte, Vienna, Austria.
Prof. Riccò, University of Catania, Sicily, Italy.
Prof. G. B. Rizzo, University of Messina, Sicily, Italy.
Mr. A. L. Rotch, Blue Hill Meteorological Observatory, Cambridge, Mass., U.S.A.
Sir Arthur Rücker, 19 Gledhow Gardens, London, S.W.

General Rykatcheff, St. Petersburg, Russia.
Prof. Dr. J. Scheiner, Konigl. Friedrich Wilhelms Universität, Berlin.
Dr. W. N. Shaw, Meteorological Office, 63 Victoria Street, London.
M. A. Silvado, Direction de Meteorologia, Morro de St. Antanis, Rio de Janeiro, Brazil.
Prof. A. Steen, Meteorological Institute, Christiania.
Mr. R. F. Stupart, Canadian Dominion Meteorological Service, Toronto.
Prof. J. Violle, Conservatoire des Arts et Métiers, Paris.
Prof. Dr. C. H. Wind, University of Utrecht, Holland.
Prof. A. Woeikoff, St. Petersburg, Russia.
Prof. Dr. Max Wolf, Grossherz. Ruprecht-Karls Universität, Heidelberg, Germany.
Prof. A. Wölfer, Zurich Observatory, Switzerland.

At a meeting at Cambridge in August (18–23), 1904, Sir Norman Lockyer was elected president and Sir John Eliot secretary.

A provisional programme was considered, and the following resolutions were passed or action taken :—

A letter received from Mr. Hale respecting the cooperation of the Commission with the Committee on Solar Research of the National Academy of Sciences was read, and it was agreed to cooperate with the Committee on questions of common interest.

Upon the initiation of the Committee a union was formed for the study of solar phenomena, and Dr. W. J. S. Lockyer was appointed later by correspondence to attend the meeting of this union at Oxford in September, 1905, as the representative of the Commission.

A scheme of solar observations was approved.

It was resolved (1) that in connection with the observations of solar radiation, observations of the transparency of the air would be desirable, more especially (*a*) on the visibility of distant and high mountains when possible; and (*b*) photometrical observations of Polaris.

The following resolutions were passed :—

(1) That, in the first instance, for the purpose of comparison with solar phenomena, the meteorological observations to be considered should be monthly means of pressure, temperature (including maximum temperature and minimum temperature) and rainfall.

(2) That the members of the Commission be requested to communicate to the secretary a short report of the data available in their respective countries, and the number of years over which they extend.

(3) That a circular be addressed to the various meteorological organisations asking them to send to the secretary, for the purposes of the Commission, a copy of the publications of their offices embodying the data specified in the two preceding resolutions, and that the organisations be also requested to obtain and forward copies of similar publications from the colonies and dependencies of their respective countries.

(4) That the Commission considers it is desirable that the data for the purposes of comparison should be sent to the president of the Commission, South Kensington (Solar Physics Observatory), for tabulation and comparison. The Commission attaches the greatest importance to this work, more especially as it may lead to a practical system of long-period forecasting, and hopes that if it be necessary, an increase of staff at that observatory may be authorised to bring all old observations up to date.

(5) That the establishment of magnetical observatories in about lat. 70° N. (*e.g.* Bosskop, in Norway) and in very high latitudes of the southern hemisphere is of the highest importance for the advancement of science.

Prof. Riccò informed the Commission that it is intended to establish in Italy or Sicily a magnetic observatory with self-recording instruments belonging to the Italian Meteorological Office.

It was agreed that all communications for the Commission should be received at a central address, viz. the Solar Physics Observatory, South Kensington.

At the meeting at Innsbruck, September 11–15, 1905, the following resolutions were adopted :—

(1) That for the sake of brevity the name of the Commission be the Solar Commission of the International Meteorological Committee.

(2) That the secretary be instructed to report the proceedings of the meetings of the Commission held at Cambridge in August, 1904, and at Innsbruck in September, 1905, to the International Meteorological Committee, and to ask that it will take the proper steps to bring their suggestions before the International Association of Academies.

(3) Que pour la pression et la temperature les chefs des différents services météorologiques soient priés de preparer une liste des stations qu'ils considèrent comme suffisantes pour bien representer les différents régimes météorologiques que existent dans leur pays.

(4) Que dans le nord de Siberie et le nord de l'Amerique soient organizés des stations permanentes météorologiques au moins deux ou trois sur chaque continent.

La Commission exprime le desir de recevoir communication des observations des îles dont les noms suivent;[1] insiste sur l'utilité d'assurer la permanence des observations météorologiques dans ses regions, et prie son président de faire par intermédiaire du Comité international des Académies officiellement auprès des divers gouvernements les démarches necessaires pour que des observations météorologiques soient organizés et maintenues dans les stations mentionées ou ces observations n'existent pas d'une manière regulière et permanente.

A form was prepared and approved for the tabulation of the pressure, rainfall and temperature data.

Pour le but que poursuit la Commission, il est désirable que dans toutes les stations, les valeurs normales soient déduites des *mêmes* années (20, 25, ou plus) le millésime de la première année se terminant par 1 ou 6 d'après les recommendations du Congrès météorologique international de Vienne.

The normal period selected for comparison when possible is the twenty-five year period from 1881 to 1905.

M. Angot presented a selected list of stations for France which the Commission decided should be utilised in the circular as an example of the requirements of the Commission. In connection with this selection it was decided that the proportion of mountain stations to plain stations in any country should not exceed one to four.

The questions of magnetic and rainfall data were taken up, and it was resolved

(1) That the Magnetic Commission should be asked to assist the Solar Commission in the selection of magnetic observatories, and to advise as to the amount and extent of information which these observatories would be able to give in order to assist in the investigation of the relations of solar and terrestrial meteorology.

(2) That the suggestion of Mr. Langley that ten-day means as well as monthly means be employed be referred to the Magnetic Commission for opinion.

General Rykatcheff, president of the Magnetic Commission, read a communication in reply to the request mentioned above :—

" Décision de la Commission magnétique par rapport à la demande de la Commission solaire.

" La Commission magnétique a pris certaines décisions qui entrent dans les rues de la Commission solaire, celles sont les décisions sur la publication des courbes troublées, sur les listes des jours calmes et troublés, sur les coefficients exprimant l'activité magnétique de chaque jour et sur la publication d'une liste d'observatoires magnétiques.

La Commission magnétique décide que toutes ces publications seront communiquées aux membres de la Commission solaire.

" Si la Commission solaire trouverait que d'autres données, que celles enumerées tout à l'heure sont désirables, la Commission magnétique se déclare prête à collaborer avec la Commission solaire en la priant toutefois de vouloir bien presiser ses desirs !

" Quant à la question des moyennes par decades la Commission estime que cette question ne peut être resolu que par le comité des directeurs, auquel elle sera remise.

" La Commission magnétique estime qu'il serait bien de diriger l'attention du futur Bureau permanent magnétique sur les demandes de la Commission solaire."

(3) Pour le moment on se contente de demander les données relatives à la pluie aux stations que fournissent déjà celles de la temperature et de la pression; on pourra

[1] The complete list will be given later in the official report of the meeting of the Commission.

ultérieusement étendre le nombre des observations pluviométriques si la necessité s'en fait sentir.

