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*"To the solid ground
Of Nature trusts the mind which builds for aye."*—WORDSWORTH

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INDEX.

REVIEWS AND OUR BOOKSHELF.

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NATURE

A WEEKLY ILLUSTRATED JOURNAL OF SCIENCE

"To the solid ground
Of Nature trusts the mind which builds for aye."—WORDSWORTH.

THURSDAY, NOVEMBER 1, 1906.

SOME RECENT WORKS ON LOGIC.

(1) *Symbolic Logic and its Applications.* By Hugh MacColl. Pp. xi+141. (London: Longmans, Green and Co., 1906.) Price 4*s.* 6*d.* net.

(2) *The Development of Symbolic Logic.* By A. T. Shearman. Pp. xi+242. (London: Williams and Norgate, 1906.) Price 5*s.* net.

(3) *An Introduction to Logic.* By H. W. B. Joseph. Pp. vii+564. (Oxford: Clarendon Press, 1906.) Price 9*s.* 6*d.* net.

(4) *Thought and Things, or Genetic Logic.* By James Mark Baldwin. Vol. i. Functional Logic, or Genetic Theory of Knowledge. Pp. xiv+273. (London: Swan Sonnenschein and Co., Ltd., 1906.) Price 10*s.* 6*d.* net.

(1) WHETHER Mr. MacColl is the Athanasius of symbolic logic or only its Ishmael, the fact remains that he seems unable to come to an agreement with other exponents of the subject. But he contends that his system "in the elastic adaptability of its notation bears very much the same relation to other systems (including the ordinary formal logic of our text-books) as algebra bears to arithmetic." The present work contains the results of a series of researches dating from the year 1872. Portions have appeared at intervals in various magazines, English and French. Points on which he lays considerable stress, and in which he does not command the uniform assent of the other symbolic logicians, are these:—(*a*) that he takes statements and not terms to be in all cases and necessarily the ultimate constituents of symbolic reasoning; (*b*) that he goes quite beyond the ordinary notation of the symbolists in classifying propositions according to such attributes as true, false, certain, impossible, variable; (*c*) that in regard to the existential import of propositions, while other symbolists define the null class o as containing no members, and understand it as contained in every class, real or unreal, he, on the other hand, defines it as consisting of the null or unreal members o_1, o_2, o_3, &c., and considers it to be excluded from every real class. A chapter is devoted to the solution of Prof. Jevons's so-called inverse problem.

(2) The sub-title of Mr. Shearman's work is "A Critical-Historical Study of the Logical Calculus," and its author's chief object is to show that during the last fifty years a definite advance has been made by symbolic logic.

> "I have traced the growth of the subject," he writes, "from the time when Boole originated his generalisations to the time when Mr. Russell, pursuing for the most part the lines laid down by Peano, showed how to deal with a vastly wider range of problems than Boole ever considered."

He is careful to point out that the view which he expresses in his work as to the relation of mathematics to logic "is to be regarded as preferable only to the doctrines that were in vogue prior to the time of Peano's analysis of mathematical notions."

Mr. Shearman's opinions on some disputed points may be noted:—(*a*) He can see no valid reason why symbols may not designate now classes, and now propositions. "The only thing to be remembered is that the rules of procedure are not quite the same in the two cases." (*b*) He rejects all attempts to deal with any but assertoric propositions, and holds that if Mr. MacColl wishes to work with such data as probable and variable he should introduce new terms. (*c*) He regards it as practically impossible to elaborate a calculus based on intension.

In a footnote he directs attention to a remark of the late Prof. Adamson which seems to imply that all the intermediate processes in a solution ought to be intelligible. Our author believes, on the other hand, that "a calculus is a means of reaching correct conclusions by means of the mechanical application of a few logical rules, and it is quite possible that in the application of such rules unintelligible elements may temporarily appear." The doctrines of Prof. Jevons and Mr. MacColl are subjected to some severe criticisms, and Mr. Shearman holds that Prof. Jevons's actual contributions to the development of symbolic logic were few and relatively unimportant.

The last chapter contains a warm defence of the utility of symbolic logic, though the author does not claim that it can be used directly by natural science.

(3) Mr. Joseph's work is on very different lines from the two foregoing. It is an excellent and very sound exposition of the traditional logic for which Oxford has been famous ever since the days of Chaucer's Clerk. But if the matter is traditional, the manner of exposition is as fresh and independent as it could well be, and the author has entirely fulfilled the desire expressed in his preface not to teach anything to beginners which they should afterwards have merely to unlearn. Especially valuable are some of the discussions of particular topics, *e.g.* of the *principium individuationis* (on p. 76), or (on p. 275) of the passage from Aristotle's "Categories" which is sometimes quoted as a source of the "Dictum De Omni." We note, too, Mr. Joseph's irresistible objections to classificatory division by dichotomy, so zealously defended by Jevons and the others who won our earliest logical sympathies, and his rejection (in excellent company) of the doctrine of the inverse relation of extension and intension.

Mr. Joseph has interesting remarks to make on the relation between mathematics and logic, and a good statement of the doctrine that the principle of syllogistic inference cannot be made into the premiss of a particular syllogism without begging the question. His chapter entitled "The Presuppositions of Inductive Reasoning: the Law of Causation," is a model of clear and forcible reasoning. Mill's four methods, he finds, may be reduced to one "method of experimental inquiry," which is ultimately based on disjunctive reasoning, and the essence of which is "that you establish a particular hypothesis about the cause of a phenomenon, by showing that, consistently with the nature of the relation of cause and effect, the facts do not permit you to regard it as the effect of anything else."

