THURSDAY, JUNE 27, 1907.

RESINS.

Die Harze und die Harzbehälter mit Einschluss der Milchsäfte. By A. Tschirch. Zweite stark erweiterte Auflage. Erster und zweiter Band. Pp. xxii+1268. (Leipzig: Gebrüder Borntträger, 1906.) Price 32 marks.

The Distillation of Resins. By Victor Schweizer. Pp. viii+183. (London: Maclaren and Sons; New York: Van Nostrand and Company, n.d.) Price 10*s.* 6*d.*

THE chemistry of resins has been very much neglected by investigators, so much so that even now the empirical formula of the best known of their constituents—abietic acid, which was isolated from ordinary rosin more than eighty years ago—is still a matter of dispute. It is difficult to account for this neglect, since many of the naturally occurring resins are readily resolved into crystalline or otherwise well-defined substances, so that the subject does not present the initial difficulties encountered by the investigators who have studied the terpenes, proteids, and similar intractable natural products. Resins should now be particularly attractive to chemical workers, since Prof. Tschirch and his collaborators have surveyed almost the whole field in a preliminary manner, and from their results it is possible to select the most promising materials for detailed investigation.

Perhaps the most important result which has accrued from this work is the possibility of classifying the constituents of the natural resins into a comparatively small number of groups of similarly reacting—and probably similarly constituted—substances.

Looked at from this general point of view, the chemical work done by Prof. Tschirch and his co-adjutors can be regarded as a very satisfactory contribution to our knowledge of resin chemistry.

The publication of the second edition of this monograph affords an opportunity for a review of this work as a whole, since the book is largely a reprint, with additions and corrections, of papers published in the *Archiv der Pharmazie*.

Prof. Tschirch's usual method of investigation consists in dissolving the resin under examination in an indifferent solvent, and extracting this successively with solutions of alkali carbonates and hydroxides.

The products so isolated, and perhaps subjected to a more or less satisfactory process of purification, are in general regarded as definite substances, and though they are in the majority of cases amorphous coloured products having no constants which may be regarded safely as criteria of purity, they are analysed and have names and formulæ assigned to them. The qualifying statement that such substances may be impure is no adequate defence for such a proceeding, since the names and formulæ are liable to be copied into the literature of the subject without the disclaimer which originally accompanied them.

Similarly, when Prof. Tschirch in the course of an investigation meets with a substance resembling one already known, he does not in general ascertain definitely whether the two substances are identical, but, assuming that they are probably distinct, makes a denominator for his supposed new substance by attaching a descriptive prefix to the name of the older compound; thus *palabietic acid*, from the resin of *Pinus palustris*, has the same elementary composition and melting point as abietic acid, with which, so far as one can see, it may be identical.

The application of the terms "resinolic acid" and "resene" is also objectionable. The first of these would, under any system of nomenclature now in use among chemists, imply the presence of a hydroxyl in addition to a carboxyl group in each of the substances included in the class so designated, and similarly the termination -ene is usually reserved for hydrocarbons. Prof. Tschirch's "resinolic acids" are simple carboxylic acids, typified by abietic acid, and his "resenes" are oxygenated substances.

The book is not only a record of the results of chemical investigations, but deals with the botany and habitats of the plants from which resins are obtained, and to these branches of knowledge the author and his collaborators have made many and important contributions. Much of the information given is the result of personal observations made by Prof. Tschirch during travels in the East Indies and elsewhere, and probably no previous investigator of plant products has devoted more care to securing authentic material for investigation. The botanical part of the subject is dealt with in the second and smaller volume, which gives a *résumé* of our present knowledge of the mode of origin and distribution of resins in plants. Reference should also be made to the important section dealing with latices and the resins and rubbers obtained from them, matters which are at the present moment of great economic importance.

There are a few resinous products which have been the subject of investigation, and which, in spite of Prof. Tschirch's desire to make his monograph as complete as possible, have escaped his notice, but these are for the most part of little importance.

In spite of those unfortunate tendencies to add unduly to nomenclature and to be somewhat lax in awarding the character of a definite substance to ill-defined amorphous products, to which attention has been directed, this book is a welcome addition to the rather scanty literature dealing with the chemistry and botany of vegetable products.

Mr. Schweizer's book is intended primarily for the "practical man," and is consequently of little interest from the purely scientific point of view. The descriptions of processes and plant for the distillation of rosin and the rectification of the products obtained are lucid, and their value is enhanced by the well-printed illustrations of distilling and other apparatus, made in several instances from the author's designs.

The chapters dealing with the manufacture and uses of resinates, the preparation of lampblack, and the methods of making printing and other lampblack inks are of special interest, since much of the information given was not accessible previously.

In the first line of p. 22 "position" is obviously a misprint for "composition," and there are a considerable number of such slips throughout the work.

A fairly full "contents list" is given, but the book would have been more useful if a comprehensive index had been provided. T. A. H.

THE WORKS OF C. F. GAUSS.

Carl Friedrich Gauss Werke. Siebenter Band. Herausgegeben von der Kön. Gesellschaft der Wissenschaften zu Göttingen. Pp. 650. (Leipzig: B. G. Teubner, 1906.) Price 30 marks.

THIS volume contains a reprint of Gauss's principal astronomical work, the "Theoria Motus Corporum Cœlestium," and his unpublished researches on planetary perturbations and on the lunar theory. In 1871 the late Prof. Schering brought out a "volume vii." without the cooperation of the Göttingen Academy of Science, containing the "Theoria Motus" and some notes from Gauss's papers; but for the sake of uniformity the academy considered it desirable to include the "Theoria" in the present volume, which has been edited by Prof. Brendel, of Göttingen.

A careful revision of the original edition of 1809 brought a few corrections to light, and a re-computation of the examples with modern tables of logarithms revealed a number of errors of one or two units of the seventh decimal (caused probably by the absence of decimals in the proportional parts of the old tables) which sometimes gave rise to greater errors in the course of the computation. A list of these corrections is given. Some notes found in Gauss's own copy of the book are added in footnotes. Next follow various notes on elliptic and parabolic motion, partly already published, partly extracted from letters and note-books. Of these the most important is a table for computing the true anomaly in a parabolic orbit; it was to have formed part of a supplement to the "Theoria Motus," dealing with the orbits of comets, which never was written.

The discovery of the first of the minor planets, Ceres, had obliged Gauss to work out a general method of computing an elliptic orbit. The next step was to determine the perturbations of the motion of Ceres and Pallas, which, particularly in the case of the latter, necessitated new methods owing to the great eccentricity and inclination; and on this work Gauss spent a great deal of time in the years 1802 to 1817. In 1805 he worked out a new method of computing the general perturbations by the variation of the elements, but he never published anything on the subject. The method is essentially the same as that proposed by Hansen in 1843 in his paper on absolute perturbations in orbits of any eccentricity and inclination.

The present volume first gives letters and computations on Ceres, after which follow 200 pages devoted to Pallas. Special perturbations by Jupiter for the years 1803–1811 were computed in 1810 and 1811, first for intervals of fifty days, after which the work was repeated with periods of 500 days, the elements for each period being taken from the first computation. The memoir on the theory of general perturbations was written in French, about the year 1815, apparently in answer to a prize question of the Paris Academy, but never finished. In 1811 Gauss began the immense labour of computing the action of Jupiter on Pallas, and finally, with the aid of Encke and Westphal, completed the work by the preparation of tables. The perturbations by Saturn were computed by Nicolai, and this work is preserved at the Heidelberg Observatory; it has naturally not been included in the present volume, but hopes are held out that it may be published elsewhere. Finally, the last part of the whole work, the action of Mars, was taken in hand, but owing to the press of other work it was never completed. It is much to be regretted that this fine piece of work, involving an enormous amount of computation, has been unknown until now, and that not even so interesting a result as the increase of the assumed mass of Jupiter was published. Already in 1814 Gauss found from the first nine oppositions of Pallas that Laplace's value, 1 : 1067.09, should be increased to 1 : 1042.86, a result which differs but little from the most recent determinations. If known to Encke, this correction of the mass would have prevented the errors of 5′ in the computed geocentric places in 1834, caused by the near approach to Jupiter in 1832 (*Astr. Nachr.*, No. 332). Needless to say, the remarkable commensurability of the mean motions of Jupiter and Pallas was noticed by Gauss at an early date.

It appears from letters written to Hansen and Bessel in 1843 that Gauss bitterly regretted having laid this great work aside. Thanks to the skilful editorship of Prof. Brendel, whose task of arranging and interpreting a vast mass of papers must have been a very difficult one, the work is now accessible in a clear and convenient form, and it is to be hoped that some competent hand will complete it.

Lastly, the volume contains the beginning of a lunar theory, dating from the second half of 1801, but soon abandoned, probably because vol. iii. of Laplace's "Mécanique Céleste" came out in the following year, and seemed to make work on the motion of the moon unnecessary at that moment. The form in which the perturbations are given is similar to that of Plana (1832).

Vols. viii. and ix. of the collected works of Gauss have already appeared. A tenth and concluding volume is announced, which is to include a general index. J. L. E. D.

NATURE AND FLORAL DESIGN.

Flowers and Plants for Designers and Schools. By Henry Irving and E. F. Strange. Pp. 95. (London: Hodder and Stoughton, 1907.) Price 10*s.* 6*d.* net.

IF designers could be produced by the study of books upon plant form there ought to be a large and flourishing crop of them, since so many elaborate works have appeared on this subject addressed to the supposed needs of such artists.

Every designer of any originality, however, feels the necessity of providing his own raw material, and what is suggestive and valuable to one may by no means prove equally so to another. The designer's best reference library is, of course, Nature; but Nature is always changing her dress, and her wealth of floral pattern is transformed with each season, so that unless we presuppose good opportunities combined with immense industry on the part of the artist, he must occasionally run short of working notes, and may be glad of the help of a herbal or a book which will give him the essential facts of the form, growth, general appearance, and structure of particular plants and flowers with which he is not familiar.

Such a practical aid and friend in need may be found in the admirable series of photographs from nature by Mr. Henry Irving and the valuable notes by Mr. E. F. Strange which constitute the volume before us.

The latter contributes a well-informed and interesting introduction to the book, as well as a series of notes upon the plants figured, which show his historic knowledge as well as his artistic sympathies.

While quite of the opinion he expresses as to the value of the study of the human form for *all* designers, it appears to be quite possible to attain great skill in purely floral draughtsmanship and design without any corresponding power over the human figure. Mr. Strange, too, hardly seems to appreciate, perhaps, the value of practice with a *firm point*—the severest test of draughtsmanship—the power of clear definition and definite expression being most necessary in all kinds of working designs intended to be carried out by some process of handicraft or manufacture. He is also a little severe upon what he describes as "brush-work"—the power of clear definition of form in the mass by means of brush and colour being also essential to a floral-designer's work, and needing much practice to gain facility and sureness of touch. The dexterity and directness of the method of Japanese artists have taught us much in this way.

Mr. Strange gives an admirable *résumé* of the treatment of plant form in the history of decorative art, and in speaking of the utility of such examples of plant form as are given in Mr. Irving's plates, he very pertinently remarks upon the beneficial effect upon a student or designer having to make their notes and drawings direct from nature or from photographs such as these, "uninfluenced by the versions, however admirable, of others."

If a designer cannot refer directly to nature, photographs are next best for most purposes, that is to say, for all superficial facts about a plant which can be disclosed without colour.

Mr. Henry Irving has made an interesting and judicious selection of plants and flowers likely to be useful to designers of all kinds, and he has been successful in presenting them by photography in a clear and tasteful way, often usefully silhouetting the stems and leaves against a light plain background, and giving the scale, and in some cases showing the seed vessels and the root. The plate of the tulip tree gives a singularly complete exposition of the characteristics of the tree—stem, leaf, bud, and full flower being given, and, moreover, quite decoratively spaced. Among the most successful plates, perhaps, may be named the wild rose, the yellow iris, the wood sorrel, the lily of the valley, the thistle, the teasle, and the catkins of the hazel.

More of the lily tribe might have been given perhaps with advantage, seeing that the structure is so beautiful and well defined, and it is the structure of plants and flowers above all that a designer needs to understand. Altogether the book may be heartily recommended to students and practical designers, and, indeed, to all interested in the beauty of plants and flowers. WALTER CRANE.

SOME RECENT PHILOSOPHICAL WORKS.

(1) *Proceedings of the Aristotelian Society.* New Series. Vol. vi. Pp. 402. (London: Williams and Norgate, 1906.) Price 10*s.* 6*d.* net.

(2) *René Descartes' Philosophische Werke.* Erste Abteilung (Fortsetzung). Übersetzt und herausgegeben von Dr. Artur Buchenau. Pp. xviii+149. (Leipzig: Dürr'schen Buchhandlung, 1906.) Price 1.80 marks.

(3) *Herders Philosophie.* Herausgegeben von Horst Stephan. Pp. xliv+309. (Leipzig: Dürr'schen Buchhandlung, 1906.) Price 3.60 marks.

(4) *The International Scientific Series. The Mind and the Brain.* By Alfred Binet. (The authorised translation of "L'Âme et le Corps.") Pp. xii+280. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1907.) Price 5*s.*

(5) *Essay on the Creative Imagination.* By Th. Ribot. (Translated from the French by A. H. N. Baron.) Pp. xix+370. (London: Kegan Paul, Trench, Trübner and Co., Ltd., 1906.) Price 7*s.* 6*d.* net.

(6) *Structure and Growth of the Mind.* By W. Mitchell. Pp. xxxv+512. (London: Macmillan and Co., Ltd., 1907.) Price 10*s.* net.

(1) THE sixth volume (new series) of the Proceedings of the Aristotelian Society contains the papers read before the society during its twenty-seventh session, 1905–6, and is unusually bulky, as publication has now become a much more important part than formerly of the society's work. Among other articles, it contains one on teleology by Dr. Shadworth H. Hodgson, the veteran ex-president of the society; a symposium "Can Logic abstract from the Psychological Conditions of Thinking?" to which contributions are made by Messrs. Schiller, Bosanquet, and Rashdall; and the records of a controversy (on Kantian and anti-Kantian lines) between Dr. G. Dawes Hicks and Prof. Stout. Scientific readers will turn with interest and profit to a paper by Mr. T. Percy Nunn, entitled "The Aims and Achievements of Scientific Method." Mr. Nunn defines the aim of the scientific process as an endeavour to render the Objective in its actual determinations intelligible. He points out the stages of Animism and Hylozoism through which pre-scientific thought

has passed, and examines more particularly, in the case of Kepler, the struggle between the non-scientific (and commonly theological) prepossession and the purely scientific spirit—so well illustrated, for example, in Kepler's demonstration that the orbit of Mars is an ellipse, and not a circle as his "prepossession of perfection" had originally compelled him to suppose. But in all attempts at explanation, whether "the divine" is invoked or not, the primary facts are qualified by an hypothesis—in other words, they are made to form part of an apperceptive system. In this way the non-scientific attempts to render the Objective intelligible do not differ formally from the scientific, and Mr. Nunn argues that it is, in fact, difficult to declare *any* concept essentially incapable of mediating a scientific interpretation of the Objective to some thinker: he instances the use made by some scientific men of the concept of cause in the sense of transeunt action, or again the preference shown by Weber and the Continental school for the concept of action at a distance, as contrasted with the equally marked preference of the British school for the concept of an intervening medium. Finally, as for the close connection between mathematics and science, it is due simply to the fact that primary facts present themselves for the most part in series, and so "the most useful method of determining the Objective consists in correlating terms of these series with the members of the number series."

(2) and (3) These two books form part of the excellent "Philosophische Bibliothek." The Descartes volume contains (in a German translation) the "Regulae ad Directionem Ingenii" and the "Inquisitio Veritatis per Lumen Naturale." The editor, in a well-written introduction, discusses the question of dates, and reaches the conclusion that the "Regulae" were composed about the year 1628, and in Latin, as Descartes at that early age still employed the language of his instructors. The "Inquisitio," on the other hand, was probably written in French between 1644 and 1647, and translated into Latin by the unknown editor of the posthumous works published in 1701. Dr. Buchenau concludes that its fragmentary condition is due to the fact that Descartes, in 1645, had an opportunity of comparing the French translation of the "Meditations" with his own new French work, and on finding a great similarity between the two thought it unnecessary to proceed with his later effort.—Herder's works readily lend themselves to selection, and it would be a pity that we decadents should forget one who, though overshadowed by the gigantic figures of Kant and Goethe, is by no means negligible in the history of thought. The excerpts are chosen with discrimination, and include the most suggestive passages of the "Ideen." The introduction gives a good account of Herder's relation to Kant, and a useful index is provided.

(4) The title of this work is rather misleading. The International Scientific Series already contained a book entitled "Mind and Body," by Prof. Bain, and it has therefore seemed to the translator or publishers desirable, and to M. Binet tolerable, that this work in its English dress should be called "The Mind and the Brain," and not "Soul and Body" or "Mind and Body." But, for that matter, the well-known series in which it appears also contains works entitled "The Brain as an Organ of Mind," and "The Brain and its Functions," so that he who would avoid Scylla must reckon with Charybdis. And certainly, when one finds that the table of contents is boldly divided into three parts, "The Definition of Matter," "The Definition of Mind," "The Union of the Soul and the Body," it argues a certain lack of insight and imagination to fix upon a name so inappropriate as "The Mind and the Brain."