(4) Les chefs des services météorologiques et hydrographiques sont priés d'ajouter aux données météorologiques envoyées à la Commission, autant de données sur la niveau et la débit des rivières et des lacs qu'ils croirent possibles et utiles.

(5) That the secretary be asked to prepare a regional statement of rainfall for India as an example of what the Commission desires in the way of reports of regional rainfall and variation of rainfall for each meteorological organisation.

Instructions were given to Dr. W. J. S. Lockyer for his action as representative of the Commission at the Oxford meeting of the Solar Research Union.

It was resolved that while thanking the Washington Weather Bureau for its courteous offer to publish in the Washington *Monthly Weather Review* the data collected by the Commission, the Commission is not yet in a position to decide upon the most appropriate form of publication.

It was decided that a circular should be sent to the various meteorological organisations in the following terms:—The Commission desire to direct attention to the concluding paragraph of Prof. Violle's report to the International Meteorological Committee, 1903, and would be greatly obliged if the Commission could be informed of the arrangements for observing solar radiation adopted at the observatories of the various meteorological organisations and the methods employed to render the observations comparable with those of other observatories.

A first list of places at which actinometric observations are made was presented.

It was resolved that "une circulaire sera envoyé aux directeurs des services météorologiques pour leur demander de designer les stations de leur pays ou les observations actinométriques sont regulièrement faites. Dans le liste des stations il serait utile d'éviter les grandes villes ou les conditions atmospheriques sont generalment défectueuses."

That steps should be taken to obtain observations from the places mentioned.

La Commission Solaire prie M. le Président de vouloir bien obtenir les courbes de la distribution de l'energie solaire pour les observatoires qui ont déjà l'obligéance de communiquer les autres données indiqués dans les Comptes rendus des Seances de la Conférence de Cambridge, à propos de la physique solaire.

## ANTHROPOLOGICAL NOTES.

*L'ANTHROPOLOGIE* usually devotes much space to archæology, and the recent number (vol. xvi., Nos. 4–5) contains three papers on that subject. Mr. H. Obermaier gives the first instalment of a most useful memoir on Quaternary human remains and the sites in Central Europe where they have occurred. Mr. A. Viré describes a prehistoric cave of the Solutré period at Lacave (Lot); the human bones were too fragmentary to have any value. Mr. E. Cartailhac and Father Breuil continue their account of the mural paintings and engravings of the Pyrenean caves; they give several illustrations; as is usually the case among primitive peoples, the representations of human beings fall greatly below the excellence of animal delineations. The authors come to the conclusion that in the cave of Marsoulas the earlier engravings with linear contours are associated with black paintings, while the later engravings, in which the contours are made with short lines to indicate hair, are associated with polychromatic paintings of animals. In a paper on the myology of a Negro, Messrs. R. Anthony and A. Hazard state that muscles are thick and short, thus indicating strength rather than agility. Hunting and agriculture among the populations of the Sudan are the subjects of a paper by Mr. J. Decorse. Mr. L. G. Seurat describes the marae, or stone altars, of the little frequented eastern islands of the Tuamotu Archipelago. Mr. C. Monteil discourses on the numbers and numeration among the Mandés, a large linguistic family of people of western French Africa. The journal contains the usual valuable *résumé* of recent anthropological literature.

Two papers in the *Journal of the Asiatic Society of Bengal* (vol. lxxiii.) should not be overlooked. Mr. J. E. Friend-Pereira has discovered totemism among the Khonds, where the wider totemic exogamy has been hidden by the narrower and probably newer rule of the "local, communal, or family type." The "septs," as the author terms the totem groups, have the ordinary totem tabus of feeding, use and marriage, and myths of origin. He believes totemism "serves to mark to a primitive people who possess no written characters to record kinship and descent as they begin to get more remote in time the distinction between separate stocks of blood. In other words, totemism is merely a guide for the observance of the rules of exogamy: it is not the cause that originated or evolved these rules." He holds that the explanation of the origin of totemism must be sought for, not in its social, but in its religious aspect. Among the Khonds "the totem ranks as the spirit of the ancestor founder of the stock, who is also the chief tutelary deity of the stock, and the totem class is considered as a manifestation of the chief tutelary deity." Major P. R. T. Gurdon has a valuable short paper on the Khasis, Syntengs, and allied tribes of Assam, among whom mother-right so predominates that males can own only self-acquired property. There are traces of totemism. Ancestors are worshipped by the erection of remarkable memorial stones, of which two illustrations are given; this form of worship largely underlies the Khasi religious system. Divination by the breaking of eggs is very common. Major Gurdon is superintendent of ethnography in Assam, and is apparently preparing a monograph on the people under his charge which, judging from these notes, should be a valuable work.

The current number of the *Journal of the Anthropological Institute* (vol. xxxv., 1905) contains papers in all branches of anthropology. Physical anthropology is represented by a paper by Messrs. F. G. Parsons and C. R. Box on the relations of the cranial sutures to age, and by a critical paper by Dr. C. S. Myers traversing the conclusion of Miss Fawcett that in certain characters a progressive evolution has taken place in regard to the "prehistoric" and modern Egyptians. South African archæology has been much to the fore of late; the notes on the Great Zimbabwe elliptical ruin by Mr. Franklin White, and a paper on the stone forts and pits on the Inyanga Estate, Rhodesia, were written before Mr. Randall-MacIver's subversive views were published. Mr. T. W. Gann discourses on the ancient monuments of Honduras and on the natives now living there. In technology there is a beautifully illustrated paper by Mr. D. Randall-MacIver on the manufacture of pottery in Upper Egypt. Mr. N. W. Thomas enumerates the varieties of the canoes and rafts in Australia and their distribution. Mr. E. B. Haddon, in a well illustrated paper on the dog-motive in Bornean art, discusses the origin and degeneration of certain designs. Religion is represented by notes by Mr. R. E. Dennett on the philosophy of Bavili of Luango, West Africa. Finally, a report on the ethnology of the Stlatlumh, one of the Salish tribes of British Columbia, by Mr. C. Hill Tout, is a good example of a paper on regional ethnography. It will be seen that the journal maintains its high standard, both for the quality of its matter and the excellence of its illustrations.

## A GAS CALORIMETER.

THE paper on a new gas calorimeter which was read before the Royal Society by Mr. C. V. Boys, F.R.S., on December 7, 1905, is of interest, partly on account of the causes which led to the design, and partly on account of the features which are original.

The agitation of the gas companies in favour of reducing the candle-power of gas on the ground that gas of lower candle-power is cheaper while the diminution of the light afforded by a luminous flame is of little consequence as incandescent lighting is so largely used, while it has succeeded in many cases in getting the statutory lighting power reduced, has on the other hand raised the question whether the value of the gas for heating purposes

and for power may not be reduced also, so that while the flame-lighting power may be reduced without much detriment, the consequent fall of heating-power may be a serious loss to the public. In the London Gas Act, 1905, such risk has been met by the obligation to test the calorific value of the gas for information only, but no penalties are incurred, even though the gas should prove to be of much less heating value than it has been.

The gas referees have therefore had the question of a suitable calorimeter before them, and in the "Notification" issued on January 1 (see p. 273) the calorimeter designed by Mr. Boys, who is one of them, is prescribed for use in official testings.

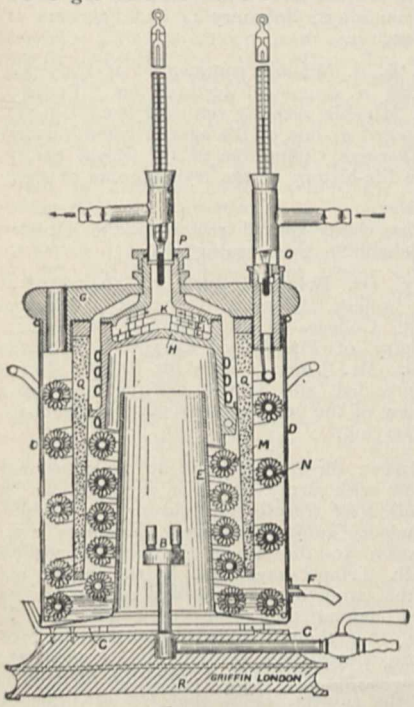


FIG. 1.

The calorimeter in question is of the Hartley type, *i.e.* a stream of water constantly passes through the instrument, and in so doing it is raised in temperature by the heat produced by the combustion of a stream of gas. The observations available enable the observer to ascertain the calorific value of the gas.

The best known instrument of this class is the Junker calorimeter, and it is in relation to this that the new features introduced by Mr. Boys are best described. From the accompanying figure it will be seen that the gas is burned at two small union jets instead of in the usual long Bunsen flame. The hot gases rising into the bell H descend outside the chimney E through the wires of the inner coil M. This and the outer coil N are made of the well known motor-car radiator tube invented by Mr. Clarkson. The circulating water enters the outer coil at the union O, and leaving the inner coil enters the space above the bell H, where it circulates between two dished plates and then leaves at the union P. The two lower turns of the Clarkson tube are immersed in a condensed water bath with an overflow F, which may be turned in any direction. This water bath serves to keep the chimney cool enough not to burn, but not cool enough to cause condensation to occur on the inner surface. One result of this construction is the slow passage of the products of combustion through the instrument and the small resistance they encounter. Hence the instrument need not be more than a foot high. The circulation of the water through the instrument strictly in series in every part prevents the formation of pockets or streaks of warmer water and consequent spasmodic changes of the outlet thermometer reading, and such small changes as might remain are almost entirely destroyed in the temperature equalising chamber above the bell H. The result is that, with a rise of temperature of 23° C., the variations do not exceed two or three hundredths of a degree, and even this appears to be largely due to friction in the meter insufficiently corrected by the governor.

Five minutes after lighting the gas the outlet thermometer is within 6 per cent. of its ultimate rise; in ten minutes it is within 2·2 per cent., and in fifteen minutes it is less than ½ per cent. In this and other respects the gas examiner who will have to use the instrument will find that not only accuracy, but his convenience has been studied.

One feature is quite peculiar. While hitherto gas calorimeters have been soldered up so as to be of the nature of mystery boxes, this can be seen in its essential features, while it can be completely taken to pieces in a few minutes for examination of every part.

After use the coil system is lifted out of the outer vessel by the lid and is then immersed in a dilute solution of bicarbonate of soda, so as to neutralise the weak sulphuric acid condensed upon the metal and prevent it and its dissolved oxygen from prematurely destroying the metal-work of the coils. The instrument is made by Messrs. Griffin and Sons.

## *THE ELECTRIC PRODUCTION OF NITRATES FROM THE ATMOSPHERE.*[1]

AS the demand of the white races for wheat as a foodstuff increases, the acreage devoted to wheat growing increases, but at a less rapid rate; and being limited by climatic conditions will in a few years, perhaps less than thirty, be entirely taken up. Then, as Sir William Crookes pointed out in his presidential address in 1898, there will be a wheat famine, unless the world's yield per acre (at present about 12·7 bushels per acre on the average) can be raised by use of fertilisers. Of such fertilisers the chief is nitrate of soda, exported from the nitre beds in Chili. The demand for this has risen from 1,000,000 tons in 1892 to 1,543,120 tons in 1905, and the supply will at the present rate be exhausted in less than fifty years. Then the only chance of averting starvation lies, as Crookes pointed out, through the laboratory.

In 1781, Cavendish had observed that nitrogen, which exists in illimitable quantities in the air, can be caused to enter into combination with oxygen, and later he showed that nitrous fumes could be produced by passing electric sparks through air. Although this laboratory experiment had undoubtedly pointed the way, though the chemistry of the arc flame had been investigated in 1880 by Dewar, and though Crookes and Lord Rayleigh had both employed electric discharges to cause nitrogen and oxygen to enter into combination, no commercial process had been found practical for the synthesis of nitrates from the air until recently.

After referring, in passing, to the tentative processes of Bradley and Lovejoy, of Kowalski, of Naville, and to the cyanamide and cyanide processes, attention was directed to the process of Birkeland and Eyde, of Christiania, for the fixation of atmospheric nitrogen, and their synthetic production of nitrates, by use of a special electric furnace. In this furnace an alternating electric arc was produced at between 3000 and 4000 volts, but under special conditions which resulted from the researches of Prof. Birkeland, the arc being formed between the poles of a large electromagnet, which forced it to take the form of a roaring disc of flame. Such a disc of flame was shown in the lecture theatre by a model apparatus sent from Christiania. In the furnaces, as used in Norway, the disc of flame was 4 feet or 5 feet in diameter, and was enclosed in a metal envelope lined with firebrick. Through this furnace air was blown, and emerged charged with nitric oxide fumes. These fumes were collected, allowed time further to oxidise, then absorbed in water-towers or in quicklime, nitric acid and nitrate of lime being the products. The research station near Arendal was described, also the factory at Notodden, in the Hitterdal, where electric power to the extent of 1500 kilowatts was already taken from the Tinnfoss waterfall for the production of nitrate of lime. This product in several forms, including a basic nitrate, was known as Norwegian saltpetre. Experiment had shown that it was equally good as a fertiliser with Chili saltpetre, and the lime in it was of special advantage for certain soils. The yield of product in these furnaces was most satisfactory, and the factory at Notodden—which had been in commercial operation since the spring of 1905—was about to be enlarged; the neighbouring waterfall of

[1] Abstract of a discourse delivered at the Royal Institution on Friday, February 2, by Prof. Silvanus P. Thompson, F.R.S.

Svaelgfos being now in course of utilisation would furnish 23,000 horse-power. The Norwegian company had further projects in hand for the utilisation of three other waterfalls, including the Rjukanfos, the most considerable fall in Telemarken, which would yield more than 200,000 horse-power. According to the statement of Prof. Otto Witt, the yield of the Birkeland-Eyde furnaces was more than 500 kilograms of nitric acid per year for every kilowatt of power. The conditions in Norway were exceptionally good for the furnishing of power at exceedingly low rates. Hence the new product could compete with Chili saltpetre on the market, and would become every year more valuable as the demand for nitrates increased, and the natural supplies became exhausted.