M. Binet writes in an interesting and generally a clear style, with a French lightness of touch which occasionally borders on superficiality. The subject could, in our judgment, have been better treated. The reader is often irritated by one-sided statements which are apparently, a few pages later, contradicted by one-sided statements in precisely the opposite sense. One yearns for the synoptic view, for the *cacoethes explicandi*, which will compel the writer, even at the risk of being tiresome, to burrow to the very roots of his problem. Thus, for example, on p. 25 we are told that our nervous system, which enables us to communicate with objects, prevents us from knowing their nature. Sensation has, as its unknown cause, the great X of matter. On p. 38 we find objection taken to the physicist's attempt to explain sensations of sound:—"outside our ears there exists something we do not know which excites them; this something cannot be the vibratory movement of the tuning fork, for this vibratory movement which we can see is likewise [as much as the sensation of sound] a subjective sensation"; and the airy reference on p. 39 to the hegemony of certain of our senses over others still avoids much of the difficulty. But in the light of all these statements the conclusions reached on p. 109 are little short of astonishing; they are these, that (1) there remains no reason for refusing to admit that we perceive things as they are, and that the consciousness, by adding itself to objects, does not modify them; (2) the statement that we only know our sensations, and not the excitants which produce them, is to be understood in this way that these sensations are matter—they are matter modified by other matter, viz. our nervous centres. This is perhaps skilful, but is it convincing?

(5) M. Ribot's "Essay on the Creative Imagination," which appeared in French about six or seven years ago, has now been translated into English. Like all its author's work, it is suggestive and thorough. The translation is usually well done; but is it author or translator who is responsible for the statement on p. 58 ("The Unconscious Factor") that inspiration is the result of an *underhand* process existing in men? Chatterton is said, on p. 145, to have died at the age of sixteen, some emphasis being attached to that precise number; the usual statement is that "the marvellous boy" had almost reached his eighteenth year when he died.

(6) Mr. Mitchell's work will compare very favour-

ably with the best philosophical books of recent years. At its best the exposition of the subject is very clear and engaging, and gives evidence of much reading and sound study. If it errs at all, it is perhaps in occasional over-subtlety. An excellent running analysis is given in the table of contents.

Where all is so excellent and thorough, a short notice can do little more than indicate the point of view. The first part of the volume deals with the direct explanation of the mind, *i.e.* the explanation of experience in terms of itself. The second considers Sympathetic and Æsthetic Intelligence, and contains valuable chapters on Imitation, Fellow-feeling and Individuation (with a good note on *Einfühlung* on p. 149), and Absorption in the Object. The Growth of Intelligence in its two forms, Perceptual and Conceptual, is the subject of the third part, and in the last we return to an extension of the direct explanation of experience, and to the indirect explanation or explanation in physical terms.

We note one or two small points. (i) Mr. Mitchell rounds on the materialist position thus:—

"The capacity of the brain has to be inferred from the capacity to experience. . . . Whatever is possible to the mind is possible to the brain."

(ii) While not accepting the ordinary man's use of the term "mental faculty," and not accepting the division into faculties as though they were physical, the author has a refreshing bluntness and honesty in dealing with the term faculty itself. He has no objection to its use as properly defined, and complains that too often writers on psychology have thought that, so long as they avoided the *term* faculty, they could ask any number of indefinite questions—as to whether feelings depend on thoughts, or whether reason is the slave of passion—and could, in fact, substitute for faculties "a miscellaneous collection of experiences in every kind, of processes conscious and unconscious, and even of laws, as combining to make experience or causing it somehow." "I think it a needless penance," he adds, "to use the word 'disposition' in the sense that everyone would be willing to give to 'faculty' if he understood."

THE IMPERIAL GAZETTEER OF INDIA.

The Imperial Gazetteer of India. The Indian Empire, Vol. i., Descriptive. New edition. Pp. xxxi+568. (Oxford: The Clarendon Press, 1907.) Price 6*s.* net.

THE completion of the census in 1901 necessitated a revised issue of "The Imperial Gazetteer of India," of which two editions had already appeared, both compiled by the late Sir W. Hunter. Hunter, while in charge of the statistical department, had gained considerable knowledge of the country and its people, and in one subject, the history of the British occupation, was a competent authority. It is true that he inclined to overestimate the importance of his labours, and that he failed to give due credit to the district authorities who provided the raw material on which his compilation was based. At the same time he performed an invaluable service in popularising India for European readers. It became clear, however, that the Gazetteer was beyond the capacity of any single man, and that it was necessary to divide the subjects among a body of specialists. In the present issue, which will be nearly double the size of the last edition, little remains of Hunter's work except the final historical chapter.

During the quarter of a century which has passed since the last edition appeared, much has been done to extend our knowledge of the country. It is significant that in its physical aspects it is now officially assumed to include those outlying territories over which the Government has extended its control, even to the southern limits of Persia, Russia, Tibet, and China. The progress in the natural sciences is marked by Sir G. Watt's unwieldy "Economic Dictionary," Sir J. Hooker's "Flora," the "Manual of the Geology of India," the series of monographs on the fauna edited by Mr. Blanford, and a great mass of special literature. Scientific anthropology was in its infancy in Hunter's day; Dr. Grierson's linguistic survey was not even dreamed of; meteorology had not begun to gather its materials from beyond the Indian Ocean; hygiene had not yet been confronted with the problem of Oriental plague. Lastly, in the domain of religion, the translation of the sacred books had only just begun, and little attention had been given to the not less important subject of the beliefs and superstitions of the peasantry.

In the present edition of this great work these stores of new learning have been summarised and interpreted. Four introductory volumes are devoted to a series of lucid articles on the various scientific and administrative questions to which reference is made in the body of the work. The first volume contains ten articles. It opens with a chapter on the physical aspects of the country by Sir T. Holdich. The natural sciences are represented by a chapter on geology by Mr. T. Holland, one on meteorology prepared from materials supplied by Sir J. Eliot, while the veteran Sir J. D. Hooker deals with botany and Mr. W. T. Blanford with zoology. The chapter on ethnology and caste is a summary of the views expressed by Sir H. Risley in his last census report; that on language is the work of Dr. Grierson. Mr. W. Crooke is responsible for religions, Mr. E. A. Gait for sociology, and Dr. A. E. Roberts for public health and vital statistics.

The volume is thus made up out of a series of essays, each the work of an expert, and each provided with an adequate bibliography. In some cases, as that of geology, the treatment is more technical than will suit the general reader, but the review within narrow limits of space of a wide and intricate subject rendered this inevitable, and the serious student is the gainer. Many of the articles, however, are eminently readable; in particular, Sir T. Holdich, dealing with Mr. Holland's materials, has so interpreted the story of rock, mountain, and river that he has produced a fresh and graphic picture of the physical aspects of the country and of the environment of its people.

The gazetteer, which is issued in excellent form

and at a most moderate price, should be in the hands of all who are interested in the fortunes of India. It should remain for many years the most authoritative source of information regarding our great eastern empire. The Government of India and its official editors and contributors are to be congratulated on the completion of a work of national importance.

OUR BOOK SHELF.

The Laboratory Book of Mineral Oil Testing. By James A. Hicks, with introduction by Sir Boverton Redwood. Pp. xii+76. (London: C. Griffin and Co., Ltd., 1906.) Price 2*s.* 6*d.* net.

EMPIRIC methods of testing, however simple in principle, are just those which require exact procedure in practice; otherwise two equally skilful analysts, by slight and apparently insignificant modifications, may arrive at different results. As the flash-point and viscosity methods, applied to the testing of mineral oils, depend on specially designed apparatus used under special conditions, it is essential that every chemist should work under the same conditions, and for this reason Mr. Hicks's little book will be gratefully appreciated by those who have to do with mineral oil testing. In addition to a careful description of various flash-point and viscosity apparatus and their application, the book contains an account of colour-testing and the use of sundry apparatus for estimating pressure of naphtha vapour, detection of petroleum vapour, capillarity testing, methods for estimating melting points of paraffin, wax, and scale, and for determining the calorific value of mineral oils. There is also a table (which should be unnecessary) for converting centigrade into Fahrenheit degrees, and a list of all the apparatus required for oil testing, including the name of the firm which undertakes to supply it. The book is evidently designed to meet every requirement, and its appearance under the auspices of Sir B. Redwood should be a guarantee of its practical value and utility. J. B. C.

Theories of Chemistry. Being Lectures Delivered at the University of California in Berkeley. By Svante Arrhenius. Edited by T. Slater Price. Pp. xii+212. (London: Longmans, Green and Co., 1907.) Price 5*s.* 6*d.* net.

THE nature and aim of this work are clearly stated by the author in his preface. He writes:—"The present lectures were delivered at the University of California during the summer of 1904. I have for a long time wished to give a coherent account of the development of theories in general chemistry. This seemed to me the more desirable because the latest extensions of this science are often, both by followers and opponents, regarded as something wholly new and quite independent of the progress in the past. Many seem to hold the opinion that the new developments are the more to be admired, the less dependent they are on the older chemical theories. In my opinion, nothing could be less correct. It is just the circumstance that the new theoretical discoveries have developed organically from the old generally accepted ideas, that is to me their most promising feature."

This is a somewhat unexpected view to be held by perhaps the greatest innovator in modern chemical theory, but there is no question that it has led to the production of a most unusual and stimulating book, the perusal of which no scientific chemist can afford to neglect. A detailed enumeration of the chapters would do little to indicate their contents. The subject-matter is familiar to all chemists—it is the treatment which is of special value. The various theories and hypotheses are critically examined and exhibited in their proper relationship and subordination. The whole work bears the stamp of a mind of uncommon power applied to the matter in hand with a balance and sobriety of judgment no less rare.

Life and Flowers. By M. Maeterlinck. Translated by A. T. de Mattos. Pp. xii+312. (London: George Allen, 1907.) Price 5*s.* net.

THIS volume contains a collection of essays of which some have appeared in periodicals, others are published in English for the first time. They are all more or less directly concerned with life, from the phantasy on the sun-dial to the eulogy on the boxer's fist, but only the two last, on the intelligence of flowers and perfumes, are relevant to the subject of flowers. In the former of these, M. Maeterlinck describes in his perspicuous language some of the striking phenomena connected with fruit dispersal, flower pollination, and movement in plants. The accuracy of the word-painting bears witness to the author's first-hand observation of many of the phenomena, although, as he points out, except for his original experiments with the species of Salvia, the results of which are not sufficiently advanced to publish, the facts are taken from well-known sources. The attribution of arithmetical powers to the Rue and other such hyperboles may be regarded as the expression of a strong imaginative temperament. The account of the pollination in *Orchis pyramidalis* furnishes one of the best examples of the author's faculty of description.

LETTER 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.*]

Unscientific Administration.

IN his letter of June 20, Mr. M. D. Hill refers to the defective education of our schools and universities, and seems to suggest that it is not the mass of the people who are to blame for England's isolated position in her national neglect for science. May I point out that in the education of our future working classes equally unscientific ideals still prevail?

The recent review of Mr. Mair's book in NATURE of June 13 (p. 147) under the title "Realistic School Mathematics" shows that there is one Government department which is striving to introduce thoroughly sound and practical, and therefore scientific, methods of teaching into this country. But the training colleges in which teachers for elementary schools are educated at the expense of the State are tied down, by examination requirements, to courses which cannot be described otherwise than as useless mechanical drudgery, with the result that the student who obtains the highest class certificate of competency to teach becomes thoroughly unfitted to appreciate or even understand such a stimulating book as "A School Course of Mathematics." The children who are taught by such a teacher will in time become the electors in whose hands lies the duty of returning a Conservative or Liberal Government to power. Unless the teachers are trained on more scientific and practical lines, there is little prospect of any Government being administered scientifically.

One further point may be mentioned. In Germany and Austria the Government confers titles of honour—Geheimrat and Hofrat—on professors who have distinguished themselves by their researches. In Great Britain it is the universities which confer honorary degrees on prominent politicians. G. H. BRYAN.

LONDON BOTANIC GARDENS.[1]

THIS little work comprises in book form a series of articles contributed to the *American Journal of Pharmacy* by Mr. P. E. F. Perrédès in 1905 and 1906. Written by a pharmaceutical chemist to a pharmaceutical journal, these papers naturally devote attention primarily to the relationship of the London botanic gardens to the art of pharmacy. In tracing the origin of botanic gardens to the private gardens of the herbalists of the sixteenth and seventeenth centuries, the author shows that the cultivation of medicinal and officinal plants was the fundamental object kept steadily in view. But recognising that the modern botanic garden, while not departing from this original function, has developed other and equally important features, he has not confined himself exclusively to the pharmaceutical aspect of the London botanic gardens, but has given in a concise but comprehensive manner a review of the work accomplished by them in the domain of pure botany and in the application of the science to technical affairs. The subject has been treated throughout with a breadth of view, an insight and a sense of proportion which have too often been lacking in sketches of this nature, and the absence of which may be held accountable in a great measure for the vague ideas prevalent as to the functions of a botanic garden.

The gardens dealt with are the Chelsea Physic Garden, the Royal Botanic Gardens, Kew, the Royal Botanic Society's Garden, and the garden of the Royal Horticultural Society. The last makes no claim to rank as a botanical establishment, but in view of the close association with it of such men as Lindley, Bentham, and Fortune, and of the services rendered to botanical science by the collectors of the society, such as Don and Douglas, the author rightly feels that in a comprehensive review the Royal Horticultural Society cannot be ignored. In dealing with the three London botanic gardens proper, Mr. Perédès judiciously leaves the reader to form his own idea of their relative importance. Each is dealt with separately, from three points of view—historical, functional, and administrative.

From the historical standpoint it may almost be said that the history of these gardens is the history of systematic botany in England. In dealing with their functions, as already remarked, there has been no attempt at comparison. But the conclusion one arrives at is that, in inception at least, these respective botanic gardens were complementary rather than antagonistic or competitive. While founded on a common basis, they differed widely in scope, and though perhaps not dovetailing perfectly, there was no material overlapping. Thus the deed conveying the Chelsea Physic Garden to the Society of Apothecaries in 1722 stated that the conveyance was made "that their apprentices and others might better distinguish good and useful plants from those that bore resemblance to them, and yet were hurtful, and other the like good purposes."

The Royal Botanic Society was established, in 1839, on a somewhat wider footing "for the promotion of botany in all its branches, and its application to medicine, arts and manufactures, and also for the formation of extensive botanical and ornamental

Chelsea Physic Garden (*circa* 1850) from the river, before the construction of the Chelsea Embankment. From "London Botanic Gardens."

[1] "London Botanic Gardens." No. 62 of the Publications of the Wellcome Chemical Research Laboratories, Snow Hill, E.C. Pp. 99, with 31 plates.

gardens within the immediate vicinity of the metropolis." Both were strictly metropolitan institutions, and both were essentially educational establishments, differing only in scope. Various exigencies have at times modified, and even obscured, their primary object, but each has, so far as circumstances permitted, devoted itself to educational work. The extent and value of the services they have rendered, and continue to render, in this direction are fully detailed in the work under review.

Kew, on the other hand, can only be termed a *London* botanic garden in a strictly limited sense. As a national institution it has a much wider field, and its activities are on a correspondingly broader basis. Unlike the other gardens, it does practically no direct educational work, but "stands out prominently as a centre of botanical research, and as the cradle of botanical enterprise in India and the Colonies."

The principal aspects of Kew work are touched upon, but the limits of space have compelled the writer to treat them by way of illustration rather than exhaustively. No reference is made to the horticultural or ornamental side of Kew. While detracting in a measure from the completeness of the sketch, the omission is the less to be regretted because of the growing tendency on the part of the general public to regard this feature as fundamental rather than incidental, and to look upon botanic gardens as places of recreation rather than as scientific institutions. Mr. Perrédès's work, by directing attention to the conspicuous part that the London botanic gardens have played in the scientific and material progress of the nation, should go far towards removing the reproach that our botanic gardens are better understood and more appreciated abroad than at home, a reproach which gains point from the fact that the papers under notice were contributed to an American journal, and are only available in this country at second-hand.

The work is well illustrated, and contains a copious bibliography.

THE NATIONAL PHYSICAL LABORATORY.[1]

THE recent discussion of the affairs of the National Physical Laboratory in Parliament, and the appointment of a departmental committee of the Treasury to inquire into the working of the laboratory, with special reference to its alleged "competition with private establishments," have tended to produce amongst the newspaper-reading public an impression that the institution was not being carried on satisfactorily. It may be useful, therefore, to state in a few words what is really the position of affairs.

The laboratory was established in 1899 to serve as an independent testing authority, and to carry out researches into the properties of materials which, while necessary for the advance of the industries of the country on scientific lines, are generally too extensive and laborious to be undertaken by private individuals. It was not anticipated that it would ever be necessary to compete with the existing private institutions in the testing of materials, but nothing in the Royal Society's scheme on which the laboratory was founded limited its testing powers. Once it was equipped and staffed, the desire of industrial firms to have their materials tested by men who had already made names for themselves in the scientific world appears to have led to much work of this kind being sent to the laboratory, and it is difficult to see on what grounds it could be refused. Whether it is to be undertaken in future or not the Treasury Committee must decide.

With regard to the research work of the laboratory, there can be no two opinions. A glance through the two works under notice is sufficient to show how well it is fulfilling its task. Dr. Stanton's work on the resistance of iron and steel to reversals of stress is supplying information urgently needed, and with Dr. Carpenter's work on the structure of high-speed tool steel and on the properties of iron-nickel-manganese-carbon alloys is constituting the laboratory *the* authority in this country on the properties of the materials used by mechanical engineers. Mr. Paterson's investigations on light standards and glow lamps, communicated to the Institution of Electrical Engineers in January, supply gas and electrical engineers with information of the greatest value as to the relative merits, or rather demerits, of the various standards of light. Mr. Campbell's researches on the properties of the paper and cellulose used in telephone cables, on insulating materials suitable for high temperatures, and his hysteresis research, all bear intimately on the electrical engineering industry, as does Dr. Caspari's work on guttapercha and balata. Dr. Harker's new bench-mark 1710° C. for the melting of platinum will serve as a starting point for a revision of all our high temperature melting points, and will introduce precision into a region in which uncertainty has been the prevailing feature. His interesting work on the Kew temperature scale may lead to Kew methods becoming international.