## POLAR EXPLORATION.

AFTER discussion at a meeting of explorers and geographers interested in the study of the polar regions, a statement was submitted to the congress held at Mons in September, 1905, setting forth the expediency of founding an International Association for the Study of the Polar Regions, with the objects of "(1) obtaining an international agreement upon different questions associated with polar geography; (2) making a general effort to reach the terrestrial poles; (3) organising expeditions having for their object an extension of our knowledge of the polar regions in every respect; and (4) forming a programme of scientific work to be carried out in the different countries during the existence of the International Polar Expeditions." The congress unanimously passed a resolution expressing the wish "(1) to see the formation of this Association in 1906 by a previous meeting of a general Conference of the larger scientific and maritime nations, who have taken part in the principal polar expeditions up to the present time; and (2) to see that the Belgian Government takes the initiative in approaching the Governments of other countries."

We have received a copy of a letter which has been addressed by M. Lecointe, to whom the congress entrusted the work of making the necessary preliminary arrangements, to the presidents of academies and of learned societies all over the world. It is proposed to hold the first conference at the beginning of May, for the consideration of general questions, and to discuss in detail "(1) the basis of a series of polar expeditions; (2) the programme of term of observations to be carried out in all the observatories; and (3) the text of the working arrangements of the international Association" at a second conference, composed of State delegates and delegates from academies and learned societies, in September. The conclusions arrived at by the second conference will be transmitted for examination to the Belgian Government, which eventually will ask the support of other countries for the new association.

In connection with the proposed International Association for the Study of the Polar Regions, M. Lecointe invites polar explorers to send him papers or notices dealing with questions which will be considered at the general conference in May next. A paper of the kind has been issued in which M. Henryk Arctowski makes a number of suggestions for work in the future. M. Arctowski expresses the opinion that in future Arctic research much use may be made of ice-breakers of the type of Makaroff's *Yermak*. With regard to Antarctic exploration, the settlement of the continental question is admittedly of primary importance, but M. Arctowski strongly urges the advisability of exploring thoroughly the circumpolar areas as a preliminary, especially by hydrographical expeditions.

## UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The recommendation of the Forestry Syndicate with regard to the general management of the examinations, the schedules of the proposed forestry examination, &c., passed the Senate last Thursday. The most important of these recommendations is that the general conduct of the examinations and the prescription of courses of training are to be entrusted to a committee of the Board of Agricultural Studies. Such a committee will include the professors of agriculture, botany, chemistry, and geology, and the reader in agricultural chemistry, together with three other members of the Board of Agricultural Studies. The committee will have the power to co-opt annually, if it thinks fit, four other persons.

The professor of experimental physics gives notice that a course of three lectures on "The Life-history of Surface Air Currents" will be given by Dr. W. N. Shaw, F.R.S., director of the Meteorological Office, in the Cavendish Laboratory on Wednesdays, February 14 and February 21, and Thursday, March 1.

LONDON.—Prof. E. A. Minchin commenced at University College on Monday a course of lectures on "Parasitic Protozoa." Prof. Minchin recently returned from Uganda, where he was engaged as one of the special commissioners of the Tropical Diseases Committee of the Royal Society in research on the life-history of the trypanosome of sleeping sickness.

PROF. DRUDE has been elected rector of the Dresden Technical High School for the ensuing year.

DURING January, Dr. Bolam, lecturer on chemistry at Queen Margaret College, Glasgow University, delivered in Leith Nautical College a short course of lectures on "The Chemistry of Dangerous Cargoes" to large nautical audiences. Mr. James Currie (of Messrs. James Currie and Co.) presided, and pointed out the importance of the course in view of the very complex cargoes merchant ships were now carrying.

MR. H. F. TRIPPEL directs attention to an important point in connection with army entrance examinations in a letter to the *Pall Mall Gazette* of February 3. Mathematics is a compulsory subject for every candidate competing for admission to the Royal Military Academy, Woolwich; yet Mr. Trippel says that in the recent examination one of the competitors who scored zero in mathematics was placed among the successful candidates. It appears, therefore, that though it is compulsory to take mathematics in the competitive examination, a candidate may do so without having any serious intention of gaining a single mark in the subject. Now that the attention of the authorities has been directed to the defect in the regulations which permits this course to be followed, it is to be hoped that a minimum standard of marks to be gained in mathematics by all candidates will be prescribed, or some other remedy found.

## SOCIETIES AND ACADEMIES.

### LONDON.

**Geological Society**, January 10.—Dr. J. E. Marr, F.R.S., president, in the chair.—The clay-with-flints: its origin and distribution: A. J. **Jukes-Browne.** Until recently the clay-with-flints has been regarded as being, in the main, a residue from the slow solution of the Chalk. Of late years, the opinion has been growing that it consists very largely of material derived from the Eocene. The present paper is devoted to an examination of the facts, with the view of ascertaining whether the clay-with-flints could possibly be derived from the Chalk, or whether the theory of its derivation from the Eocene is confirmed by more detailed inquiry. From several lines of investigation the author concludes (1) that the clay-with-flints cannot have been formed from mere solution of the Upper Chalk; (2) that all its components, except the unbroken and angular flints, could have been furnished by the Reading beds; (3) that the positions occupied by it are such that no great thickness of Chalk can have been destroyed to form it, the tracts being seldom more than 30 feet or 40 feet below the local plane of the Eocene base, or the presumed level of that plane.—Footprints from the Permian of Mansfield (Nottinghamshire): G. **Hickling.** These fossils were discovered in 1897 by Mr. Francis Holmes in the Rock Valley Quarry, Mansfield, in a local, lenticular mass of sandstone intercalated in the Magnesian Limestone. The prints present some resemblance to those named *Ichnium acrodactylum*, from the Upper Permian of Thuringia.

**Zoological Society**, January 16.—Mr. Howard Saunders, vice-president, in the chair.—Some bones of the lynx (*Felix lynx*) found in a limestone cavern in Cales Dale, Derbyshire: W. Storrs **Fox.** This was only the third record of remains of this species having been met with in the British Islands.—Mammals recently collected in the Malay Peninsula by Mr. C. B. Kloss, and presented to the National Museum: J. L. **Bonhote.** The collection contained examples of seventeen species, chiefly rodents, of which two, representing well known Bornean species, were described as new. There was also a series of *Mus jarak*, a species hitherto known from one specimen only, and recently described by the author.—The minute structure of the teeth of the creodonts: C. S. **Tomes.** The author stated that suggestions which had been made as to a possible relationship between the creodonts and the polyprotodont marsupials had rendered it interesting to see how far the structure of their teeth either supported or tended to disprove such speculations. Marsupial teeth possessed in the structure of their enamel a well marked peculiarity, namely, the free penetration of the epiblastic enamel by tubes continuous with those of the mesoblastic dentine, and it happened that recent Carnivora, the descendants, more or less direct, of the creodonts, also presented a disposition of the prisms of their enamel somewhat unusual amongst Mammalia. Teeth of Hyænodon, Sinopa, Oxyæna, Pachyæna, Borhyæna, Didynictis, and Cynodictis had been examined, and in none of them were marsupial characters observed; on the contrary, in most of them characteristic carnivorous patterns were found, so that in Oligocene and Eocene times their enamel had already attained to its full specialisations.—Contributions to the anatomy of the Ophidia: F. E. **Beddard.**—Synopsis of the toads of the genus Nectophryne, with special remarks on some known species and description of a new species from German East Africa: Dr. J. **Roux.**

**Royal Meteorological Society**, January 17.—Mr. Richard Bentley, president, in the chair.—Annual general meeting.—Address on meteorology in daily life: R. **Bentley.** The president referred to the increasing interest shown lately throughout the country in the study of meteorology, and to the recent advances which had been made in it—more especially in the analysis of the composition of the atmosphere—and in the investigation of the upper currents of the air. He also laid stress on the increasing urgency of safeguarding the water supply, and gave various illustrations of the effects of weather on human life, on the land, on navigation, on transit, &c.

**Royal Microscopical Society**, January 17.—Dr. D. H. Scott, F.R.S., president, in the chair, annual meeting.—Annual address, the subject being "The Life and Work of Bernard Renault": **President.**

**Chemical Society**, January 18.—Prof. R. Meldola, F.R.S., president, in the chair.—The refractive indices of crystallising solutions, with especial reference to the passage from the metastable to the labile condition: H. A. **Miers** and F. **Isaac.** The authors found that the refractive index of a strong solution of sodium nitrate, measured at intervals while the liquid cools, rises to a maximum value and then falls, crystals appearing before the maximum is reached. There are always two periods of crystallisation: a first, in which a few crystals are growing gradually; a second, in which many crystals appear spontaneously. The authors regard these as being undoubtedly the metastable and labile states.—The effect of constitution on the rotatory power of optically active nitrogen compounds, part i.: M. B. **Thomas** and H. O. **Jones.** The resolution of a set of optically active nitrogen compounds and the examination of the rotatory power of their salts in dilute aqueous solution have been made in order to find the rotatory power of the ions. The values of $[M]_D$ for some of the principal alkyl radicals are given.—The determination of available plant food in soil by the use of weak acid solvents: A. D. **Hall** and A. **Amos.** The authors have investigated the effect of repeating the attack of weak acid solvents on soils of known history derived from the Rothamsted experimental plots. In the case of soils continuously manured with superphosphate, the phosphoric acid goes into solution at a rate which decreases logarithmically, but soils which have received complex manures do not show the same regular decrement in the amounts of phosphoric acid passing into solution.—The action of ammonia and amines on diazo-benzene picrate: O. **Silberrad** and G. **Rotter.**—The preparation of bistriazobenzene: O. **Silberrad** and B. J. **Smart.**—Gradual decomposition of ethyl diazoacetate: O. **Silberrad** and C. S. **Roy.**—Studies on nitrogen iodide, iii., the action of methyl and benzyl iodides: O. **Silberrad** and B. J. **Smart.**—Action of bromine on benzeneazo-*o*-nitrophenol: J. T. **Hewitt** and N. **Walker.**—The condensation of dimethyldihydroresorcin and of chloroketodimethyltetrahydrobenzene with primary amines, part i., monamines, ammonia, aniline, and *p*-toluidine: P. **Haas.**—Silicon researches, part x., silicon thiocyanate: J. E. **Reynolds.** The author found that silicon thiocyanate, $Si(SCN)_4$, is best prepared by prolonged digestion of excess of pure lead thiocyanate in a benzene solution of silicon tetrachloride.—Halogen derivatives of substituted oxamides: F. D. **Chattaway** and W. H. **Lewis.** A number of substances obtained by the action of halogens on substituted oxamides are described.—Menthyl benzene-sulphonate and menthyl naphthalene-β-sulphonate: T. S. **Patterson** and J. **Frew.**—Some reactions and new compounds of fluorine: E. B. R. **Prideaux.** The fluorine prepared by the electrolysis of anhydrous hydrogen fluoride, contained in a copper vessel, was found to contain oxygen produced at the anode even after the current had passed for a considerable time. Liquid fluorine has no solvent or chemical action on iodine or solid bromine. Bromine fluoride, $BrF_3$, was prepared for the first time. Gaseous fluorides of selenium, $SeF_6$, and tellurium, $TeF_6$, were prepared by direct combination. The vapour pressure curve of $SF_6$ was compared with those of $SeF_6$ and $TeF_6$, and shown to be similar.—Contributions to the chemistry of the rare earths, part i.: M. **Esposito.** The various methods advocated by Watts, Brauner, Popps, Mosander, Debray and others for the separation of cerium, lanthanum, and "old didymium" have been examined comparatively.—A synthesis of aldehydes by Grignard's reaction: G. W. **Monier-Williams.**—The action of ultra-violet light on moist and dry carbon dioxide: S. **Chadwick,** J. E. **Ramsbottom,** and D. L. **Chapman.**—A contribution to the study of stable diazo-compounds, preliminary note: G. T. **Morgan** and W. O. **Wootton.**—Triarylsulphonium bases: S. **Smiles** and R. **Le Rossignol.**—An improved apparatus for the continuous extraction of liquids with ether: R. S. **Bowman.** In this apparatus, which comprises a simple system of tubes, a condenser, and two ordinary flasks, the extraction is effected by passing cool liquid ether through the solution.

**Physical Society**, January 26.—Prof. J. H. Poynting, F.R.S., president, in the chair.—The isothermal distillation of nitrogen and oxygen and of argon and oxygen: I. K. **Inglis.** Mixtures of liquid nitrogen and oxygen are particularly suitable for an exact study of the relations obtaining during isothermal distillation, for the distillation bulb being the coldest instead of the hottest part of the apparatus, errors due to back condensation, &c., can be eliminated. In addition, the vapour can easily be circulated and passed time after time through the liquid until equilibrium is complete. Experiments were carried out in this way in a specially designed apparatus, and the results showed that the ratio of nitrogen to oxygen in the vapour was not in a constant proportion to the same ratio in the liquid. When, however, the partial pressures of nitrogen and oxygen were plotted against the *concentrations* in the liquid a straight line was obtained in the case of nitrogen and a curve in the case of oxygen. This indicated that nitrogen obeyed Henry's law of solubility, and the deviation in the case of oxygen pointed to its being slightly associated in the liquid state when mixed with nitrogen. A few experiments were also carried out with mixtures of argon and oxygen. At the temperature used, argon was a volatile solid, and therefore the greatest concentration of argon that could be obtained was that of the saturated solution in oxygen. Argon seemed to agree with nitrogen in obeying Henry's law.—The use of chilled cast iron for permanent magnets: A. **Campbell.** The present investigation was made on rings in addition to rods of the standard dimensions usual in testing magnet-steels. All

the specimens were heated to 1000° C. and then chilled in cold water, care being taken to support them during the process, as cast-iron is very brittle at such a high temperature. The rods were tested for maximum remanent B and coërcivity by Madame Curie's method, the magnetised bar being placed in a long solenoid producing a demagnetising field which was gradually increased until a search-coil slipped along the bar showed that the demagnetisation was complete. The results showed the chilled cast-iron to be not very inferior to ordinary magnet-steel. By ballistic tests on the two rings, their permeability curves were obtained, and these indicated that the simple process of chilling used was quite satisfactory even for a tolerably massive ring of 6 sq cm. cross section. The cheapness and ease of working cast-iron should encourage instrument makers to test its capabilities in various instruments.—Experiments on the propagation of longitudinal waves of magnetic flux along iron wires and rods: Prof. **Lyle** and Mr. **Baldwin.** The experiments described in the paper were undertaken with the object of determining if there is a definite rate of propagation of magnetism in iron. The method adopted was to produce magnetisation at a particular point on a bar by means of a coil through which an alternating current was passed, and then to observe the magnetic flux at various distances from the coil by means of a small secondary coil, free to be moved to various places on the bar. By the use of Prof. Lyle's wave-tracer the magnetic flux at various points along the bar was thus obtainable. The wave curve was then analysed by Fourier's series. Various curves given in the paper show the value of the constants in Fourier's series and of the lag in the magnetisation as the coil was moved along the bar. Contrary to what had been observed in previous researches, the authors found that the phase lag, instead of continuously increasing along the bar, reached a maximum value and then diminished, proving the absence of true wave propagation.