The testing work of the observatory department has increased, and the department appears now to turn out "hall-marked" men, *e.g.* Wood, Simpson, and Gold, as well as "hall-marked" instruments. Two important discussions, by Dr. Chree, of terrestrial magnetism and of atmospheric electricity records, and their relation to meteorological phenomena, show that there is no likelihood of the reputation of Kew as a place of research suffering now it has lost its independence.

The few investigations mentioned above serve as examples of the work that is being done in the laboratory, but they tell nothing of the good influences exerted by the laboratory through the members of its staff on the councils and at the meetings of scientific and technical societies throughout the kingdom.

Although there will always be members of the public, and even Members of Parliament, who are unable to understand why any of the nation's money should be invested outside the circle of "small profits and quick returns," no one who is anxious that our country should stand shoulder to shoulder with its neighbours in the march of scientific and industrial progress can feel other than gratified that in establishing the National Physical Laboratory we have taken a step in the right direction.

C. H. L.

[1] The National Physical Laboratory Report for the Year 1906. Pp. 61. (Teddington: Parrott and Ashfield, 1907.)
The National Physical Laboratory—Collected Researches, vol. ii. Pp. ii+310. (N.D.)

DR. EDWARD JOHN ROUTH, F.R.S.

BY the death of Dr. Routh on June 7, after a period of gradually failing health, a commanding figure in the recent history of English mathematics has been removed. Born at Quebec in 1831, the son of a distinguished British officer, he was educated in London at University College School, and subsequently studied mathematics under de Morgan at University College. He matriculated at Peterhouse in 1850, but did not drop his London connection, obtaining the gold medal in mathematics with the degree of Master of Arts in 1853, then a somewhat rare distinction. At Peterhouse he had Clerk Maxwell, who

soon after migrated to Trinity, as his rival in the same year; while Tait and Steele were undergraduates of the College, and Lord Kelvin (already Prof. W. Thomson, of Glasgow) was a junior Fellow.

Not long after taking his degree, in January, 1854, being senior wrangler, and bracketed with Clerk Maxwell for the Smith's prizes, he began the career of tuition of advanced honour men in mathematics, which was soon to lead to a unique reputation as a successful teacher. From 1858 to 1888 he had, in all, between 600 and 650 pupils, of whom the great majority graduated as wranglers, twenty-seven being seniors, while forty-one were Smith's prizemen; between 1861 and 1885, when he retired from this strenuous work at the age of fifty-four, he had all the senior wranglers as pupils, with but one exception near the end of the time.[1] The number of his pupils, which was for many years about 100, was not at all unprecedented; what was unique was the fact that for all this time he directed, almost without challenge, most of the intellectual activity of the *élite* of the undergraduate mathematical side of the University. This herculean task naturally demanded methodical arrangements, and the husbanding of his resources to the utmost. What he aimed at was to impart thorough mastery of the main principles of ascertained knowledge over the field of mathematics then cultivated at Cambridge; it was clearly out of the question to stray very far into the regions of nascent science in which ordered theory gradually evolves itself in response to concentrated and specialised effort. He was in the habit of claiming that this would follow spontaneously in the case of the mathematician born, once he had learnt mastery of the resources of the science; while even when it did not follow, the record in the legal and other professions of persons who had done well in youth in mathematical studies proved their supreme value as a deductive mental discipline.

His plan was to take small classes, each of about ten men selected to run together, and to maintain an average by catechetical methods. Those who could go faster than the average had extra material provided in the form of manuscript digests for study, and especially in the institution of a weekly paper of about a dozen problems, selected from recent examination papers, or abstracted from memoirs in the home and foreign mathematical journals. An element of competition formed a stimulus in answering these papers, while written solutions were afterwards at hand for study in cases of failure to unravel them. Looking back on those times, it might be thought that there was too much problem and too little sustained theory; but no one ever accused the standard of the problems selected of being lower than it ought to be, while, on the other hand, absence of some such rigid procedure would have rendered quite impossible that focussing of undergraduate mathematical activity and ambition in one place which was a main feature of the system. Men with further ambitions would struggle with Thomson and Tait's "Natural Philosophy" or with Maxwell's "Electricity," or with brilliant and stimulating courses of lectures given on growing special subjects by the more eminent mathematical physicists, and thus learn that though in youth mastery may be rapid, yet at all times invention must be slow. It was, moreover, thus possible for the abler men to have time to spare to expand their outlook by taking up some other branch of knowledge as a relaxation from mathematics, or for joining in other activities of the University. Nowadays the field covered by the mathematical instruction offered at Cambridge is vastly wider than would have been conceived as practicable twenty years ago; but the question is still unsettled how far it is expedient to extend the preliminary undergraduate course into complex special theories.

Whatever may be thought as regards Dr. Routh's views on postponing special research in favour of thorough preparation, it could not be urged that he did not himself, notwithstanding his other absorbing work, set an example of what research might be. Many of his earlier papers, mainly in the *Quarterly Journal of Mathematics*, related to the dynamics of rigid solids, spinning tops, rolling globes, precession and nutation, and such like, and were distinguished by the development of methods relating to moving systems of coordinate axes, and to the differentiation of vectors such as velocity and momentum with regard to them. In another connection he applied the kinematics of special systems of coordinate axes moving along a curve to problems of curvature and torsion. The advantages of these methods in differential geometry have come again into recognition, as may be seen in such works as Darboux's "Théorie des Surfaces." Afterwards, arising out of his researches on dynamical stability, which will be referred to presently in more detail, there came a series of papers in the Proceedings of the London Mathematical Society on the propagation of waves and the analysis of complex vibrations in networks of interlacing threads and in other such laminar systems, leading up to a mechanical treatment or illustration of the broad general theory of harmonic analysis, principal periods, and related topics.

In the early 'seventies, the question of the possible explanation of steady, including apparently statical, relations of material systems by the existence of latent steady motions, such as the rotations of concealed flywheels or gyrostats attached to the system, was much to the fore. The fundamental problem as regards such representations is their degree of permanence; for a state of motion which falls away, however slowly, cannot be appealed to in elucidation of secular steadiness of relations. At a later stage the ideas of the subject were crystallised by Lord Kelvin in his British Association address, Montreal, 1884, entitled "Steps towards a Kinetic Theory of Matter," and in later addresses on cognate topics, mainly reprinted in vol. i. (Constitution of Matter) of his "Popular Lectures and Addresses," culminating in a way in 1897 in his gyrostatic model of a rotationally elastic optical æther.

It is thus not surprising that the Adams prize subject at Cambridge for the period 1875–7, announced over the signatures of Challis, Clerk Maxwell, and Stokes, should have been the search for "The Criterion of Dynamical Stability." This subject suited Routh's predilections exactly; and his classical essay, "A Treatise on the Stability of a Given State of Motion, particularly Steady Motion," composed, as he states in the preface, almost entirely during the year 1876, was the result. The greater part of the work in the essay is analytical, and is concerned with the discussion of the nature of the roots of the algebraic equation determining the free period of slight vibration of the dynamical system; but where it enters upon the discussion of dynamical principles, such as the criteria connected with the Energy and the Action, the essay moves in a high plane. In particular, the burning question of how adequately to represent latent, and, therefore, unknown steady motions, such as those of concealed flywheels or gyrostats attached to the system, is solved at a stroke by the famous theorem of the "modified Lagrangian function." It was established, in fact, that the presence of concealed steady motions does not fundamentally alter the standard mode of analytical specification of dynamical interaction developed originally by Lagrange, except in the one respect that the effective Lagrangian function

[1] These and other facts have been taken from a valuable notice in the *Cambridge Review* signed W. W. R. B.

now involves terms linear in the velocity-components as well as quadratic terms. The procedure of Lagrange, evolved originally from the side of the Principle of Action, constituted the science of general dynamics by eliminating from the problem all variables the values of which are prescribed in terms of the remaining ones by relations of permanent constraint, thus reducing the dynamical analysis to the discussion of just as many quantities as are required to specify the state of the system. It gives cause for some surprise that nearly a century elapsed before the correlative step was taken, namely, the elimination from the analytical specification of the system of permanently steady or cyclic motions, as well as the permanent geometrical constraints above mentioned. In the hands of the analysts who treated the subject meanwhile, the requirements of the actual planetary and lunar theories were perhaps the main aim; it is only recently, and largely in the hands of the English school, notably Lord Kelvin and Clerk Maxwell, in later conjunction with Helmholtz, and building largely on the earlier work of W. Rowan Hamilton, that the subject of general dynamics has been welded into an instrument for the inductive, and in many cases speculative, exploration of physical processes in general. Anyhow, it will be evident how fundamental an advance in the principles of the dynamical interpretation of nature was involved in Routh's formulation of what he called the "modified Lagrangian function."

The problem thus solved by Routh with remarkable simplicity had already been some time in evidence. In the first edition of Thomson and Tait's "Natural Philosophy" in 1868, the equations of Lagrange had been applied in most effective manner to problems of motions of solids in fluid media, the energy function involved being determined in terms of the motions of the solids alone, and the fluid thus being *ignored* in the subsequent work. This procedure was soon challenged by Kirchhoff, as going beyond the existing conditions of validity of general dynamical theory; and a special justification for the case of motion in fluids was given by him on the basis of a Least Action analysis. Soon afterwards the same difficulty was pressed on Lord Kelvin independently by J. Purser, who also published a justification on more physical lines. This was, not unlikely, the origin of Lord Kelvin's general theory of "ignoration of coordinates," first published in 1879 in the second edition of Thomson and Tait's work, but which probably existed in manuscript anterior to Routh's essay. A report was once current that most of it was worked out in the harbour of Cherbourg, while his yacht was refitting, and the carpenters were all the time hammering overhead. This form of the theory, though more expressly suggested by the needs of physical dynamics, was less complete in one respect than Routh's, in that it did not bring the matter into direct relation with a single characteristic function (Lagrangian function of Routh, kinetic potential of Helmholtz), but simply obtained and illustrated the equations of motion that arose from the elimination of the cyclic coordinates that could be thus ignored.

Later still, Helmholtz, in his studies on monocyclic and polycyclic kinetic systems, which began in 1884 and culminated in the important memoir on the physical meaning of the Principle of Least Action in vol. c. (1886) of *Crelle's Journal*, developed the same theory more in Routh's manner, and built round it an extensive discussion of physical phenomena, so that on the Continent the whole subject is usually coupled with his name. Shortly before, the work of Routh and Kelvin had already been coordinated with the Principle of Action by more than one writer in England.

The most elaborate published result of Dr. Routh's scientific activity was the "Treatise on the Dynamics of a System of Rigid Bodies," which began as a thorough, though rather difficult, handbook in one octavo volume, but expanded in successive editions in a manner of which other classical instances readily occur to mind, until it became a sort of cyclopedia of the dynamical section of theoretical physics. In the course of an inquiry some ten years ago as to the reason why English mathematical physicists had so much practical command over the application of their knowledge, the mode of teaching in Cambridge came under review; and in particular this book was discovered by Prof. F. Klein, of Göttingen, who made arrangements for its introduction to the Continental public in a German translation, containing some brief valuable annotations such as the wide analytical outlook at Göttingen suggested. Especially was emphasis given to the great extension of the scope of abstract dynamics above described, with which Routh's name was associated, it is to be hoped permanently. Somehow the book does not seem to have attracted even yet much sustained attention in France.

Until lately, Dr. Routh's presence was a familiar and welcome one to residents in Cambridge. Though he never sought public positions, his services were in requisition in many ways, as Senator and Fellow of the University of London, as member of the University Council at Cambridge, member of council of the Royal Society, and in other activities; while he declined more prominent offices more than once. In society he was bright and attractive though somewhat retiring, simple, and entirely free from any suggestion of superiority. The respect and affection which he inspired in a long succession of distinguished pupils found expression on the occasion of his partial withdrawal from work in 1888, when at a remarkable gathering of judges, engineers, and men of science, his portrait by Herkomer was presented to Mrs. Routh, with many expressions of warm appreciation. His leisure he employed mainly in mathematical research, and in the preparation of a series of treatises on subjects of mathematical physics, of which the only criticism to be made is that his wealth of valuable material tended to convert them into cyclopedias rather than text-books. His last public action was to take the lead in opposition to the proposals for change in the system of the mathematical tripos at Cambridge. It is possible that he did not fully realise the altered circumstances of the time, and the insistent claims of other studies; anyhow, it will be matter for congratulation if the new arrangements work as well and as smoothly as did the older mathematical tripos during the long period when the practical direction was mainly in his hands.

J. L.

PROF. A. S. HERSCHEL, F.R.S.

THE death of Prof. Alexander Stewart Herschel, F.R.S., on June 18 will be deplored by many astronomers. Prof. Herschel was born in 1836, and was the second son of Sir John Herschel. He was appointed professor of physics at the Durham College of Science, Newcastle-on-Tyne, in 1871, and was honorary professor and governor of the college at the time of his death, though he left Newcastle about twenty years ago, and resided with his brother, Col. John Herschel, F.R.S., at Observatory House, Slough, which was the home of his renowned grandfather, Sir William Herschel, and of his father. Prof. Herschel was elected a Fellow of the Royal Astronomical Society in 1867, and of the Royal Society in 1884.

Inheriting an illustrious name, Prof. Herschel also inherited the love for astronomy, the indomitable perseverance and capacity for work,

and much of the ability which distinguished his father and grandfather. As a mathematician, physicist, and observer, Prof. Herschel was *facile princeps*, and it was fortunate for meteoric astronomy that he devoted himself to its practical and theoretical investigation. Sir John and Sir William Herschel had swept the heavens with large telescopes in quest of nebulæ, double stars, and other objects, but Prof. Alexander Herschel appears to have preferred naked-eye observation to instrumental work. For about half a century he watched diligently for meteors, and obtained numerous and valuable results, as past volumes of the Monthly Notices of the Royal Astronomical Society and NATURE fully attest.

Apart from his observational results Prof. Herschel accomplished a large amount of important work in the summation, reduction, and discussion of various other observations. In conjunction with Mr. R. P. Greg he formed several extensive catalogues of the radiant points of shooting stars, and the most important of these were published in 1868, 1872, and 1874. One of his greatest successes, though it has been little commented upon, was the prediction made in the Monthly Notices, vol. xxxii., p. 355, of the great Bielid shower of 1872 November 27. For many years he compiled the annual reports of the luminous meteor committee of the British Association, and contributed, until 1880, the yearly notes on meteoric astronomy published in the anniversary number (February) of the Monthly Notices.

Prof. Herschel was a voluminous writer, and all those who enjoyed the pleasure of corresponding with him will agree that his letters were just as interesting as they were long. The writer of this notice will always have reason to be grateful to him for kind encouragement, advice, and instruction in the earlier years of his observing career. It is not too much to say that without the deep interest incited by Prof. Herschel's letters the meteoric observations obtained at Bristol during the last thirty-five years may never have been made.

As an observer of shooting stars Prof. Herschel was remarkably accurate, and he not only recorded their apparent paths with fidelity, but accompanied his results with descriptive details marvellous in their fulness. He computed the real paths of a great many fireballs and ordinary falling stars, and very ably discussed the often discordant observations which formed the basis of these inquiries.

The present writer has often been impressed at the acumen and sound judgment he displayed in dealing with difficult materials of this character. Meteoric astronomy has indeed lost one of its ablest votaries in Prof. Herschel, and it may truly be said that the present high position of this branch of science is due in no small measure to his prolonged and able researches. W. F. DENNING.

NOTES.

A CORRESPONDENT recently directed our attention to a sensational report that certain signals are regularly received at one of the Marconi wireless telegraph stations, and are believed to be communications from Mars or another planet. As Mars will be in opposition on July 6, and is well situated for observation in southern observatories, the rumour will probably be extensively circulated during the next few months. A copy of the report was sent, therefore, to Mr. Marconi, who has favoured us with the following reply:—"There is no truth whatever in the statement which has been freely published for the last year or two that mysterious signals have been received at Cape Clear from probably some distant planet. There is, in the first place, no wireless telegraph station at Cape Clear. The stray or vagrant electrical effects which do manifest themselves from time to time at wireless telegraph stations are due to atmospheric discharges or other natural causes. To attribute this phenomenon to any such source as is contemplated in these newspaper reports is, so far, purely imaginative and idle speculation."

WE regret to have to record the death of the well-known ironmaster, Mr. Thomas Andrews, F.R.S., at Wortley, near Sheffield, on June 19. Mr. Andrews was born at Sheffield in 1847, and succeeded his father as proprietor of the Wortley Iron Works many years ago. He was the author of numerous papers, chiefly on metallurgical subjects, but his researches were of a varied nature, and included such widely separated subjects as the composition of river waters and the strength of railway axles. Of late years his writings dealt chiefly with the microstructure of metals, carrying on work which originated in Sheffield. He was awarded a Telford medal and premium by the Institution of Civil Engineers in 1884, and was elected a Fellow of the Royal Society in 1888. He was also a gold medallist and Bessemer prizeman of the Society of Engineers, London.

MR. A. W. HILL, fellow and dean of King's College, Cambridge, and university lecturer in botany, has been appointed assistant director of the Royal Gardens, Kew.

PROFS. GUIDO CASTELNUOVO, of Rome, George William Hill, of New York, Camille Jordan, of Paris, and Vito Volterra, of Rome, have been elected honorary members of the London Mathematical Society.

A CHARTER of incorporation has been granted by the King to the Society of Chemical Industry, which was founded in 1881 to promote the application of chemical science to arts and manufactures.

A COMMITTEE has been appointed by the President of the Board of Agriculture and Fisheries to inquire into the nature of distemper in dogs in Great Britain and the methods of its infection, and to report whether any, and, if so, what, preventive or remedial measures, exclusive of ordinary medical treatment, can with advantage be taken with respect to it.