**Mineralogical Society,** January 23.—Prof. H. A. Miers, F.R.S., president, in the chair.—Studies in crystallisation; sodium nitrate: H. A. **Miers** and J. **Chevalier.** Microscopic observations were made upon solutions of known strength contained in open tubes or sealed tubes maintained at a known temperature, or in the form of drops upon a slide, with the object of comparing the growth of crystals in metastable and labile solutions respectively. The limits of the labile state (in which the solution can crystallise spontaneously) have been fixed by previous experiments by H. A. Miers and Miss F. Isaac. If a crystal of the salt be introduced into a supersaturated solution which is not labile, the centres of growth of new crystals are on its surface, and they grow in parallel positions upon it; if it be introduced into a labile solution the new centres of growth are in its neighbourhood, and the crystals fall upon it in various positions. If it be moved about in either, a cloud of crystals is produced; but in the metastable solution this appears to be due to minute crystals which are swept from its surface. A crystal having appeared spontaneously can continue to grow in a labile solution without producing others in its neighbourhood, but if introduced it at once produces a cloud. This may be because the growing crystal is surrounded by a zone of metastable solution.—Geikielite and the ferro-magnesian titanates: T. **Crook** and B. M. **Jones.** Geikielite occurs in association with magnesian menaccanite and common ilmenite (menaccanite) in the gem gravels of the Balangoda and Rakwana districts of Ceylon. A considerable number of analyses indicate that geikielite varies in composition, the iron oxides ranging from 8 per cent. to 14 per cent. No specimen has hitherto been found which contains less than 8·1 per cent. of iron oxide. For this reason the formula $(Mg,Fe)TiO_3$ is preferable to $MgTiO_3$ as expressing the true composition of geikielite. Magnesian menaccanite containing about 28 per cent. of iron oxide is very closely allied to geikielite in all its properties, more so than to common ilmenite. The alteration products of geikielite are similar to those of ilmenite, consisting of rutile and so-called leucoxene; the latter is a mixture of amorphous titanic acid, sphene, and limonite. It seems advisable to classify the ferro-magnesian titanates as ilmenites and geikielites, treating magnesian menaccanite (which has the formula $(Fe,Mg)TiO_3$, where $Fe : Mg = 1 : 1$) as the middle member of the series.—G. F. Herbert **Smith** exhibited, and explained the use of, a diagram for the graphical determination of the refractive index from the prism angle and the angle of minimum deviation. He also explained a simple test for ascertaining the pair of faces corresponding to any refracted image.

DUBLIN.

**Royal Dublin Society,** December 19, 1905.—Dr. R. F. Scharff in the chair.—The causes of "blowing" in tins of condensed milk: Dr. G. H. **Pethybridge.** Blowing (*i.e.* bulging) is caused by the accumulation of gas produced by the fermentation of the cane sugar added during manufacture by certain wild yeasts or torulæ, which can ferment saturated solutions of sugar, and appear to be present in the original milk supplies, and are not introduced during the process of manufacture.—Two new species of Collembola for Ireland: Prof. G. H. **Carpenter.** The species described belong to the genera Isotoma and Entomobrya, the latter showing some interesting special affinities with Orchesella.

EDINBURGH.

**Royal Society,** January 8.—Prof. Crum Brown, vice-president, in the chair.—*Bathydraco Scotiae,* Poisson abyssal nouveau recueilli par l'Expedition Antarctique national Écossaise. Note préliminaire: Louis **Dollo.** The genus Bathydraco was instituted by Günther in 1878 for a small fish (*B. antarcticus,* Günth.) from the south east of Heard Island, inhabiting a depth of 1260 fathoms. The new species, named by M. Dollo, was obtained in the Weddell Sea at a depth of 1410 fathoms.—Influence of thymus feeding on allantoin excretion: Dr. J. **Maclachlan.** The work was based on experiments carried out in the laboratory of the Royal College of Physicians of Edinburgh. Reference was made to the very unsatisfactory nature of the evidence on the influence of uric acid and nucleins on the production of allantoin, and it was pointed out that the administration of thymus substance was invariably followed by a large production of allantoin. The point investigated was whether this was due to the conversion of the nucleins and puric bodies contained in the thymus or to some specific action of the substance. Boiling the thymus before it was administered reduced its power of producing allantoin to less than half. Thymus also was found to exercise a much more marked effect in causing the production of allantoin than other glands, such as pancreas, liver, and lymphatic glands, which are also rich in nucleins. The conclusion drawn was that raw thymus when administered produced a specific action on the metabolism by which the formation of allantoin was increased.—A theorem in hyper-complex numbers: J. H. Maclagan **Wedderburn.** A short proof was given of a theorem, first proved by Scheffers, that an algebra which contains the quaternion algebra can, if the moduli of the two algebras are the same, be expressed as the product of the quaternion algebra and another algebra. The theorem was then extended to a large and important class of algebras.

January 22.—Lord M'Laren, vice-president, in the chair.—A form of initiational disturbance more convenient than that of §§ 3–31 of previous papers on waves: Lord **Kelvin.** The investigations of §§ 5–31, including the "front and rear" of infinitely long free processions of waves in deep water, are all founded on superposition of equidistant initiational disturbances, the first of two typical forms described in §§ 3, 4. In this form the initial disturbance is everywhere elevation or everywhere depression, and its amount at great distances from the middle varies inversely as the square root of the distance from a horizontal line at a small height above the water surface in the middle of the disturbance. A type-disturbance derived mathematically from that used in §§ 5–31 by double differentiation with reference to time, or by single differentiation of the second of the forms of §§ 3, 4 with reference to space, is given in the present paper, and illustrated by diagrams of curves placed before the society, in which the initial disturbance has as much water above as below the undisturbed level; and at great distances the depression or elevation varies inversely as the 3/2 power

of the distance. This derived solution is used in the two following papers, for which it is found much more convenient than the solution used in §§ 5–31.—Illustrations of the indefinite extension and multiplication of a group of two-dimensional deep-sea waves, initially finite: Lord **Kelvin.** The water is left at rest and free, after being artificially displaced to a configuration of a finite number of sinusoidal mountains and valleys—five mountains and four valleys in the initiation of the diagrams placed before the society. Immediately after the water is left free, the disturbance begins analysing itself into two groups of waves, seen travelling in contrary directions from the middle line of the diagram. The perceptible fronts of these two groups extend rightwards and leftwards from the end of the initial single static group, far beyond the "hypothetical fronts" supposed to travel at half the wave velocity, which (according to the dynamics of Osborne Reynolds and Rayleigh in their important and interesting consideration of the work required to feed a uniform procession of water-waves) would be the actual fronts if the free groups remained uniform. How far this is from being the truth is illustrated by the diagrams. Besides the great extension of the fronts outward from the middle, we see that the two groups, after emergence from perceptible coexistence in the middle, travel with their rears leaving a widening space between them of water not perceptibly disturbed, and with wavelets in ever augmenting number following slower and slower in the rear of each group and causing the extreme perceptible rear to travel at a much smaller speed than half the "wave velocity." It is obviously difficult to give any definition of an "effective front," or of a "centre of group," or of a "virtual rear," according to which we could regard the group as travelling with half the wave velocity or *with any single definite velocity*.—The initiation and continued growth of a train of two-dimensional waves due to the sudden commencement of a stationary periodically varying forcive: Lord **Kelvin.** A forcive consisting of a finite sinusoidally varying pressure is applied, and kept through all time applied, to the surface of the water within a finite practically limited space on each side of the middle line of the disturbance. In the beginning the water was everywhere at rest and its surface horizontal. The problem to be solved is, to find the elevation or depression of the water at any distance from the mid-line of the working forcive, and at any time after the forcive began to act. The solution was illustrated by two diagrams—time curves—one showing the motion of the water at the mid-line of the working forcive, the other showing the motion at a distance from this line equal to the wave-length that would be in an endless uniform procession of waves having period equal to the period of the disturbing forcive. Calculations are in progress to give the motion of the water at eight wave-lengths from the source. The detailed calculations were made and the curves drawn for Lord Kelvin by Mr. George Green.

*Erratum.*—In the report of the meeting of November 20, 1905 (NATURE, December 28, 1905), the words "quite did away with" on p. 216, line 23, should be "had no appreciable effect on."

PARIS.

**Academy of Sciences**, January 29.—M. H. Poincaré in the chair.—New researches on the insoluble alkaline compounds contained in living plants: M. **Berthelot.**—The capture of a whale (genus Kogia) near Roscoff, English Channel: Yves **Delage.** The animal was captured at Siec, about 6 kilometres from Roscoff. The species is extremely rare, and has never been previously observed in European waters.—Certain systems of circles and spheres which occur in the deformation of quadrics: C. **Guichard.**—The perpetual secretary announced the death of Sir John Burdon-Sanderson, correspondant for the section of medicine and surgery.—Differential equations of the second order of which the general integral is uniform: M. **Gambier.**—The flame spectrum of mercury: C. **de Watteville.** Attempts to photograph a flame spectrum of mercury have been hitherto unsuccessful. By the use of solutions of the acetate and cyanide of mercury, sprayed into a flame, the author has been successful in obtaining the flame spectrum of mercury, consisting of the single line 2536·72. This line was measured by Kayser and Runge in the arc spectrum of mercury.—The duration of the discharge in an X-ray tube: André **Broca.** With equivalent sparking distances varying from 6 cm. to 10 cm., the time was practically constant, 0·0006 sec.—The diminution of the radio-activity of polonium with time: Mme. **Curie.** The intensity of the radiation diminishes with the time according to a simple exponential law, $I = I_0 e^{-at}$. If $t$ is expressed in days, $a = 0{\cdot}00495$, or the intensity falls to half its value in 140 days. A diagram is given showing the linear relation between log I and the time, the deviations between the values obtained from the above law and from experiment not exceeding 3 per cent. The agreement of the constant (0·00495) with that found by Marckwald for radiotellurium (0·00497) shows that the latter substance is identical with polonium.—The sulphates of some rare metals: Camille **Matignon.** Thermochemical measurements on the sulphates of lanthanum, praseodymium, neodymium, and samarium.—The rapid preparation of solutions of hydriodic acid: F. **Bodroux.** A given weight of iodine is divided into two equal portions. By the interaction of barium peroxide and the first portion, barium iodide is produced; the remainder of the iodine is dissolved in the solution of barium iodide, and the liquid treated with sulphur dioxide until decolorised, filtered from the barium sulphate, and redistilled.—An alloy of thorium and aluminium: O. **Hönigschmid.** This alloy, the composition of which corresponds to the formula $ThAl_3$, can be obtained in the form of long hexagonal prismatic needles possessing the colour and metallic lustre of aluminium, by the reduction of thorium oxide by aluminium in the electric furnace. It can also be obtained by the interaction of aluminium and the double fluoride of aluminium and thorium at a high temperature.—Researches on the halogen compounds of the borates of barium and strontium: L. **Ouvrard.** The borates of barium and strontium appear to enter into combination with chlorine and bromine less easily than the corresponding salts of calcium, only one halogen compound of each being obtainable.—α- and β-campholytic alcohols: G. **Blanc.** Details of preparation and physical properties. The pyruvic ester of each is described, and the corresponding semicarbazones.—The influence of the reaction of the medium upon the activity of the diastases: A. **Fernbach.** Remarks on a recent note on the same subject by L. Maquenne and E. Roux.—The nutrition of green plants by amides in the absence of carbon dioxide: Jules **Lefèvre.** Experiments made on the dwarf nasturtium led to the following conclusions:—Plants deprived of carbon dioxide and amides lose a notable proportion of their initial weight, this loss being due to respiration. Plants kept in the light, with amides present in the soil, in spite of the absence of carbon dioxide, developed and increased their dry weight. Light is essential for the utilisation of the amides by the plant.—A new parasitic fungus, *Trematovalsa Matruchoti*, causing the disease of the silver lime tree: Nicolas **Jacobesco.** This fungus is the cause of a disease which has ravaged the lime forests of Wallachia. It appears to belong to a new family.—The classification into genera of the family of the Bradypodidæ (genus Hemibradypus): R. **Anthony.**—Contribution to the general morphology of the higher Protozoa: J. **Kunstler** and Ch. **Gineste.**—The anatomy and histology of the Ixodidæ: A. **Bonnet.**—The effect of the injection of extract of the interstitial gland of the testicle on the growth: P. **Ancel** and P. **Bouin.**—Tables of growth drawn up in 1905 from the measurements of 4400 Parisian children between the ages of one and fifteen years: MM. **Variot** and **Chaumet.** The results are given both in graphical and tabular form, comparison being made with similar measurements of Bowditch (Massachusetts) and Rotch (Boston).—The physiological conditions of oral teaching: Pierre **Bonnier.** The effects of a want of knowledge of the principles of voice production are throat troubles with the teachers and increased mental effort on the part of the pupils. Measurements are given showing the importance of the latter effect.—Chloroform anæsthesia. The estimation of the chloroform before, during, and after anæsthesia is set up, and the quantity in the blood at the moment of death: Maurice **Nicloux.**—The Neocretacean ammonites collected by the Swedish Antarctic Expedition: W. **Kilian.**—The geology of the Peloponnesus: Ph. **Négris.**

GÖTTINGEN.