A CONFERENCE on the prevention of infant mortality and the welfare of nursing mothers and suckling infants will be held at the Town Hall, Pancras Road, N.W., on July 1, at 3.30 p.m., to inaugurate the opening of the School for Mothers at 6 and 7 Chalton Street, Euston Road, N.W., the centre of the St. Pancras Mothers' and Infants' Society. The Mayor of St. Pancras will welcome the conference, and Lord Robert Cecil will preside.

ON Monday next, July 1, at 2.30 (weather permitting), there will be a display of scientific kites and other aëronautical experiments on Chobham Common, Sunningdale, where the Aëronautical Society will hold the concluding meeting of the present session. Kites will be displayed by Mr. W. H. Dines, F.R.S., Mr. C. J. P. Cave, Mr. S. H. R. Salmon, and Mr. R. M. Balston. Mr. Cave will send up pilot balloons to determine the rate and direction of the wind at different heights, and demonstrations of the method will be given by means of a theodolite specially made from designs by M. de Quervain. Mr. Cave will also send up a *ballon-sonde* carrying self-recording instruments complete, as used by him for the international aëronautical ascents, which take place on fixed days simultaneously throughout Europe. Mr. José Weiss will perform experiments with model gliders.

As the result of an extensive correspondence with entomologists of various countries of Europe and America, it has been decided to issue, in the course of this summer, invitations for an International Congress of Entomology, to meet in 1908, probably at Brussels. The purpose of the congress is the promotion of the interests of entomology, and therefore of biology in general, by furthering cordial cooperation between the entomologists of different countries, and by stimulating research and directing it into channels where it may be most fruitful or where special research is most needed. Questions of applied entomology will likewise be dealt with in lectures and discussions, the large experience of devotees to pure entomology being applicable, with profit, to economic and hygienic entomology. Entomologists are cordially invited to advise and assist in the organisation of the congress. All communications, until further notice, should be addressed to Dr. K. Jordan, Zoological Museum, Tring (Herts).

THE fifth annual meeting of the South African Association for the Advancement of Science will be held in Natal on July 10–17 next under the presidency of Dr. James Hyslop, D.S.O. The first part of the meeting, from July 10 to July 13, will be held at Pietermaritzburg, and the second part at Durban. The council of the association has revised the arrangement of the sections. Section A, the president of which this year is Mr. E. Nevill, comprises mathematics, physics, astronomy, meteorology, geodesy, and geography. Sections B and C, including chemistry, metallurgy, mineralogy and geology, engineering, mining, and architecture, will be presided over by Mr. Cathcart W. Methven. The president of Section D, Mr. H. Watkins Pitchford, will take the chair at meetings concerned with botany, zoology, agriculture and forestry, bacteriology, physiology, and hygiene. Mr. R. D. Clark is the president of Sections E and F, before which papers will be read on education, philology, psychology, history, archæology, economics and statistics, sociology, anthropology and ethnology. It will be remembered that, in connection with the South African medal and fund, the council of the British Association adopted a resolution "that, in accordance with the wishes of the subscribers, the South African Medal Fund be vested in the names of the trustees appointed by the South African Association for the Advancement of Science; and that the dies for the medal be transferred to the association, to which in its corporate capacity the administration of the fund and the award of the medal shall be and is hereby entrusted under the conditions specified in the report of the medal committee." The council of the South African Association accepted with high appreciation the offer made by the British Association, and undertook the award of the medal and fund in accordance with the terms of the conveyance. The fund, amounting to 1376*l*., has been invested, and rules for the award of the medal and fund are being framed and will be dealt with at the forthcoming meeting. It is intended that the first award shall be made at the 1908 meeting of the association. The assistant general secretaries are Mr. E. Hope Jones for Cape Colony and Rhodesia, and Mr. Fred Rowland for the Transvaal, Orange River Colony and Natal. They may be addressed at P.O. Box 1497, Cape Town.

THE first part of a new serial, *Records of the Canterbury Museum* (N.Z.), is devoted to a list of New Zealand fishes, by Mr. E. R. Waite, based on the one in the late Captain Hutton's "Index Faunæ Novæ Zealandiæ," but containing references to the original descriptions.

ARTICLES on the fresh-water bryozoans of the country and the plankton of the coast—the former by Dr. A. Oka and the latter by Mr. K. Okamura—are included in the latest issue (vol. vi., part ii.) of *Annotationes Zoologicae Japonenses*.

NO. 10 of the Indian Forest Bulletin is devoted to an account, by Mr. E. P. Stebbing, of the ravages inflicted by a longicorn beetle (*Butocera rubus*) on fig-trees in Baluchistan. The beetles made their appearance two years ago in a garden in the Duki district noted for the size of its fig-trees, on which they have inflicted very serious injuries. It is hoped, however, that by the use of suitable remedies the plague will shortly be stayed.

ACCORDING to the annual report for the year 1906, the Zoological Society of Philadelphia is in a rather unsatisfactory financial condition, owing to the increased cost of almost everything connected with the upkeep of the menagerie. The result is an account overdrawn by nearly 3000 dollars. Neither have animals been acquired so rapidly as usual, very few new to the collection having been added during the year.

DESPITE the plethora of popular ornithological literature, there seems certainly room for a journal devoted to the purpose of recording recent additions to our knowledge of the birds on the British list. This gap is to be supplied by *British Birds; an Illustrated Magazine devoted to the Birds on the British List*, of which the first (June) number is now before us. Edited by Mr. H. F. Witherby, with the assistance of Mr. W. P. Pycraft, the magazine is to be published monthly by Witherby and Co. at the price of one shilling. The frontispiece to the first part is an exquisite photograph of an osprey descending on its nest, the most important article in this issue being one in which Mr. Howard Saunders enumerates the species added to the British list since 1899.

IN the May number of the *Quarterly Journal of Microscopical Science* Miss Georgina Sweet, of Melbourne, continues her elaborate account of the anatomy of the marsupial mole (*Notoryctes typhlops*), dealing in this instance with the structure of the skin, hair, and reproductive organs. In examining the structure of the skin of the head, certain curious modified groups of cells with a more or less definite arrangement were detected, and similar cells were also found to exist in a modified patch of skin on the rump as well as in the region of the pouch. Although direct proof of the existence of nervous function is lacking, it seems probable that these modified cells represent some form of tactile sense-organ, which would obviously be of very considerable use to a blind burrowing creature like Notoryctes. It is unfortunate that at present nothing is known with regard to the embryology and development of this remarkable animal.

TO the first part of vol. xvi. of *Anales Mus. Nat. Buenos Aires* Dr. F. Ameghino contributes four interesting plates in which skeletons of the extinct Hippidium and Machærodus (Smilodon) of Argentina are respectively contrasted with those of the modern horse and tiger. In its huge skull and short limbs the extinct horse presents a remarkable contrast to its existing representative. It may be added that, through the kind offices of Dr. Ameghino, plaster reproductions of the skeletons of the two extinct species are now exhibited in the British Museum (Natural History). In a second paper in the same issue the author records the existence of what he regards as rudimentary horns in certain members of the toxodont group. In one instance (Trigodon) the rudiment takes the form of a low

median frontal boss, compared by its describer to that of the Old World Elasmotherium, but in a skull figured under the name of Ceratoxodon there appear to be at least four pairs of smaller prominences.

THE fifth annual report of the Rhodesia Museum (Bulawayo, 1907) shows that the accessions to the museum in 1906 exceeded in importance those of any previous year, and that the number of visitors was 2292. A considerable number of interesting minerals and rocks were examined during the year, the number of identifications made for prospectors having been exceptionally large. Gem-stones were especially in evidence. For the guidance of prospectors, an able essay on the mineral wealth of Rhodesia has been written by the curator, Mr. F. P. Mennell, and is appended to the report. With the appointment of Mr. E. C. Chubb, of the British Museum (Natural History), as an additional member of the staff to take charge of the zoological department, the activity of the museum cannot fail to be increased in various directions.

OF the various branches of work undertaken by the Liverpool Institute of Tropical Research, the most productive and useful have been the missions abroad, especially the two expeditions to West Africa, where the representatives of the institute had the opportunity of noting conditions and resources, and brought away valuable collections. The results are summarised by the director, Viscount Mountmorres, in the fourth number of the Quarterly Journal issued by the institute. In the same number Dr. D. Spence communicates an account of two substances prepared from the resin of *Ficus Vogelii*, leading to the conclusion that the resinous products are closely related to caoutchouc, and Mr. R. Newstead discusses three types of weevils that are found in West African grain, and the suggested methods of destruction.

A PAMPHLET has been received in which the author, Mr. P. Frazer, describes experiments undertaken with the view of tracing the sources of injury to vegetation in the neighbourhood of manufacturing works. The results are in accord with former investigations, that the poisonous effects are produced chiefly by oxides of sulphur coming into direct contact with the leaves of plants, while the acids percolating into the soil do not injure the roots. A full bibliography is appended to the paper, which was read in April at the New York meeting of the American Institute of Mining Engineers.

IT has been observed that when potato plants are grown in a very moist atmosphere, swellings or intumescences often develop on the leaves. An account of experiments undertaken by Miss E. Douglas to examine their origin and discover the causes regulating their production was published in the *Botanical Gazette* (April). The intumescences are due to the growth of the cells, generally the palisade cells of the mesophyll, that elongate and divide until they break through the epidermal layer. The experiments indicate that the growth is the result of an abnormal state of turgescence when more water is absorbed than can be transpired or used in normal growth, and this is probably caused by the accumulation of osmotically active glucose.

THE twentieth volume of the Journal of the College of Science, Tokio University, is devoted to an enumeration of flowering plants and ferns from Formosa, compiled by Prof. J. Matsumara and Mr. B. Hayata. The compilation is based on specimens collected by several Japanese botanists who have toured through the island, their routes being shown upon an accompanying map. The number of new species is not very great, and the majority are figured in the excellent plates appended. Under *Spiraea prunifolia*, a plant that with double flowers is common in Japan, the authors describe a single-flowered plant, and mention that it is the first they have seen. A new order, Alniphyllaceæ, is proposed for a plant receiving the name of *Alniphyllum pterospermum*, that bears strong affinities both to the Styraceæ and Ericaceæ.

SOME admirably planned and instructive investigations carried out by Mr. W. J. Cudworth and Mr. Wilson Worsdell on the North-Eastern Railway are described in *Engineering* of June 14. The object of the investigations, which have extended over fourteen years, was to ascertain the cause of the inequalities which from time to time develop on the surface of rails. The results, though not conclusive, are stimulating. They show that the structure of the metal is an important factor in the wear and tear of rails, the difference in structure being probably due to the varying conditions of temperature and the different speeds at which the rails are rolled. The hard knobs which develop in the course of usage on all lines may be produced by mechanical action due to vibration when the wheels are passing over the rails.

THE first report of the Royal Commission on Mines has been issued (Cd. 3548, price 1*s*. 3*d*.). The Royal Commission, of which Lord Monkswell is chairman, was appointed on June 6, 1906, to consider questions concerning the health and safety of miners. The present report, which covers fifty-two pages, is devoted to the use of breathing appliances. The Commissioners do not suggest that the use of such appliances, the compulsory provision of which would not be justified at present, is likely to lead to any considerable decrease in the number of lives lost by explosions. Apart from actual rescue work, they may, however, be of great service in making it possible to deal with underground fires safely and effectively. The use of breathing appliances is not unattended by risks, but such risks can be reduced to a minimum by a proper system of training, which could be provided by the establishment of central rescue stations. Appended to the report are reports on breathing apparatus, by Dr. Boycott; on colliery fires, by a committee of the South Yorkshire Coalowners' Association; on rescue apparatus, by a committee of the Fife and Clackmannan Coalowners' Association; and on breathing apparatus, by a French commission. For educational purposes the value of the report is enhanced by the accompanying detailed drawings of the pneumatogen, the Draeger, the Shamrock, the improved Fleuss, the Weg, and the Aërolith apparatus.

PROF. HANN presented a treatise on the daily range of temperature in the tropical regions of Asia and Australia to the Vienna Academy on April 25, being the conclusion of a laborious discussion of the daily range of temperature in the tropics. The principal object of the treatise in question was to obtain corrections for reducing to the true daily mean the means obtained from combinations of observations at various hours. The author finds that the best mean is obtained from the readings at $(7+2+9+9):4$ both for coast and inland stations, and that the mean obtained from the readings of the maximum and minimum thermometers, which is most usually adopted, is, except for higher latitudes, the worst that can be employed; a mean obtained from even two fixed hours daily would be more satisfactory than the mean of the daily extremes.

THE mean and extreme meteorological values for twenty-five stations in the British Empire during the year 1905 are given in *Symons's Meteorological Magazine* for May. So far as these stations are concerned, the following high shade temperatures were recorded:—Calcutta, 106°·1 (June); Madras, 107°·9 (May); Melbourne and Coolgardie (West Australia), 108°·5 (January); Adelaide, 109°·7 (January). The lowest readings were:—Fredericton (New Brunswick), −33°·5, Winnipeg, −39°·1, Dawson, −50°·5 (all in January); the latter station had the lowest mean temperature (25°·2). Coolgardie had the highest temperature in the sun's rays, 178°·8, the lowest mean humidity, 52 per cent., and least rainfall, 7·86 inches. The greatest rainfall, 77·89 inches, was at Grenada, and the dampest station was London, 83 per cent. Similar valuable tables have been published monthly for more than twenty-five years, but it must be clearly understood that these few widely scattered stations are quite insufficient to give a complete conspectus of the climate of the vast area included in the British Empire.

THE new method of lighting which has recently been installed in the courtyard of the Savoy Hotel is creating much interest, and is, we believe, the first installation of this particular system in this country. The system is the result of years of experimenting, and the results are now given by Mr. D. McFarlane Moore in his paper recently read before the American Institution of Electrical Engineers. The chief feature of the system is the automatic valve, which admits the exact quantity of air or gas required to prevent the violent spasmodic flickering due to the higher degree of vacuum in the tube causing a higher resistance, and which up to the present has prevented a perfect vacuum-tube lighting being placed on the market. The important points about the valve are its simplicity and its automatic action. The valve admits the air required about once a minute, and by changing the nature of the gas admitted the colour of the light can be arranged as required. The main objection to the system appears to be that a high pressure is required; consequently each tube must at the ends be led into a transformer. We should also like to know more about the initial cost of the installation, the length of life of the tube, efficiency, &c., than we are told by Mr. Moore in his paper. If the matters mentioned above are satisfactory in comparison with the present costs and efficiency of modern forms of lighting, the new system should prove of value for large shops, studios, and art galleries, where it is essential to have the lighting as near as possible to daylight. Further developments will be watched with interest, but fuller figures relating to tests will be required before the system can be considered seriously.

FROM Messrs. Hilger, Ltd., we have received a copy of their newly published "List A," in which many well-designed spectroscopes and pieces of spectroscopic apparatus are described and illustrated. The Hilger wave-length spectrometer may now be had fitted with a camera of 21 inches focal length at an additional charge of 6*l*. 10*s*. Spectroscopists will be interested, too, in the new series of six spectrographs—three of which are fitted with ultra-violet glass and three with quartz prisms and lenses—especially designed to give, with a short exposure, the whole length of spectrum, in good definition throughout, on a flat plate, and to be in permanent adjustment. The excellent results obtainable with these spectroscopes are illustrated by an enlarged copy of the spectrum of copper extending from λ 5782 to λ 2160, which we have examined. This was taken with a quartz spectrograph having two 30° prisms and lenses of 8″ focus, the distance from λ 6000 to λ 2160 on the original negative being 60 mm. ($2\frac{3}{8}$″), price 21*l*. 10*s*. The Michelson interferometer, reading to one ten-thousandth of a millimetre, is a fine instrument at the moderate price of 35*l*., as is also the Jamin refractometer at 17*l*. 10*s*. Messrs. Hilger also make a speciality of the strips of plane parallel glass for the Lummer and Gehrcke parallel-plate spectroscope. The prices range from 10*l*. for a plate 100×30×10 mm. to 39*l*. for one measuring 300×40×10 mm.

"WHAT is Genius?" ("Che cosa è il genio?") is the title of a small book by Adolfo Padovan (Milan: U. Hoepli, 1907, second edition). The author discusses examples of genius among artists, poets, philosophers, and others; he distinguishes between genius and talent, and strongly advocates the view that genius is to be regarded as a healthy or physiological rather than a morbid or pathological quality. In this way he is led to the definition on the cover of the book: "a physiological state of exquisite and exceptional nervous sensibility."

DR. PAUL and Tatina Ehrenfest revive interest in the statistical problems of the kinetic theory in their paper on two of the objections to Boltzmann's minimum theorem in the *Physikalische Zeitschrift* (May). They deal, first, with Loschmidt's objection, based on the consideration of reversal of the motion, according to which for every possible direct motion there exists a possible reversed motion, and, secondly, with Zermelo's objection, based on the quasi-periodicity of the motion of a system of gas-molecules. The authors claim to have overcome these objections by showing that a state in which Boltzmann's function increases is statistically enormously improbable. It would, however, seem to follow, according to this view, that the existence of irreversible molecular phenomena must be regarded as due to the assumed preexistence of enormously improbable initial conditions.

PART vi. of "G. A. Fothergill's Sketch Book," which is published by Mr. James Dodds, of Darlington, continues the "History of Cleasby in Yorkshire, with Biography and Portraits of John Robinson, D.D., *The Last* Statesman-Bishop (1650 to 1723); and numerous Sketches of Blackwell Grange and Thornton Hall, Darlington, &c." Some good sketches of sundials are included in the part before us.

A LECTURE appreciative of the work and influence of the late Mr. Herbert Spencer, delivered by Prof. August Stadler in the Zürich Town Hall on December 6, 1906, has been published in pamphlet form by Mr. A. Muller, Zürich.

DIVISIONAL-VOLUME ii. of "Practical Coal Mining," the first divisional-volume of which was reviewed in NATURE of May 23 (p. 77), has just been published by the Gresham Publishing Co. The volume contains a continuation of section iv., on shaft-sinking, by Prof. Henry Louis; section v., on breaking ground, by Mr. H. F. Bulman; and section vi., on methods of working and timbering, by Prof. E. H. Robertson. We propose to defer any further notice of the work until the whole of the volumes have been issued.

WE have received from the proprietors of the periodical called the *Young Citizen* (12 Salisbury Square, E.C.) a case containing twenty-four paper butterflies, pinned and outspread to resemble real specimens. They are, we believe, copied from a well-known work on the subject, and at a considerable distance might pass muster, but we

regret that we are unable to speak favourably of the scheme. The palpi are clumsily represented, but the specimens show no trace of legs, proboscis, or even antennæ, the last deficiency being the most serious and inexcusable of all, especially as they could easily have been imitated in fine wire. We cannot suppose that so incomplete a design can have been executed by, or even submitted to, anyone with the slightest knowledge of entomology. The colouring is fairly good, though in the case of some of the white butterflies it has too greenish a shade.

THE annual report of the Board of Scientific Advice for India for the year 1905–6 has reached us. It will be remembered that the Board is a central authority for the coordination of official scientific inquiry, and the object it has in view is the distribution of the work of research to the best advantage, the prevention of dissipation of energy by the useless duplication of inquiries, and its misdirection by a lack of inter-departmental cooperation. The Board by its advice also aids the Government of India in prosecuting practical research into questions of economic or applied science. During 1906 the Board appears to have held two meetings only, one at Simla in May and the other in December at Calcutta. The greater part of the report, which runs to nearly 200 pages, is made up of contributions by distinguished specialists on scientific work in various directions accomplished in India during the year under review.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN JULY:—

July 3. 8h. Uranus in opposition to the Sun.
6. 3h. Mars in opposition to the Sun.
7. 7h. Vesta in conjunction with Moon (Vesta 0° 15′ S.).
8. 12h. 29m. Minimum of Algol (β Persei).
10. 3h. 7m. Sun eclipsed, invisible at Greenwich.
11. 9h. 18m. Minimum of Algol (β Persei).
13. Saturn's Ring. Major axis = 42″·11, Minor = 1″·72.
15. 19h. Jupiter in conjunction with the Sun.
20. 11h. 58m. to 12h. 57m. Moon occults θ Libræ (mag. 4·3).
24. Partial eclipse of the Moon.
13h. 59m. First contact with the penumbra.
16h. 22m. Middle of the eclipse.
18h. 46m. Last contact with the penumbra.
Magnitude of the eclipse = 0·620.
At 16h. 10m. the Moon sets at Greenwich.
27–31. Meteors numerous from Aquarius and Perseus.
28. 11h. 10m. to 12h. 14m. Moon occults 30 Piscium (mag. 4·7).
,, 13h. 4m. to 14h. 6m. Moon occults 33 Piscium (mag. 4·6).
29. 11h. 23m. to 11h. 55m. Moon occults 20 Ceti (mag. 4·9).
31. 10h. 40m. to 11h. 18m. Moon occults ξ^2 Ceti (mag. 4·3).

COMET 1907*d* (DANIEL).—The following set of elements and ephemeris for comet 1907*d* have been computed by Dr. E. Strömgren, and appear in Circular No. 98 of the Kiel Centralstelle:—

Elements.

T = 1907 Sept. 2·0105 (Berlin M.T.)

$\omega = 241° 59'·04$
$\Omega = 143\ 41'·99$ } 1907·0
$i = 6\ 14'·81$

$\log q = 0·11436$

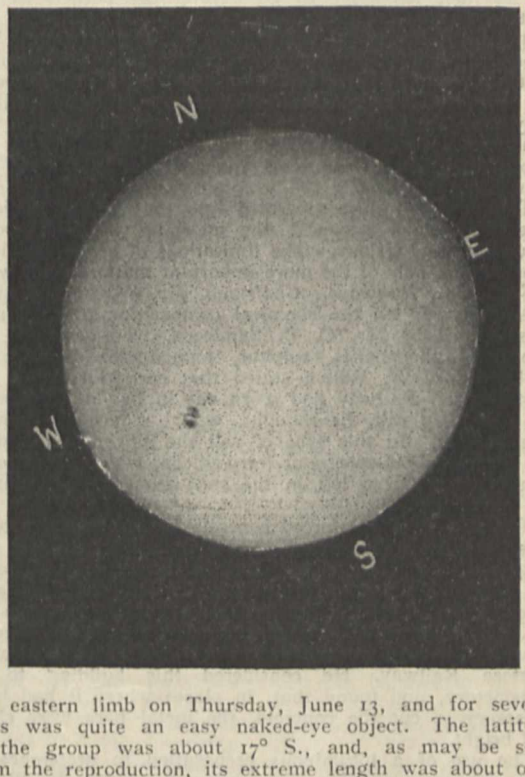
Ephemeris 12h. M.T. Berlin.

1907	α	δ	Brightness
June 24 ...	0 31·3 ...	+2 25·9 ...	1·37
,, 28 ...	0 44·1 ...	+3 27·2 ...	1·54
July 2 ...	0 57·4 ...	+4 29·0 ...	1·73

The brightness at the time of discovery, given as equal to mag. 11·0, is taken as unity. As will be seen from the above, the comet is brightening considerably, and is travelling through Pisces, towards Aries, just south of the ecliptic. At present it rises above the eastern horizon about midnight.

Observations by Prof. Hartwig on June 15 gave the magnitude as 9·5, the diameter as 2′, and the magnitude of the nucleus as 10·0.

A LARGE SUN-SPOT.—One of the most marked features of the present year has been the large number of sun-spot groups of sufficient magnitude to be seen with the naked eye; according to the Greenwich report, fourteen such groups had been seen on the solar disc up to May 10. The accompanying photograph, taken at 2h. 30m. on June 21, shows the group of spots which appeared on



the eastern limb on Thursday, June 13, and for several days was quite an easy naked-eye object. The latitude of the group was about 17° S., and, as may be seen from the reproduction, its extreme length was about one-tenth of the solar diameter, or about 85,000 miles. The shape of the principal umbra changed considerably during the spot's progress across the disc.

THE VARIABILITY OF ASTEROIDS.—A striking photograph, illustrating apparently rapid changes of brightness in an asteroid, accompanies a paper on the subject published by Mr. Joel Metcalf, of Taunton (Mass.), in No. 4, vol. xxv. (p. 264, May), of the *Astrophysical Journal*. The original negative was produced by making two exposures of equal duration on the same plate, the camera being guided so that the asteroid images are round and the images of the surrounding stars are shown as trails. The similarity of the two star trails for each star is evidence that the rating of the clock and the atmospheric conditions were constant throughout, and yet there is a marked difference in the size and density of the images of the asteroid—in this case 1906 *WE*. This plate was taken on November 6, 1906, and the two exposures had thirty-five minutes each, with an interval of a minute between them; therefore the asteroid appears to have changed considerably in magnitude during an interval of one hour eleven minutes.

COMET 1907*c* (GIACOBINI).—A set of elements and a daily ephemeris extending to July 11 are given for comet 1907*c* by Dr. Strömgren in No. 4183 (p. 128, June 14) of the *Astronomische Nachrichten*. Prof. Millosevich, at Rome, found this a difficult object to observe with the 38 cm. (15 inches) telescope, and, according to the ephemeris, it is decreasing in brightness.

THE ENGINEERING CONFERENCE.

THE fourth engineering conference of the Institution of Civil Engineers commenced on the morning of Wednesday, June 19, when an opening address was delivered by Sir Alexander B. W. Kennedy, F.R.S., the president of the institution. In the course of his remarks, the president referred to the essential catholicity of the aims of the institution. All and every department of industrial activity which can possibly be covered by the name engineering fell within the ken and interest of the institution. In spite of the very extended ground covered by the subjects of the sections, members of the Institution of Civil Engineers alone had been invited to take part. It was not necessary to go beyond the borders of the institution to find men, not only interested, but distinguished, in every department of engineering. The president emphasised the unity rather than the diversity of their work, and expressed the hope that members would not confine their interest and presence to those sections only with the business of which their every-day work was concerned. In conclusion, the president explained that the papers to be read were notes, intended merely to open and stimulate discussion.

The members then separated into the various sections. The discussions occupied the morning of Wednesday, Thursday, and Friday. The limitations of space permit of brief notices only of the more important matters dealt with.

Section I., Railways. Chairman, Mr. W. R. Galbraith.

A discussion on the chemical composition of steel rails was opened by Mr. C. P. Sandberg, who described the effects of phosphorus, sulphur, manganese, silicon, and carbon. Mr. W. Willox stated that certain rails on the Metropolitan Railway had worn out in five months only; the Sandberg rail, he thought, would reduce the trouble considerably. In this type of rail the silicon is added in the form of silico-spiegel or ferro-silicon, which gives better results than silicon left in the steel from pig-iron during the conversion.

The subject of reinforced concrete for railway structures was introduced by Dr. C. A. Harrison. Evidence was sought of the ability of this form of construction to resist the fatigue and stress of railway traffic, and also as to whether the metal reinforcement is not liable to corrosion. Mr. W. Bell gave information regarding a building in ferro-concrete erected under his supervision for the North-Eastern Railway. He considered this building to be satisfactory, and found that, in places where it had been necessary to cut the concrete, the metal bars were clean and bright.

The use of a bituminous preparation in preference to paint wherever possible was advocated by Mr. B. Blount as being the best means of preserving iron and steel work. Mr. H. R. A. Mallock, F.R.S., contributed a note on the action between the wheel and the rail, in which he calculated from theoretical grounds that the wear on rails having a two-minute service for twelve hours a day would amount to 2·6 inches per year, a result which might be altogether avoided by somewhat increasing the tread.

Mr. W. Dawson described a system of audible signalling which has been experimented on by the Great Western Railway. The danger signal is given to the driver by means of a small steam whistle fixed to the cab of the engine, actuated by a fixed bar bolted to the sleepers. The fixed bar is electrified when it is desired to give the "all right" signal, and then has the effect of ringing a bell on the engine. Colonel Yorke expressed the importance attached by the Board of Trade to such apparatus, but stated that his department would insist on absolute trustworthiness before sanctioning its use.

In speaking on light-railway policy, Sir A. B. W. Kennedy thought that, in view of the development of motor traction, light railways had nearly reached their termination in this country, excepting in special cases.

Section II., Harbours, Docks, and Canals. Chairman, Sir William Matthews, K.C.M.G.

Lord Pirrie contributed a paper on harbour and dock requirements as affected by the development of shipping. In his opinion, finality in the size of ships had not yet been reached. The desire for greater economy and also passengers' wishes for greater comfort and luxury would lead to further developments. Owing, however, to existing conditions as regards dock accommodation and depth of channels, shipbuilders had been forced into increasing the length rather than the breadth or draught.

Ferro-concrete and reinforced concrete structures were also discussed in this section. Mr. C. S. Meik gave evidence of the strength and durability of the ferro-concrete pier at Purfleet on the Thames. Questions of dock equipment, dredging, and electric and hydraulic power for working dock machinery were dealt with. Mr. W. W. Squire considered that the tendency towards the extended use of electric appliances was on the increase.

Section III., Machinery. Chairman, Prof. W. C. Unwin, F.R.S.

The business of this section opened with a valuable and interesting discussion on the relative merits of turbines as applied to marine propulsion and of reciprocating engines. The principal point raised was the relative coal and steam consumptions. The Hon. C. A. Parsons stated that in war vessels the consumption has now been brought to substantially the same figure as with reciprocating engines, and that in pleasure steamers the turbine now showed an efficiency 5 per cent. to 15 per cent. superior to similar vessels having triple-expansion reciprocating engines. Sir Wm. White and Sir John Durston contributed to the discussion. Mr. Gerald Stoney referred to the great efficiency of the low-pressure steam turbine, and quoted instances of the successful application on land of such turbines working with the exhaust steam discharged from reciprocating engines, which steam would otherwise be wasted owing to the inability of reciprocating engines to deal economically with steam at very low pressures. Mr. Parsons was of the opinion that future development for slow-speed vessels such as cargo steamers would be in the direction of a combination of reciprocating engines for the high-pressure part of the expansion and of turbines to deal with the low-pressure part. He estimated that such an arrangement would show an improvement in coal consumption of about 12 per cent. over quadruple-expansion reciprocating engines, and from 15 per cent. to 20 per cent. over the best triple-expansion engines.

Other subjects discussed in this section were precision grinding, machine-tool design as affected by the use of high-speed cutting tools, the use of pneumatic tools, reciprocating air-compressors, and turbo-compressors for high pressures. The last subject was introduced by Prof. A. Rateau, of Paris, who described his recent work in the development of turbo-compressors. He specially directed attention to one of his machines (which consists essentially of a reversed steam turbine) placed in the mines at Bethune, which compresses the air to 6 and even 7 atmospheres, and has the further interesting feature of being driven by a steam turbine utilising the exhaust steam from one of the winding engines. The efficiency of turbo-compressors is about of the same order as piston compressors. Turbo-compressors have the advantages of simplicity of parts and the capability of being directly connected to high-speed motors.

Section IV., Mining and Metallurgy. Chairman, Mr. John Strain.

This section opened with a discussion on problems of the Witwatersrand goldfields, introduced by Mr. G. A. Denny. Questions of labour difficulties and machinery were dealt with. Shaft-sinking and shafts for deep winding were also discussed. Recent applications of the Poetsch freezing method of shaft sinking in the Durham coalfield were described by Mr. H. Louis. Arrangements of colliery surface works were described by Mr. E. M. Hann. Mr. J. E. Stead, F.R.S., introduced the subject of segregation in steel, and illustrated his remarks by reference to etched specimens. The causes of segregation and its effect on the mechanical properties were fully dealt with. Mr. B. Blount contributed a paper on electro-metallurgy, dealing with the present state of the industry and the possibilities of its application to the manufacture of steel. The subject of the education of students of mining and metallurgy was introduced by Mr. W. Rowley, who described the methods adopted in the West Riding of Yorkshire. Mr. Rowley severely criticised the present Government examination for certificates of competency, an examination which,

he said, could be passed by men who have not that acquaintance with scientific principles which is desirable. The papers have often been so stereotyped that correspondence and other methods of cramming only are needed to enable a man to pass. The composition of the board of examiners had often been characterised by conspicuous absence of men qualified by scientific training and knowledge to examine candidates, however eminent might be their position in particular branches of the mining profession. Mr. Rowley emphasised his opinion that a solid foundation of a broad and liberal education was essential to the student prior to his course in applied science.

Section V., Shipbuilding. Chairman, Dr. F. Elgar, F.R.S.

A joint discussion with Section II. on harbour and dock requirements opened the work of this section. A very important discussion on the uses of high-tensile steel was opened by three papers contributed by Mr. A. E. Seaton, Mr. A. F. Yarrow, and Mr. E. W. De Rusett. High-tensile steel for structural work may be described as steel having an ultimate tensile strength of about 40 tons per square inch. In the Forth Bridge such steel was used in compression only; Mr. Seaton was of the opinion that to-day there need be no hesitation in using it under tension. By use of this material it is possible to reduce largely the weight of a given structure. Recently the huge Cunard ships have been constructed so as to withstand the heavy expected stresses by the free use of the high-tensile steel of Spencer and Colville. Mr. Yarrow quoted the present Admiralty practice of steel of 37 tons to 43 tons per square inch with specified minimum elongations in 8 inches. In his own practice a considerable reduction of dead weight had been effected by the use of high-tensile steel. Mr. E. W. De Rusett gave information as to the use of high-tensile steel in the construction of the *Mauretania*. By instruction of the authorities of Lloyd's Registry, rivets of mild ingot steel were adopted. The rivet holes in plates less than $\frac{1}{2}$ inch thick were punched $\frac{1}{4}$ inch under size and rimered out. This method was found not to interfere with the strength of the joints. Rivet holes in plates more than $\frac{1}{2}$ inch thick were drilled. Sir Wm. White recommended for the proper use of high-tensile steel (*a*) thorough testing in the makers' works; (*b*) proper treatment of the material (as regards heating, &c.) in the shipbuilders' yards; (*c*) structural arrangements suitable for the new material. He was of the opinion that both mild steel and high-tensile steel can be successfully used in the same structure. Rivets of quality agreeing with the material of the plates should be employed, and such was the practice of the Admiralty. Sir P. Watts said that high-tensile steel rivets were at present used successfully in the Service. Mr. Colville gave the results of the experience of the Steel Co. of Scotland on the manufacture of high-tensile steel. Mr. Ritchie, of Parkhead Forge, quoted the case of a steam boiler of high-tensile steel working at 500 lb. per square inch pressure. Mr. Thearle, of Lloyd's, spoke of the necessity for avoiding improper heat treatment of high-tensile steel rivets. Other subjects dealt with in this section were structural details of cargo steamers, arrangements for working cargo, high-speed vessels, modern applications of superheating, and the welding of structural materials in place. In the last, methods of electric welding, welding by the oxy-hydrogen and oxyacetylene flames, and welding by the use of thermit were discussed.

Section VI., Waterworks, Sewerage, and Gasworks. Chairman, Sir George Thomas Livesey.

The first paper read in this section was on the comparative cost of pumping by steam, internal combustion engines, and electricity, based on actual working. The authors, Messrs. Charles Hawksley and Henry Davey, made out a strong case in favour of direct pumping by steam engines. Speakers in the discussion disagreed with certain figures given in the paper. Thus the authors give 1 lb. of oil per B.H.P. generally for oil engines, but the Diesel oil engine has a guaranteed consumption of 0·4 lb. of oil per B.H.P.; 1·75 lb. of coal per B.H.P. for gas engines is stated in the paper to be the engine-maker's estimate, but 1·25 lb. would be nearer. Electric current could also be obtained at a cheaper rate than that given, viz. $\frac{1}{2}d.$ per unit.