**Royal Society of Sciences.**—The *Nachrichten* (physico-mathematical section), parts iv. and v. for 1905, contains the following memoirs communicated to the society:—

July 8.—Determination of all curves by the translation of which minimal surfaces are generated: P. **Stäckel.**

July 22.—Outlines of a general theory of linear integral equations, x., Riemann's problems in the theory of functions of a complex variable: D. **Hilbert.**—On finite algebras: L. E. **Dickson.**—On pyroelectricity in centro-symmetric crystals; with appendix (October 28): On the piezoelectricity of centric crystals: W. **Voigt.**

August 5.—On the origin of the salt deposits of north-west Germany: A. **von Koenen.**

November 25.—Remarks on an essay on the stellate appearance of the stars (*Nachrichten*, 1905, p. 238). The effect of the background on the estimation of magnitude (*e.g.* of the moon on the horizon). The "jumping" of the image in vision with the right and the left eye alternately: W. **Holtz.**—Measurements of the density of the vertical electric conduction-current in free air made during the balloon voyage of August 30, 1905: H. **Gerdien.**—The Doppler effect in "Canal-strahlen" and the spectra of positive atomic ions: J. **Stark.**—Determination of all curves by the translation of which minimal surfaces are generated: G. **Scheffers.**

The official communications, part ii., for 1905, of the *Nachrichten* contain an anniversary address by W. **Voigt** on hypotheses concerning work.

## DIARY OF SOCIETIES.

*THURSDAY*, FEBRUARY 8.

ROYAL SOCIETY, at 4.30.—On Roche's Ellipsoids and on Allied Problems Relating to Satellites: Sir George H. Darwin, K.C.B., F.R.S.—Polarisation in Secondary Röntgen Radiation: Dr. C. G. Barkla.—Ionic Size in Relation to the Physical Properties of Aqueous Solutions: W. R. Bousfield, K.C.—Explosions of Coal-Gas and Air: Prof. B. Hopkinson.—On Periodicities in Sun-spots: Prof. A. Schuster, F.R.S.—Constants of Explosion of Cordite and of Modified Cordite: Dr. Robert Robertson.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Technical Considerations in Electric Railway Engineering: F. W. Carter (*Conclusion of Discussion*).—Crane Motors and Controllers: C. W. Hill.

ROYAL INSTITUTION, at 5.—The Significance of the Future in the Theory of Evolution: Benjamin Kidd.

MATHEMATICAL SOCIETY, at 5.30.—Special General Meeting.—Partitions of Numbers in Space of two Dimensions: Major P. A. MacMahon.—The Eisenstein-Sylvester extension of Fermat's Theorem: Dr. H. F. Baker.

*FRIDAY*, FEBRUARY 9.

ROYAL INSTITUTION, at 9.—Eclipse Problems and Observations: H. F. Newall, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Anniversary Meeting.

PHYSICAL SOCIETY, at 8.—Annual General Meeting. Address by the President-elect, Prof. J. Perry, F.R.S.

ROYAL GEOGRAPHICAL SOCIETY, at 5.30 (Research Department).—The Ruins of Rhodesia and the Probable Date of Outside Intrusions in East Africa: Discussion to be opened by D. Randall MacIver.

MALACOLOGICAL SOCIETY, at 8.—Annual Meeting.—On Pearl-Oyster Culture and Pearl Fishing: T. H. Haynes.—Irish Molluscs and their Habitats: R. J. Welch.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Electric Driving at the Locomotive Works of the North London Railway: R. H. Mackie.

*SATURDAY*, FEBRUARY 10.

ROYAL INSTITUTION, at 3.—Advances in Microscopy; J. W. Gordon.

*MONDAY*, FEBRUARY 12.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Geography of the Spanish Armada: Rev. W. Spotswood Green.

SOCIETY OF ARTS, at 8.—Modern Warships: Sir William White, K.C.B., F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Graduates' Lecture: The Niagara Power-Stations: Prof. W. C. Unwin, F.R.S.

*TUESDAY*, FEBRUARY 13.

ROYAL INSTITUTION, at 5.—Food and Nutrition: Prof. W. Stirling.

ANTHROPOLOGICAL INSTITUTE, at 8.15.—Exhibition of Lantern-slides of Kikuyu Ceremonies: W. Scoresby Routledge.—Exhibition of Kikuyu Ceremonial Images: T. A. Joyce.—Exhibition of Slides of Rude Stone Monuments and Notes on Stone Monuments in Glamorganshire: A. L. Lewis.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Adjourned Discussion*: The Railway-Gauges of India: F. R. Upcott.—*Probable Papers*: Country Roads for Modern Traffic: J. E. Blackwall.—A Plea for Better Country Roads: G. R. Jebb.

*WEDNESDAY*, FEBRUARY 14.

SOCIETY OF ARTS, at 8.—The Horseless Carriage, 1885–1905: Claude Johnson.

*THURSDAY*, FEBRUARY 15.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Influence of Increased Barometric Pressure on Man, No. 1: Dr. L. Hill, F.R.S., and M. Greenwood.—On the Existence of Cell-communications between Blastomeres: C. Shearer.—Innervation of Antagonistic Muscles. Ninth Note: Successive Spinal Induction: Prof. C. S. Sherrington, F.R.S.—The Chemical Constitution of Protoplasm as shown by the Rate of Tissue Disintegration: Dr. H. M. Vernon.—The Development of the Head-Muscles of the Common Fowl (*Gallus domesticus*), together with some Remarks on the Head-Muscles of Reptiles: Prof. F. H. Edgeworth.

CHEMICAL SOCIETY, at 8.30.—Cuprous Formate: A. Angel.—The Solubility of Triphenylmethane in Organic Liquids with which it forms Crystalline Compounds: H. Hartley and N. G. Thomas.—The Spontaneous Crystallisation of Supersaturated Solutions: H. Hartley.—The Preparation and Properties of some New Tropeines: H. A. D. Jowett and A. C. O. Hann.—Studies in Asymmetric Synthesis, Part IV., The Application of Grignard's Reaction for Asymmetric Syntheses: A. McKenzie.

LINNEAN SOCIETY, at 8.—The Structure of *Isis hippuris*: J. J. Simpson.—Note on the Geographical Distribution of the Genus Shortia, Torr. and Gray: B. Daydon Jackson.—*Exhibition*: Developmental Changes in Zooglœa (with Lantern Slides): Dr. H. Charlton Bastian, F.R.S.

SOCIETY OF ART at 4.30.—The Navigable Waterways of India: R. B. Buckley, C.S.I.

INSTITUTION OF MINING AND METALLURGY, at 8.—Pyritic Smelting: R. C. Alabaster and F. H. Wintle.—The Acme Combined Concentrating Table: L. H. L. Huddart.—Stadia in Careful Work: A. H. Webb.—The Detailed Mapping of Stoping Areas: H. R. Sleeman.—Sinking, Development and Underground Equipment of Deep Level Shafts on the Rand: A. E. Pettit.—The Hydraulic Filling of a Coal Seam at Lens, Pas de Calais, France: L. E. Hill and M. Butt.

*FRIDAY*, FEBRUARY 16.

ROYAL INSTITUTION, at 9.—The Passage of Electricity through Liquids: W. C. D. Whetham, F.R.S.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—Large Locomotive Boilers: G. J. Churchward.

*SATURDAY*, FEBRUARY 17.

ASSOCIATION OF TEACHERS IN TECHNICAL INSTITUTES (Regent Street Polytechnic), at 7.30.—The Teaching of Mathematics to Engineering Students: G. E. St. L. Carson.—The Teaching of Mathematics to Building Trade Students: H. Bustridge.

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