Papers on water softening and water hardening were contributed by Messrs. W. Matthews and J. Watson respectively. Softening is of value in many cases where the water is too hard to be available for supply, and the process also gives a means of defence against bacteria. The working in practice of various systems of water softening was discussed. The practice of hardening water for domestic purposes is intended to counteract acidity and neutralise peaty water possessed of lead-dissolving properties.

Applications of towns' gas as a heating agent were described in a paper by Mr. W. H. Y. Webber. The author referred to the practice now generally adopted by gas engineers of speaking of their product in terms of its calorific value rather than of its illuminating power. The domestic uses of gas for heating purposes were dealt with, and the author expressed his opinion that producer gas did not make headway against town gas at 2*s.* per 1000 cubic feet.

The distribution of gas at increased pressure was introduced by Mr. C. C. Carpenter, who described the present practice of the South Metropolitan Gas Company in using non-positive blowers giving an initial pressure of about 20 inches of water. Gas engines are preferred for driving the blowers as being more convenient. This company has 1200 miles of pipes, and finds that the unaccounted gas amounts to $4\frac{1}{2}$ per cent. only.

Mr. J. D. Watson contributed a paper on sewage disposal by biological processes, in which he gave the results of the methods adopted at Birmingham, where sewage purification is effected by mechanical precipitation and septic treatment.

The relative merits of chemically treated, settled, and septic sewage in preparing the liquid for oxidising beds formed the subject of a paper by Mr. G. A. Hart. The author has compiled facts obtained from observations made on the sewage of Leeds during the last nine years. The most effective chemical precipitant was found to be a combination of 6 to 8 grains of lime and 2 grains of aluminium sulphate per gallon of sewage. Settlement is employed sufficient to reduce the suspended solids in crude sewage to an average of about 8 grains per gallon. Dealing with septic fermentation, the author stated that at a twenty-four hours' rate of flow about 30 per cent. of the suspended solids were digested in the tanks, 31 per cent. passed out with the effluent, and the balance of 39 per cent. remained as deposit.

Section VII., Applications of Electricity. Chairman, Colonel R. E. B. Crompton, C.B.

The first paper taken was on electrical transmission gears on motor vehicles, by Mr. A. A. C. Swinton. The author directed attention to the crude methods of gear changing used in petrol-driven motor vehicles, and gave short descriptions of several arrangements of electrical transmission which have been adopted. Mr. Hart gave the results of his experiments using continuous current machinery, which he had discarded in favour of polyphase alternating current. He had now an omnibus running in which the consumption of petrol amounted to one gallon per $6\frac{1}{2}$ miles, the electric machinery being used for starting only, giving a smooth and rapid acceleration. Mr. W. H. Stevens advocated the use of continuous current. Mr. Swinton referred to the question of the weight of the petrol-electric equipment, which is greater than that of purely petrol machinery.

The subject of electric working of railway points and signals was opened by Mr. Ferreira, who enumerated the principal conditions considered essential in modern signalling, and discussed the various electric methods adopted for complying with these conditions.

Papers on upkeep charges on large electric generating sets and on modern applications of electricity to mines were contributed by Messrs. Burstall, Highfield and Sparks. In the last paper the application of the high-lift centrifugal pump in combination with the electric motor was mentioned as showing a great advance on previous methods of pumping.

On the evening before the formal opening of the conference, the James Forrest lecture, on "Unsolved Problems in the Design and Propulsion of Ships," was delivered by Dr. Francis Elgar, F.R.S.

During the conference the members had the privilege of visiting many works and generating stations, and these opportunities were taken advantage of to a large extent. The institution conversazione was held on Thursday evening in the Albert Hall, when a large and representative gathering met for social intercourse.

THE ROYAL SOCIETY CONVERSAZIONE.

MOST of the exhibits of scientific interest at the Royal Society on June 19, on the occasion of the soiree to which ladies as well as gentlemen are invited, were shown at the conversazione on May 8, and have been described already in NATURE (May 16, p. 57). It will be sufficient, therefore, to refer briefly to exhibits not mentioned in the previous article.

Lantern and other demonstrations were given during the evening by Prof. H. A. Miers, Prof. Flinders Petrie, and Mr. Louis Brennan. Prof. Miers showed experiments illustrating the growth of crystals in drops of solution, and indicating that the latter are of two sorts. If a solution be sufficiently strong, crystallisation may be started spontaneously by mere shaking or friction. In such a solution the crystals are apt to grow rapidly in the form of delicate needles and fronds. If the solution be supersaturated, but not strong enough to give birth to crystals in this way, they can only grow if introduced from without (by "inoculation" of the drop), and are apt to grow in symmetrical forms. A solution, as it cools, passes quite suddenly from the one state to the other. Prof. Petrie lectured on houses in ancient Egypt, and Mr. Brennan again showed and described his working model of the Brennan mono-railway.

The subjoined descriptions of the exhibits have been abridged from the official catalogue :—

Mr. A. A. Campbell Swinton: Vacuum tube phenomena. (1) Exhibition of the mechanical effects of kanal rays in causing the rotation of mill-wheels in Crookes tubes. These rays, which are positive, travel in the opposite direction to the negative rays that proceed from the kathode. They can be detected both when they are approaching the kathode, and also, if the latter is perforated, after they have passed through the apertures. (2) Photomicrographs of the bubbles that are developed by sudden heating of portions of the glass walls of Crookes tubes, owing to the occlusion by the glass of the residual gas during prolonged use. (3) Exhibition in the microscope of a special case of the above, in which the sudden heating was occasioned by an electric spark, which has thus impressed its own image on to the glass. The image is entirely made up of minute bubbles, and from its form it is clear that the spark was a positive one.—*Mr. C. E. S. Phillips:* (1) A fibre electroscope. In this electroscope the gold leaf is replaced by a fibre of electrically conductive glass which is delicately hinged so as to move very readily under the influence of a difference of potential. (2) An electroscope charger. The ease with which celluloid may be electrified by friction, together with its poor insulating property, are made use of in this apparatus. A celluloid rod is rubbed at one end by a flannel-lined split brass tube. The charge so produced slowly spreads to the opposite extremity of the rod and is there utilised. Either a positive or negative charge may be obtained with the same instrument. (3) Electrically conductive glass. The composition of this glass is as follows :—sodium silicate, thirty-two parts; borax, eight parts; Powell's flint glass, 1·25 parts. The electrical conductivity is about 500 times as great as that of any other glass, and this material is suitable for the windows of electrostatic instruments as well as for supplying the fibres used in the fibre electroscope.—*Mr. J. Mackenzie Davidson:* Stereoscopic X-ray photographs in a revolving lenticular stereoscope. A single X-ray photograph is a central projection shadow of the object placed between the Crookes tube and the photographic plate, and cannot therefore correctly indicate the real relative position of the parts—but *stereoscopic* X-ray photographs at once give a combined image which shows correctly their relative size and position. This could be observed in the series of transparencies exhibited.—*Mr. A. Kershaw:* A new visual method of measuring the speeds of photographic shutters. This consists principally of a variable-speed revolving disc with radial slits, in con junction with a stationary illuminated slit.—*Mr. Edward Whymper:* Photographs taken in the Rocky Mountains of Canada and in the Alps.

Mr. William Burton: Pilkington's Lancastrian lustre pottery. The examples illustrate the perfecting of the old lustre process of decoration. By this method metallic vapours of silver and of copper can be driven into pottery glazes at a very low red heat under the influence of reducing gases. The surface of the metallic film so obtained glows with brilliant iridescent colours. The process has been reduced to such precision that the kilns are hermetically sealed during the firing, and no "trials" of any description are drawn from start to finish of the process. The temperature is recorded by the use of two thermocouples, placed at the bottom and top of the kiln respectively. The reducing gases are of standard composition, so that the process is so far as possible automatic.—*Hon. C. A. Parsons, F.R.S.:* Photographs of diamonds obtained from pure iron heated in a carbon crucible in an electric furnace and rapidly cooled. Scale, 150 diameters.—*Dr. Herbert Smith:* Precious stones, cut and uncut. The exhibit includes most of the mineral species that are available for jewellery purposes. The following are the more noteworthy of the specimens :—a star-twin of diamond; crystals and faceted specimens of olivine (peridot) from the Red Sea; sapphires from Montana and Ceylon; natural and "reconstructed" rubies; various opals, including opalised shells; diamonds, chrysoberyls, and topazes from Rhodesia; garnets from German East Africa; and specimens of the rare species phenakite, axinite, and diopside.—*Dr. Tempest Anderson:* Photographs illustrative of the volcanoes of Central America, and of a revisit to the Soufrière of St. Vincent. The volcanoes of the Soufrière of St. Vincent and Montagne Pelée in Martinique, both to the east of the Caribbean Sea, erupted in 1902. The volcano of Santa Maria in Guatemala, to the west of the same sea, erupted in the same year, and when it was examined this spring the eruption proves to have been of the same character.

The Royal Society: The Linnæus bicentenary—original certificate of candidature of Linnæus, dated 1753, for election into the Royal Society.—*Dr. W. A. Cunnington and Mr. C. L. Boulenger:* Examples of the fauna of the Fayûm Lake, Birket-Qurun, investigated at the request of the Egyptian Survey Department. (1) Series of the fishes, including examples of the three different kinds of Bulti (Tilapia). The females take charge of the eggs and young, which they seclude in the mouth and gill-chambers. (2) Series of the invertebrates of the lake, including examples of a new lacustrine medusa (*Moerisia lyonsi*).—*Prof. Charles Stewart, F.R.S.:* (1) Specimens illustrating alternation of generation. (2) Various invertebrates and birds showing colours due to structure; mostly thin films, and not pigment; consequently the colour is lost on crushing.—*Prof. S. J. Hickson, F.R.S.:* A collection of species of the genus Corallium, and a specimen of *Corallium maderense*, polished and mounted in silver.—*Dr. Ernst Hartert:* Birds represented in the British Isles by peculiar forms, and their Continental allies. So late as 1892 Wallace accepted only three birds as peculiar to the British Isles ("Island Life," p. 340), and even more recent works have not mentioned more than three or four. Careful investigations, however, have shown that about twenty British birds show constant and often easily recognised differences from their Continental allies. Eighteen of these are exhibited, with their allies, in order to show their differences.

Prof. Flinders Petrie, F.R.S.: Pottery soul-houses, 3000 B.C. These models, made by the Egyptians, were found at the cemetery of Rifeh in Upper Egypt, where they had been placed upon the graves. They were developed from the trays of offerings for the dead, to which a shelter was added, and further enlarged with the addition of furniture so as completely to resemble an actual house, in which the soul was supposed to dwell. Their period is from the ninth to the twelfth dynasty. Found by the British School of Archæology in Egypt, 1907.

THE CRUISE OF THE "NEPTUNE."[1]

THE cruise of the *Neptune* is the official narrative of the voyage of the Dominion Government Expedition to northern parts of Hudson Bay and the north-eastern Arctic islands in 1903–4 in charge of Mr. A. P. Low.

The Dominion Government in the spring of 1903 decided to send a cruiser to patrol the waters of Hudson Bay and those adjacent to the eastern Arctic islands, and to aid in establishing on the adjoining shores permanent stations for the collection of customs, the administration of justice, and the enforcement of the law as in other parts of Canada.

Major J. D. Moodie, of the North-West Mounted Police, was appointed acting commissioner of the unorganised north-eastern territories. The expedition carried a scientific staff.

Dr. L. E. Borden, besides being the medical officer, collected data relating to ethnology, botany, and zoology; Mr. Andrew Halkett, naturalist of the Department of Marine and Fisheries; Mr. C. F. King, who was attached from the staff of the Geological Survey, took charge of the topographical and meteorological work, assisted by Mr. C. F. Caldwell (photographer) and Mr. Ross (purser).

Mr. Low undertook the geological work. The latter writes in the preface to the book:—"The greater part of the credit for the complete and successful accomplishment of all the instructions for the voyage is due to Captain S. W. Bartlett, the officers and the crew of the *Neptune*." The latter was the largest and most powerful ship of the Newfoundland sealing fleet, 465 tons net register and engines 110 nominal horse-power.

Besides the narrative of the voyage during the seasons 1903–4, there is a short historical account of earlier explorations and discoveries in north-eastern Arctic America, a geographical sketch, and chapters dealing with the Eskimo inhabitants and the geological formation of these north-eastern territories, and a description of the important whaling and sealing industries, and opinions as to the possible navigation of Hudson Strait and Hudson Bay.

In the form of appendices are the results of the meteorological observations taken on the voyage, notes on the thickness and growth of ice, and lists of the birds, plants, and fossils collected in these northern regions. The full results, especially with regard to the determination of marine invertebrates, are promised in a future publication.

The *Neptune* wintered in Fullerton Harbour, at the entrance to Roes Welcome (latitude 64° N.). During the winter various tribes of Eskimos congregated about the ship and kept it supplied in fresh caribou meat. The two long chapters on the Eskimos are fascinating reading, and contain a mass of information for the anthropologist. In the form of an appendix there are notes on the physical condition of the Eskimos by the surgeon to the *Neptune*, Dr. L. E. Borden.

The excessive cold of the early spring practically rendered impossible any surveying or other scientific work until the month of April. The minimum temperature observed was −53° F., early in March. The really cold months were January, February, and March, the mean temperatures being respectively −23°·0 F., −27°·0 F., −20°·6 F. The thickness of the ice around the ship continued to increase until April 25, when it attained a maximum of 74 inches.

The *Neptune* broke her way out of Fullerton Harbour on July 18, after having been fast frozen for nine months, and proceeded on her summer cruise to the Arctic islands. Chapter x. contains a great deal of valuable information concerning whales and whaling. Although the capture of a right whale repays the expenditure incurred in outfitting a steam whaling ship, and if more than one is killed on the voyage it means large dividends to the owners, the chase is becoming more and more unprofitable owing to the few whales remaining and to the frequent "empty" voyages made of late years. The future of the whaling industry certainly appears to be very gloomy.

The chapters on geology are perhaps the most valuable portion of the book. Although they contain little that is absolutely new, the results of former expeditions and work of former geologists have been brought together in a concise and interesting manner.

The work is admirably written, and contains more real information than such narratives usually do. The illustrations are fairly good, and the geological map compiled by the Geological Survey of Canada to illustrate the cruise of the *Neptune* (scale, 50 statute miles to 1 inch) is probably the best of its kind published. L. C. B.

[1] Report on the Dominion Government Expedition to Hudson Bay and the Arctic Islands on Board the D.G.S. *Neptune*, 1903–1904. By A. P. Low (officer in charge). Pp. xvii+355 and map. (Ottawa: The Government Printing Bureau, 1906.)

NATURAL HISTORY IN NORTHUMBRIA.[1]

THE third and concluding part of the first volume of the new series of the Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne has just been issued, and it proves that the district is able to maintain its reputation as a home of eager and distinguished naturalists. In addition to the usual reports on the field meetings and the short notes on local natural history, which do not present any noteworthy features, there are six papers of more general interest which may be regarded as serious contributions to knowledge.

Among these we notice a paper by Miss M. Lebour on the larval trematodes of the Northumberland coast. Having chosen for her investigations a field of work that has unfortunately been very inadequately explored, this author is able to contribute more that is really original than her companions. A list of thirteen common littoral mollusca is given in which larval trematodes were found, and of these *Paludestrina stagnalis* was proved to be the host of no less than six different species of trematodes. Although no single complete life-history was worked out, reasons are given for supposing that the first host of *Distomum* (*Echinostomum*) *leptosomum* is *Paludestrina stagnalis*, and that encystment may take place in the same species of mollusc or in *Scrobicularia tenuis*, the final host being the dunlin. The bucephalus larva of Gasterostomum, the well-known fluke of the angler fish, was found in the cockle, this being only the second time in which the larva has been recorded in British waters. The paper is well illustrated by five plates.

In an interesting paper by Dr. Brady several species of Crustacea new to the district are recorded from a pond at Amble that has been formed by the filling up of an old quarry from the adjacent sea. The occurrence in the pond of a new ostracod for which a new genus (Proteocypris) is instituted is of special interest, as, according to the author, it is the only instance of a typically fresh-water cyprid occurring in a truly marine habit. It is to be regretted that Dr. Brady makes no statement of his opinion as to the relations of this genus or of the family to which it belongs.

The longest paper in the part is one by Mr. A. R. Jackson on the spiders of the Tyne valley. This paper will doubtless be of considerable value to arachnologists, but apart from the description of five species new to Britain, of which three species were at the time of their discovery new to science, it does not present any features of general interest.

In some interesting notes on rare local beetles, Mr. Bagnall describes his experiences in proving that the female *Epuraea angustula* enters the bores of different species of Trypodendron in order, as he believes, to deposit her eggs on those of the borer, and suggests that the staphylinid *Acrulia inflata* is similarly parasitic on Trypodendron.

Geology is represented in the part by two papers—one, on the result of the borings in the valley of the Tyne Derwent, by the Rev. A. Watts, and the other by Dr. Woolacott, on the recent landslip at Claxheugh. The photographs that illustrate this last-named paper are of permanent interest and value.

In bringing the first volume of the new series to a conclusion, the society may be congratulated on the evidence it affords of the interest taken in natural history by its members and of the valuable work they are doing.

[1] "Transactions of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne." Vol. i., parts i.-iii. (1907). Price 5*s.* 6*d.*

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Among the additions made during the year 1906 to the collections under the charge of the museums and lecture-rooms syndicate, special mention has been made in the forty-first annual report of the syndicate of the gift to the school of botany, by Mr. Francis Darwin, of the scientific library of his father. Dr. E. C. Stirling has presented to the museum of zoology a cast of a skeleton of the gigantic extinct marsupial *Diprotodon australis*, and the Duke of Bedford two specimens of Przewalsky's horse from the collection at Woburn Abbey. The collection of antelopes has been largely increased, principally through the donations of Mr. C. B. C. Storey, Mr. A. L. Butler, Major W. B. Emery, and Captain E. Mackenzie Murray. The executors of the late Mr. J. S. Budgett have presented a number of specimens to the museum of zoology, and certain pieces of apparatus to the zoological laboratory. The Strickland curator directs attention to the completion of the late Prof. Newton's "Oötheca Wolleyana," and to the fact that the whole of Prof. Newton's magnificent collection of palæarctic eggs becomes thereby the property of the University. Numerous anthropological gifts to the museum of human anatomy are recorded in the reports of Dr. Barclay-Smith and Dr. Duckworth.

A SUMMER school for university extension students will be held at Oxford during August. The inaugural address will be delivered in the examination schools on Thursday, August 1, at 8.30 p.m., by the Earl of Halsbury, F.R.S. The meeting will be divided into two parts, the first of which will extend from August 1 to August 14, and the second from August 15 to August 26. The lectures in the science section will be arranged with the object of illustrating the part played by Oxford in the advancement of science, particularly in the seventeenth century. Among the lecturers will be Dr. T. B. Strong, Dr. W. Osler, F.R.S., Mr. J. Wells, Dr. Brereton Baker, F.R.S., Prof. F. Gotch, F.R.S., Prof. H. H. Turner, F.R.S., Prof. E. B. Poulton, F.R.S., and Mr. J. L. Myres. There will also be special classes in practical map-making, nature-study, and principles and practice of education.

PROF. A. S. HEMMY, Government College, Lahore, writes to correct a report as to the state of science in the Punjab which appeared in the *Civil and Military Gazette*, and was summarised in NATURE of May 16 (p. 70). The local paper pointed out that comparatively few students present themselves for examinations in the science faculty of the Punjab University, and therefore suggested that scientific studies are not making much headway in India. Prof. Hemmy remarks that though the study of science in the Punjab is in a somewhat backward condition, the various laboratories being badly endowed, the article in the local paper, upon which our note was based, is misleading. The regulations of the Punjab University permit science (of a very slightly lower standard) to be taken up for the arts degree as well as for the B.Sc., and the great majority of students who take up science do so as part of the more popular B.A. course. It appears that the numbers quoted in the note only represent, therefore, a fraction of the total number studying science. For 1907, in the arts faculty, out of 3666 candidates for matriculation, 1426 took up physics and chemistry; out of 689 candidates for the intermediate, 254 took the same subject; of the 340 for the B.A., 25 took physics and 32 chemistry; while of the 52 M.A. candidates, 3 took physics and 4 chemistry.

AN exhibition of selected specimens of work of pupils in the rural schools of East Suffolk was held at the County Hall, Ipswich, on June 15. The exhibition was arranged by Alderman the Rev. C. J. Steward, chairman of the Education Committee of the East Suffolk County Council, to whose energy and enthusiasm this movement owes so much. It is clear that valuable work is being done in East Suffolk schools to train observational powers and to stimulate interest in natural phenomena. Forty-three distinct exhibits were shown, including some excellent collections of the grasses and wild plants of each district, while mounted and labelled specimens illustrating the life-history of common plants and animals, meteorological records kept and displayed in the form of charts, plans of the villages and of the school buildings, carefully selected specimens showing the structure and growth of common timber trees, plans of school gardens, records of the country month by month, and excellent studies of the changes in ditches and ponds during the year, were also shown. In addition, there were records of bee-keeping and illustrations of budding and grafting. East Suffolk has made a good start in the newer teaching, and the exhibition itself, as well as the numbers of those who attended from all parts of the county, shows that a genuine interest is being taken in the matter. A selection of the exhibits is to be sent to the Royal Agricultural Society's show at Lincoln.

A CONFERENCE will be held in Naini Tal this year, we learn from the *Pioneer* of Allahabad, for the purpose of considering many difficult questions connected with technical education, and if possible to devise some properly coordinated scheme which shall lead the way for the whole of India. In an enlightened editorial article the *Pioneer* reviews the objects the advocates of technical instruction have in view, and indicates many of the special requirements of the Indian population which must be borne in mind in devising a scheme suited to Eastern needs. It is pointed out that for the success of any system provision must be made for the different classes of workers engaged in modern productive industries, workmen or artisans, foremen or overseers, managers or masters, and that it is necessary to provide grades of technical education corresponding to primary, secondary, and university or higher education. The lowest grade is that which presents most difficulty in India. At the present time, the article states, it is impossible to give instruction in elementary science in Indian village schools, but something might be done to teach drawing and to give handicraft training by means of a form of apprenticeship to village craftsmen. It is proposed that the most promising of those so trained might then be assisted to undergo a course at an industrial school in the nearest large centre, and thus the instruction in the primary schools of the country could be brought in touch with modern needs, and a system commenced which would advance any scheme of technical education finally adopted. It is suggested that workshop practice could best be given in India in apprenticeship schools of the Continental type, and that evening classes would serve the purpose of improving the workmen and selecting those capable of profiting from a systematic course of higher study. No difficulty is anticipated so far as educating the foremen is concerned, and technical institutes of the right kind are recommended as the best way to provide higher technical education. Undoubtedly, the article continues, much has already been done in India to provide a system of technical education, and progress has been made by means of art schools, industrial schools, and engineering colleges, but there is a tendency to lose sight of modern developments, and the immediate need now is a systematic arrangement of the work at present undertaken.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, May 9.—"The Ascent of Water in Trees." (Second paper.) By Prof. A. J. **Ewart**. Communicated by Francis Darwin, For.Sec.R.S.

The experiments detailed or quoted tend to show that the continuous ascent of water is only possible in living wood, and that the power of conduction is rapidly lost on death, without any mechanical blocking of the vessels being necessarily responsible for the change. Hence we are forced to conclude that the living cells in tall trees continually restore the conditions for the ascent of water wherever these are affected by the excessive emptying of the vessels, and decrease the resistance to flow, as far as possible, by maintaining continuous water columns in parts at least of the wood. So long as these are present *ab initio*, a pumping action only becomes necessary in trees more than 20 to 50 metres in height, but suspended

columns cannot be maintained for any length of time in the vessels of tall trees without the aid of the living cells of the wood.

The energy required to pump water upwards in the tallest trees represents only a small fraction of that produced by the daily photosynthetic assimilation, and it is the feeble character and diffuseness of the pumping action which render it so difficult to demonstrate practically.

Experiments on the suction and exudation of trees at different levels and upon the influence of the entry of air and water under pressure showed that no continuous suspended water columns, or high internal tensions, existed in the conducting elements of the trees experimented on (maple and poplar) during active transpiration, or, indeed, at any period of the year.

The same was shown by direct measurements of the pressure in intact vessels of Wistaria during active transpiration. This fact, coupled with the high total resistance to flow, shows that this resistance is overcome locally from point to point, and not by any enormous tension from above or pressure from below, neither of which exists, nor could be maintained to a sufficient extent to carry on the elevation of water in a tall tree. A high tension from above leads to rapid blocking with air; a high pressure from below leads to great loss by lateral exudation from the vessels.

The surface adsorption of dissolved solids in the vessels plays a very important part in their function as translocatory channels, causing a delay in the ascent of dissolved solids, such as sugar and salts, and an accumulation of them along the outer walls of the vessels. The latter facilitates their outward diffusion, but at the same time renders the transference of small quantities of material between widely removed organs difficult or impossible.

The tallest trees in Australia do not appreciably exceed 300 feet in height, so that the values previously given for the maximal total resistance to the upward flow of sap in actively transpiring trees must be reduced to between thirty and fifty atmospheres.

May 30.—"Report of Private Expedition to Philippeville, Algeria, to View the Total Eclipse of the Sun on August 30, 1905." By Dr. T. C. **Porter** and W. P. **Colfox.**

The two observers camped out on a hill near the village of St. Charles, in lat. 36° 45′ 38″·7 N. and long. 6° 51′ 59″·1, and 690 feet above sea-level. The line of central eclipse passed directly over their station. They had magnificent weather on the day of the eclipse, and were able to carry out almost all the observations contemplated, both visual and photographic. Two simultaneous photographs were taken of the corona through two large Nicol prisms, the axes of which made angles of 45° with the horizon, and were at right angles to each other. The negatives, and also the reproductions given in the paper, show very strikingly the radial polarisation of the outer corona; one of the streamers, for example, can be traced with certainty from within 2′ 7″ to 2·2 diameters away from the moon's limb on *one* of these photos., whilst no part of it can be so traced on the other. There is unmistakable evidence in both photos. that the coronal development as a whole was more considerable on the N.E. limb of the sun, *i.e.* on the side where the great prominence was visible. The telescopic examination of the details of the inner corona on the N.E. limb proved exceptionally interesting, a superb radial "pillared" structure being seen, cut by the streamers at various angles, and limited externally by a very thin shell concentric with the sun, suggesting partial condensation and a possible differentiation of the "reversing layer" into concentric shells of vapours of varying condensability. Jets were also observed on the S.E. limb of a different colour from that of the prominences visible, their narrow stems being white, but passing into "rounded, soft-looking summits of the bluish-pink of the cyanogen flame." A photograph of the "coronium ring," taken with a specially prepared screen, revealed obvious jets, forty being easily counted on the enlarged negative, and it is shown in the paper that these must be attributed either to "coronium" itself or to some unknown element the radiation from which was capable of penetrating the screen used.

The so-called "shadow bands" were very well seen, both before and after totality, and are fully discussed in the paper. They were waved, and the waves seemed to have a motion of their own along the lines of shadow, which makes it almost certain that the true direction of travel of each band considered as a whole was *not* at right angles to its length, though at first sight the bands seemed to be so travelling. It was proved that the directions of the lengths of the bands coincided within the errors of experiment with the trace on the horizontal sheet on which they were observed of the plane passing through the cusps of the solar crescent and the sheet; the frequently observed rotation of their direction during the progress of an eclipse is accounted for. A full meteorological record was kept for a few days, both before and after the eclipse day, and the information gained is all exhibited on one chart, from which the reduced barometric height, the humidity, solar radiation, temperature of the air, direction and force of the wind, and amount and distribution of cloud, as well as its kind, can be read off for any hour of the day, and during the eclipse for every ten minutes. The total length of the certainly disturbed-barometer district at any one moment was some 5000 odd miles, the part of it *preceding* the *umbra* being some 200 miles shorter than that following it, and the barometric maximum seems to have travelled about 500 miles behind the centre of the umbra, and to have covered a region about the same number of miles in length, measured along the line of central totality. The eclipse wind is discussed, and seems to have been due to the inrush of air from all sides towards the centre of the shadow, the effect of this influx being superposed, at the station, on the northerly sea breeze. The direction of motion of the shadow bands had certainly a large northerly component, and thus their motion was also towards the line of central eclipse, thus following the general direction of the wind. A careful estimate of the height of the reflecting layers of matter in the earth's atmosphere, made by measuring the altitude of the orange glow seen near the horizon during central totality, gave six miles, a result coming very near the inferior limit given by many hundreds of observations in different latitudes by one of the observers.

The stars seen during totality were Venus, Mercury, Regulus, Spica, Arcturus, and Procyon.

"An Experimental Inquiry into the Nature of the Substances in Serum which influence Phagocytosis." (Second communication.) By George **Dean.** Communicated by Dr. C. J. Martin, F.R.S.

(1) Dilution of fresh unheated serum is not accompanied, so far as the higher concentrations are concerned, by a fall in the sensitising power for certain organisms (staphylococcus, tubercle bacillus). The diminution in this was found, as a rule, to begin at the quarter concentration.

(2) So far as the present experiments go, the points corresponding to the 1/4th, 1/8th, 1/16th, and 1/32nd dilutions of normal human serum lie on a parabola the equation of which is $y^2=4X$, *i.e.* for these dilutions the phagocytosis is proportional to the square root of the serum concentration.

(3) The phagocytic index obtained by mixing appropriate dilutions of a heated immune serum with a normal fresh serum is greater than results from the two substances acting separately.

(4) In the case of certain normal sera (guinea-pig and rabbit) previously investigated for amboceptor and complement in relation to the extra-corpuscular bacteriolysis of the typhoid bacillus (Wechsberg), an exact parallelism can be demonstrated to exist between that function and opsonisation. The normal amboceptor can be complemented by fresh serum in regard to both functions.

(5) An "anti-complement" serum, when mixed with a fresh normal serum alone or in a mixture containing heated immune serum, throws out of action the thermolabile substance, whereas it does not appear to influence the thermostable substance.

"The Correlation of the Ovarian and Uterine Functions." By E. S. **Carmichael** and Dr. F. H. A. **Marshall.** Communicated by Prof. E. A. Schäfer, F.R.S.

(1) The removal of the ovaries in young animals (rodents) prevents the development of the uterus and Fallopian tubes.

These remain in an infantile condition. The subsequent growth and general nutrition of the animals seem to be unaffected.

(2) The removal of the ovaries in adult animals (rodents) leads to fibrous degeneration of the uterus and Fallopian tubes (most marked in the mucous membrane). The animals' subsequent health and nutrition remain good.

These observations, for the most part, support the evidence obtained clinically in the human subject after surgical operation.

(3) The removal of the uterus in a young animal has no influence in preventing the further development of the ovaries. These are capable of ovulating and forming corpora lutea after adult life has been reached.

(4) The removal of the uterus in an adult animal does not give rise to any degenerative change in the ovaries, if the vascular connections of the latter remain intact.

These latter observations do not support the contentions of those surgeons who advocate subtotal hysterectomy, believing that the functional activity of the ovary is in some way dependent on the presence of the uterus.

"On Mitosis in Proliferating Epithelium." By Dr. J. O. Wakelin **Barratt.** Communicated by Prof. C. S. Sherrington, F.R.S.

(1) In epithelial proliferation brought about by scharlach R, both normal somatic and reduced mitoses occur. This statement applies to epithelium proliferating *in situ*, and also to the same implanted under the skin.

(2) In the reduction mitoses the number of chromosomes which could be counted varied from fourteen to eighteen. In the somatic form the number counted varied from twenty-eight to thirty-six.

(3) Reduction mitoses could be recognised less frequently than somatic mitoses.

(4) Post-reduction mitoses were met with.

(5) The character of the mitoses occurring was not definitely altered by implantation under the skin.

"The Solubility of Air in Fats, and its Relation to Caisson Disease." By Dr. H. M. **Vernon.** Communicated by Dr. J. S. Haldane, F.R.S.

At body temperature, fats dissolve more than five times as much nitrogen as an equal volume of water or blood plasma.

The special tendency of the fat-containing tissues (such as subcutaneous tissues, spinal cord, and peripheral nerves) of caisson workers and divers to suffer injury from the liberation of gas bubbles after rapid decompression is dependent on this great solubility.

Geological Society, June 5.—Sir Archibald Geikie, Sec.R.S., president, in the chair.—A marine fauna in the basement beds of the Bristol coalfield: Herbert **Bolton.** During exploration at the Ashton Vale Colliery, fossiliferous shales were traversed in the lowest Coal-measures resting upon the Millstone Grit. A section of the Coal-measures in this part of the coalfield is given, and the chief fossiliferous shale is localised at a depth of 84 feet below it. The feature of the fossils is their dwarfed condition. The thickness of the Millstone Grit appears to be about 980 feet. The palæontological description embodies a list of fossils from the marine horizon, which shows correspondence with the list from the marine beds associated with the gin coal of North Staffordshire, but it is not desirable to conclude that the horizons are identical until further evidence has been obtained from the Bristol area. The brachiopod fauna contains forms identical with or closely approximating to species occurring in the Cyathaxonia and Dibunophyllum zones. The description includes notes on Productus, Chonetes, Derbya, and Orthothetes, contributed by Dr. A. Vaughan, and new species of Chonetes, Raphistoma, and Loxonema.—Brachiopod morphology: Cincta, Eudesia, and the development of ribs: S. S. **Buckman.** The test ornament of brachiopods is found in three main phases, smooth, ribbed, and spinous, and of these a costate species is more advanced than a smooth one and less advanced than a spinose one. The first phase of development dealt with may be called the lenticular stage; the next phase would be the Cincta stage, in which the front margin is rounded in youth, truncate in adolescence, incipiently excavate and bilobate in the adult. The Cincta stage may develop in two directions—out of broad forms the quadrifid stage, out of narrow forms the cornute stage. The next development may be called the quadricarinate or trigonellid stage, and the fourth stage the multicarinate or *pectunculus* stage. In Eudesia there is a highly developed multicarinate stage. In degree of ribbing it is higher than Cincta, and even higher than the *pectunculus* stage, but both the ribbing and the loop forbid connection with Cincta.

Chemical Society, June 6.—Sir William Ramsay, K.C.B., F.R.S., president, in the chair.—The relation between absorption spectra and chemical constitution, part vii., pyridine and some of its derivatives: F. **Baker** and E. C. C. **Baly.** The absorption spectra of pyridine and the pyridones are consistent with the view that the nitrogen atom tends to restrain the motions of the ring, this restraint being very much lessened by the addition of acid to the solutions.—The interaction of methylene chloride and the sodium derivative of ethyl malonate: F. **Tutin.**—The constitution of the diazo-compounds: J. C. **Cain.** The author proposes for diazo-benzene chloride the quinonoid formula, which bears much analogy to the formula of quinonechloroimide, which, like diazo-salts, loses nitrogen on boiling with water.—Dibromoaminoazobenzene: J. T. **Hewitt** and N. **Walker.**—Phenol-*p*-sulphoxide: S. **Smiles** and A. W. **Bain.**—*p*-Cresol sulphoxide and sulphide: S. **Smiles** and T. P. **Hilditch.**—Molecular weight of β-naphthol in solution in solid naphthalene: E. P. **Perman** and J. H. **Davies.** It is concluded from vapour-pressure measurements that in dilute solutions β-naphthol has the same molecular weight as in the gaseous state, whilst it associates in more concentrated solutions.—Synthesis of hexatriene derivatives. (Preliminary note): Miss I. **Smedley.**—The reduction of aromatic nitro-compounds to azoxy-derivatives in acid solution: B. **Flurscheim** and T. **Simon.** The conditions which favour or prevent the formation of azoxy-products by reduction of nitro-bodies in acid solution have been determined.—Action of selenium and tellurium on arsine and stibine: F. **Jones.** It is found that the action of arsine and stibine on sulphur, selenium, and tellurium corresponds with the rise in the atomic weights of these elements, stibine being readily decomposed by sulphur, more slowly by selenium, and still more slowly by tellurium.—The double nitrites of mercury and the alkali metals: P. C. **Rây.**—Silver-mercuroso-mercuric hydroxynitrates and the isomorphous replacement of univalent mercury by silver: P. C. **Rây.**—The molecular weights of amides in various solvents: A. N. **Meldrum** and W. E. S. **Turner.**—Some experiments on the oxidising action of hydrogen peroxide: W. H. **Perkin,** jun. Brazilein, hæmatein, benzil, phenanthrenequinone, and aurin are oxidised by 30 per cent. hydrogen peroxide, yielding products which are still under investigation. Experiments are in progress with the view of determining the special conditions under which hydrogen peroxide may be employed with success in the investigation of such substances.—Action of hydroxylamine on *o*-benzoquinonediazides. 3 : 5-Dibromo-*o*-azoiminobenzoquinone: K. J. P. **Orton,** W. C. **Evans,** and E. **Morgan.**—Oxime formation and decomposition in presence of mineral acids: A. **Lapworth.** The conversion of stable hydroximido-compounds into the corresponding ketones or aldehydes is, as a rule, to be effected by the use of hydrochloric acid in presence of formaldehyde. The latter is converted into formic acid in the process, while the nitrogen of the oxime appears mainly as ammonium chloride. When benzaldehyde is substituted for formaldehyde, benzaldoxime and sometimes benzonitrile are formed.—Note on the constituents of the seeds of the Para rubber tree (*Hevea brasiliensis*): W. R. **Dunstan.** The kernels of the seeds of the Para rubber tree contain about 50 per cent. of a fixed oil resembling linseed oil. The seed kernels, when ground with water, evolve small quantities of hydrocyanic acid and acetone, whence it appears that a cyanogenetic glucoside is present, similar to, if not identical with, phaseolunatin. A mixture of enzymes was prepared from the seeds which probably includes, besides a lipase-like enzyme, one capable of decomposing the cyanogenetic glucoside. The nature of the fixed oil, the cyanogenetic glucoside, and the enzymes is being fully investigated in this and the related species, *Hevea pauciflora* and *Hevea confusa*.

Mineralogical Society, June 11.—Prof. H. A. Miers, F.R.S., president, in the chair.—Hamlinite from the Binnenthal: H. L. **Bowman.** A mineral occurring in small brown six-sided plates in the white dolomite, to which the name bowmanite was given by Mr. Solly in 1904, is shown by analysis to be identical with hamlinite. The crystals show a division into six biaxial sectors, and are consequently pseudohexagonal.—Faceted beads of zinc: T. V. **Barker.** The president described beads of zinc deposited on crucible lids by sublimation of zinc through oxide of tin. Some of these beads are covered with brilliant facets, and present the appearance of crystals rich in faces. Mr. Barker has found that they do not lie in zones or obey the laws of distribution of ordinary crystal faces, and cannot therefore be regarded as the faces of a single crystal. There is, however, no evidence, from etching by acid, that the bead is an aggregate of crystals. The nature of these remarkable faces is difficult to understand. A bead of platinum presenting the same peculiarities was measured by the late Prof. Miller.—Chlormanganokalite: Dr. H. J. **Johnston-Lavis** and L. J. **Spencer.** A preliminary account of this new Vesuvian mineral was given by Dr. Johnston-Lavis in NATURE on May 31, 1906. A new analysis of the mineral gives the formula $MnCl_2.4KCl$. The crystals are rhombohedral with a rhombohedral angle of 57° 36′; they are optically uniaxial with very weak positive birefringence; the refractive index is 1·59 and the specific gravity 2·31.—Mr. L. J. **Spencer** exhibited a suite of beautifully crystallised minerals, presented to the British Museum by Mr. Percy C. Tarbutt, from the Rhodesia Broken Hill mines in north-western Rhodesia. In driving a tunnel through one of the kopjes, which consist mainly of cerussite and hemimorphite, a cavern containing flint implements and bones of recent mammals was encountered, and a cavity in the bone-breccia on the floor of this cave was encrusted with magnificent groups of hopeite crystals (the rare hydrous zinc phosphate discovered by Sir David Brewster in 1823). In the vicinity of the cave, crystals of another hydrous zinc phosphate were found in association with descloizite (hydrous vanadate of lead and zinc). The crystals of this new species, for which the name *tarbuttite* is proposed, are anorthic; they possess a perfect cleavage in one direction, through which emerges obliquely the acute negative bisectrix of the optic axes. Cavities in the ordinary ore are lined with large twinned crystals of water-clear cerussite, which are encrusted with small crystals of hemimorphite.—A group of quartz crystals from British Guiana was exhibited by Mr. **Anderson,** and a fine crystal of apatite by Mr. **Gordon.**

Mathematical Society, June 13.—Prof. W. Burnside, president, in the chair.—The number of representations of a number as a sum of $2r$ squares, where $2r$ does not exceed 18: Dr. J. W. L. **Glaisher.**—An extension of Eisenstein's law of reciprocity: A. E. **Western.**—Note on a special set of classes of partial differential equations of the second order: Prof. A. R. **Forsyth.**—Various extensions of Abel's lemma: Prof. T. J. I'A. **Bromwich.**—The arithmetical nature of the coefficients of linear substitutions, third paper: Prof. W. **Burnside.**—The invariants of the quintic: Dr. H. F. **Baker.**—Informal communications were made as follows:—Certain singular points of surfaces: A. B. **Basset.**—The minimum necessary postulates as to a function to be defined as analytic over a region: Prof. E. B. **Elliott.**

Royal Astronomical Society, June 14.—Mr. H. F. Newall, president, in the chair.—The inclination of binary star orbits to the Galaxy: Prof. H. H. **Turner** and T. **Lewis.**—The illumination of the field of view, and its effect on observations with a transit instrument: Sir W. **Christie** and H. **Christie.**—The spectrum of Mira Ceti, as photographed at Stonyhurst College Observatory: Rev. W. **Sidgreaves.** The photographs were taken during the late maximum, from December 1, 1906, to January 3, 1907, with a Thorp objective prism and with a Hilger compound prism. The spectra were compared with that of the star during the previous maximum of 1897–8. The absorption spectrum was substantially the same, but the bands were much weaker in 1906, quite sufficiently so to account for the very bright maximum.—The origin of certain bands in the spectrum of sun-spots: A. **Fowler.** The bands are hazy lines, which had not hitherto been traced to their source, various experiments made in 1905–6 having given entirely negative results. The author, however, had lately found that many of the bands are part of a fluted spectrum, and can be accounted for by the presence in the umbræ of spots of a compound of magnesium and hydrogen (magnesium hydride). The identification appeared extremely probable from a comparison of visual observations, but is rendered quite certain by reference to the admirable photographs taken by Prof. Hale at the Mount Wilson Observatory. The identification supports the view that the vapours in spots are at a relatively low temperature.—Account of the instruments and work of the Mount Wilson Observatory, California: Prof. G. E. **Hale.** A large series of slides was shown on the screen, including spectroheliograph pictures of the solar surface taken in calcium and hydrogen light, comparison of which led to important conclusions as to the relative height of the flocculi. It was suggested that the areas of the flocculi should be systematically measured, and that they might furnish data for determination of the solar rotation. A series of photographic spectra of sun-spots was also shown. Prof. Hale stated that he had found that the heat of the sun caused an actual bending of the mirror employed, the front side becoming convex and the rear side concave. He proposed to obviate this disadvantage by employing mirrors of exceptional thickness, a 17-inch mirror being under construction which is as much as 13 inches thick. Other modifications in the instrumental equipment are also in progress.

PARIS.

Academy of Sciences, June 17.—M. Henri Becquerel in the chair.—The question of the origin of the lunar seas: MM. **Loewy** and **Puiseux.** The hypothesis of the formation of the lunar seas by external collisions is discussed and shown to depend upon very uncertain hypotheses, and even then is, taken alone, insufficient to account for all the facts.—The usual mode of publication of equatorial observations and on a means of improving it: G. **Bigourdan.**—Further remarks on the obliteration of the pleural cavity of elephants: Alfred **Giard.** Referring to a recent note on this subject by G. Vasse, the author remarks that the mere fact of the lungs separating easily is no proof of the existence of a pleural cavity, and quotes recent observations by Schmaltz, Ruge, and Chapman to support his point.—The preparation of anhydrous lithium moxoxide: M. **de Forcrand.** None of the methods previously used for preparing this substance gives a pure product. Purified lithium hydroxide, placed in a platinum or silver boat, is heated to 780° C. in a current of dry hydrogen. The conversion into Li_2O is complete in one hour.—A new method of diagnosis of tuberculosis in man by the tuberculin ophthalo-reaction: A. **Calmette.** One drop of a sterilised 1 per cent. aqueous solution of tuberculin is placed in the eye. After five or six hours, conjunctivitis, accompanied by copious secretions, becomes apparent in the tuberculous subjects. In non-tuberculous subjects the tuberculin is without effect. The author suggests the use of this in clinical work as a means of diagnosis, as the reaction is prompt, and neither pain nor permanent ill effects result.—Observations of the Daniel comet (1907*d*) made with the *coudé* equatorial of the Observatory of Lyons: J. **Guillaume.**—Observations of the Giacobini comet (1907*c*) made with the *coudé* equatorial at the Observatory of Lyons: J. **Guillaume.** This comet is of thirteenth to fourteenth magnitude.—A new method for resolving several problems on the development of an arbitrary function in infinite series: W. **Stekloff.**—The surfaces engendered by a circular helix: M. **Barré.**—The mechanical integration of the hodograph: L. **Filloux.**—The displacement of the absorption bands of crystals under the action of variations of temperature: Jean **Becquerel.** The bands of tysonite, parisite, and monazite are all displaced in the direction of the smaller wave-lengths when the temperature is lowered; in xenotime, however, a large number of bands move in the opposite direction.—A new method for the production of flame spectra of metallic bodies: G. A. **Hemsalech** and C. **de Watteville.** The air supplied to the lower part of a Bunsen burner carries some of the metal in a fine

state of division. To produce this the air passes through a glass bulb containing two electrodes of the metal under examination. About ten powerful sparks per second, furnished by a condenser of high capacity, are allowed to pass between the two electrodes. Sufficient of the metal is removed in this way to give a flame rich in lines. The actual quantity used, however, is extremely small, and is hardly weighable after some hours' sparking. The method is therefore peculiarly adapted for studying the spectra of rare and costly metals.—Photomicrography in colour with autochrome plates by A. and L. Lumière: Ch. A. François **Franck.**—Remark relating to the detection of calcium: H. **Baubigny.** A reclamation of priority as regards the use of an ammoniacal solution of potassium ferrocyanide as a characteristic test for calcium.—The absolute atomic weight of manganese: Gustavus D. **Hinrichs.** An application of the author's method of calculation to the experimental results of Baxter and Hines. The value 54·95 found by these workers is converted into 55 exactly by these calculations.—Arsenic acid and the methylarsenic acids: E. **Baud** and A. **Astruc.** A thermochemical paper.—The action of fluorine on selenium in the presence of glass: Paul **Lebeau.** Experimental reasons are given for assuming that the substance produced by the interaction of selenium and fluorine in the presence of glass is not pure selenium hexafluoride, but a mixture of at least two substances.—The solubility of alumina in aluminium sulphide and of magnesia in sulphide of magnesium: Marcel **Houdard.** The oxides of both magnesium and aluminium have been obtained in a crystalline form when fused with the corresponding sulphide in the electric furnace.—The alloys of nickel and tin: Em. **Vigouroux.** The alloys of nickel and tin containing up to 40 per cent. of the latter metal are feebly magnetic. Under the action of nitric acid and potash a non-magnetic alloy having the composition Ni_3Sn can be isolated.—The glycol of anethol; its transformation into anisylacetone: MM. **Tiffeneau** and **Daufresne.**—A new method of ring formation of the substituted pimelic and adipic acids: H. G. **Blanc.** The acid is converted into its anhydride by treatment with acetic anhydride, and this, followed by slow distillation, gives the corresponding cyclic ketone. The yields are very good; details are given of eleven ketones prepared according to this method.—The dimagnesium compound of 1:5-dibromopentane: V. **Grignard** and G. **Vignon.** Dibromopentane readily forms a dimagnesium compound, soluble in ether. A preliminary account is given of the reactions of this substance with carbon dioxide, ethyl acetate, and diacetyl.—The application of the method of limiting densities to the liquefiable gases: Ph. A. **Guye.** The difficulty with these is the accurate evaluation of the term A'_0, representing the deviation from Boyle's law. A linear extrapolation from densities measured at pressures between 0·5 and 1 atmosphere is not sufficiently accurate, and the three modes of parabolic extrapolation proposed by D. Berthelot do not lead to identical results. It is pointed out that, admitting the idea of a gas constant, the parabolic extrapolation will not hold good.—The kathodic phosphorescence of complex systems. The paralysing action exercised by certain exciters of the rare earth series upon others of the same series: G. **Urbain** and Clair **Seal.**—The colloidal properties of starch: E. **Fouard.**—The comparative action of extracts of barley and of malt upon the more resisting dextrins: J. **Wolff.**—The amount of oxygen in oxyhæmoglobin from the horse: MM. **Piettre** and **Vila.**—The polymorphic transformations of isomorphous mixtures of three bodies: Fred. **Wallerant.**—The inverse bundle of *Zilla macroptera*: C. **Gerber.**—The detection of invertine, sucrase, or saccharose in various organs of the vine and in some fruits: V. **Martinand.**—Protective and evasive autotomy: Henri **Piéron.**—The structure of the divided nerves in a strictly physiological evolution: N. A. **Barbieri.**—The geology of the central Sahara: R. **Chudeau.**—The presence of Carboniferous strata in the neighbourhood of Taoudeni, south-western Sahara: G. B. M. **Flamand.**—The post-helvetian eruptions anterior to the recent volcanoes in the north-west of Sardinia: M. **Deprat.**—The storm of May 22 1907, in the department of Loiret: M. **Maillard.**

DIARY OF SOCIETIES.

THURSDAY, JUNE 27.

ROYAL SOCIETY, at 4.30.—On the Dynamical Theory of Gratings: Lord Rayleigh, O.M., P.R.S.—On the Surface Tension of Liquids investigated by the Method of Jet Vibration: S. D. Pedersen.—Cases of Colour Blindness, No. VI. to No. XVIII., together with Eleven Selected Examples of Normal Colour Sensation: Dr. G. J. Burch, F.R.S.—On the Occurrence of Post-tetanic Tremor in Several Types of Muscles: Dr. D. F. Harris.—On the Pressure of Bile Secretion and the Mechanism of Bile Absorption in Obstruction of the Bile Duct: P. T. Herring and S. Simpson.—Further Studies of Gastrotoxic Serum (Progress Report): Dr. C. Bolton.—Observations on the Life-history of Leucocytes, Part III.: C. E. Walker.—The Annealing of Copper with Special Reference to Dilatation: Prof. T. Turner and D. M. Levy.—On a Standard of Mutual Induction: A. Campbell.—A New Current Weigher and a Determination of the E.M.F. of the Normal Weston Cadmium Cell: Prof. W. E. Ayrton, F.R.S., T. Mather, F.R.S., and F. E. Smith.—On the Velocity of the Kathode Particles emitted by Various Metals under the Influence of Röntgen Rays and its Bearing on the Theory of Atomic Disintegration: P. D. Innes.—On the Force Required to Stop a Moving Electrified Sphere: G. F. C. Searle, F.R.S.—Some Notes on Carbon at High Temperatures and Pressures: Hon. C. A. Parsons, C.B., F.R.S.—The Hard and Soft States in Ductile Metals: G. T. Beilby, F.R.S.—Ranges and Behaviour of Rifle Projectiles in the Air: A. Mallock, F.R.S.—Experiments on a New Kathode Dark Space in Helium and Hydrogen: F. W. Aston.—Note on the Use of the Radiometer in Observing Small Gas Pressures: Sir James Dewar, F.R.S.—And other Papers.

FRIDAY, JUNE 28.

PHYSICAL SOCIETY, at 5.—Demonstration of the Uses of his Hot Wire Oscillographs and Hot Wire Wattmeters: J. T. Irwin.—Experiments on the Production of Sand Ripples on the Sea Shore: Mrs. Ayrton.—(1) A Cosine Flicker Photometer; (2) Some Phenomena in Colour Vision: J. S. Dow.—Description and Exhibition of Students' Apparatus for Measuring Permeability and Hysteresis: Prof. W. E. Ayrton and T. Mather.

WEDNESDAY, JULY 3.

BRITISH ASTRONOMICAL ASSOCIATION, at 5.

THURSDAY, JULY 4.

CHEMICAL SOCIETY, at 8.30.—*iso*Nitroso and Nitrodimethyldihydroresorcin: P. Haas.—The Structure of Carbonium Salts: F. Baker.—Studies of Dynamic Isomerism, Part VI., The Influence of Impurities on the Mutarotation of Nitrocamphor: T. M. Lowry and E. H. Magson.—The Relation between Absorption Spectra and Chemical Constitution, Part VIII., The Phenyl Hydrazones and Osazones of α-Diketones: E. C. C. Baly, W. B. Tuck, E. G. Marsden, and M. Gazdar.—Permanganic Acid: M. M. P. Muir.

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