There is a valuable seven-page discussion (pp. 352–8) of the inductive syllogism in Aristotle, whom the author seeks to defend—not without qualifications—from the objection that, after all, his induction rests on complete enumeration, and that thus *deduction* from any premiss so gained becomes a hollow pretence. Where the units are species, he points out, and one wants to prove something about the genus to which they belong, complete enumeration is possible and legitimate: but where the units are individuals, one does not (according to Aristotle) work by an inductive syllogism that summons all the instances; one learns the essential nature of the species to which they belong by induction, but the induction is now a psychological rather than a logical process, and we arrive at the conclusion, not through an inductive syllogism, but "in virtue of the necessary relation between the two terms which our familiarity with particulars makes possible, but which is the work of intellect or *nous*." We should have welcomed in this connection a detailed exposition of some of the difficulties in the concluding chapter of the Posterior Analytics.

(4) This volume is the first instalment of what promises to be an important inquiry, "inductive, psychological, genetic," into the actual movement of the function of knowledge. The author distinguishes genetic logic from formal (or the logician's) logic, and metaphysical logic (or logicism), and he describes genetic logic as the physiology and comparative morphology of knowledge—physiology because it examines function, and comparative morphology because "it asks about the relation of the forms and other logical determinations of the several modes of cognitive process to one another, and aims to make out an interpretation of the series of forms as conditioned upon functions."

Prof. Baldwin's account of the process by which cognition is built up is so coherent and intricate that it is impossible to give more than a fraction of its substance here. He begins with the condition of bare awareness of an object, the a-dualistic consciousness, examines the place of interest as a factor in the determination of the object, and the meaning of various terms like *disposition, autonomic, heteronomic, control, project, reality coefficient*; shows how "it is the stimulation, not the response, that is the controlling factor in the construction of sense objects," and how the first distinction is made in the perception of persons and things. Then he passes to image objects and memory objects, and discusses the process by which the inner-outer dualism is reached. This leads him to an examination of play or make-believe objects, and then we have three valuable chapters on various aspects of meaning. The last two chapters deal with the mind-body dualism and the dualism of subject and object.

The terminology of the work is not of the simplest, but behind it one finds that the writer has something true and important to say. Two other volumes—one on experimental logic and one on real logic—will complete the work, which is being published simultaneously in English and French.

A MANUAL OF PHARMACOLOGY.

A Manual of Pharmacology. By Dr. W. E. Dixon. Pp. xii+451; numerous curves, diagrams, and formulæ in the text. (London: Edward Arnold, 1906.) Price 15*s*. net.

PHARMACOLOGICAL literature in the English language has during the last few years increased considerably, and this is true even if we exclude the copious additions to this literature emanating from America. Students of pharmacology at the present time have at least three exhaustive text-books to choose from, all up to date, and written by teachers actively engaged both in teaching and original research. In each of these works the classification of the subject adopted is markedly different, from which, perhaps, the philosophical reader would be apt to infer that in the present state of our knowledge, whether of the action of drugs or of the chemical composition of their active ingredients, no absolute classification is possible. In the book before us prominence is certainly given in determining classification to the physiological action of the drugs in question, and in the present state of our knowledge perhaps a classification based upon such principles is the most satisfactory. The matter is, however, one of considerable difficulty, as nearly all drugs exert many physiological actions not always differing only in degree, but in some cases actually in kind. It is, from the nature of the case, therefore obligatory to take one action of a drug as determining its position in one or other group. As an instance we may cite caffeine. Dr. Dixon places this drug by virtue of its action in the group of diuretics; if we, however, follow the text we find that considerable space is of necessity devoted to the other, almost equally important, actions of this alkaloid.

It is difficult in a review of ordinary dimensions to do adequate justice to a work of this character, and in the remarks which follow we shall confine ourselves to a few salient points which strike us as being likely to interest the medical and general scientific reader. In the first place, it seems that on account of the entire absence of all reference to original literature the book is not intended to be a book of reference; further, the absence of information with regard to pharmacological technique obviously places the book in the library rather than in the laboratory. As the author states clearly in his preface, several of the facts are new, and doubtful statements have been verified by experiments performed in his own laboratory. In this connection we must say at once that the reader will have carefully to consider the magnitude of the evidence with regard to these new facts and verifications of doubtful ones. The therapeutics included in Dr. Dixon's work are only such as to illustrate the pharmacology; from this it clearly follows that the book is not intended for those engaged in the practice of medicine. Materia medica is only briefly dealt with, although in many cases very abstruse details and complicated formulæ with regard to the chemical composition of substances, such, for instance, as hydrastine, are given. We think such details cannot be of use to the ordinary student of pharmacology, and to be of any value to the pharmacological or chemical worker should be accompanied by a reference to the literature from which they are derived; and here we will observe that although in his preface the author mentions a list of standard works dealing with pharmacology and materia medica to which he is indebted, all reference, so far as we can find, to books dealing with the question of the chemical composition and reactions of, for instance, the alkaloids and their derivatives is omitted.

The first thirty-eight pages of the book are devoted to general considerations, amongst which perhaps the most attractive is a discussion of the relation between physiological action and chemical constitution. This interesting subject is treated at some length, and most of the important facts bearing upon it are carefully considered. Under the heading of the standardisation of drugs, the author discusses the question of physiological standardisation. He rightly directs attention to the extreme difficulty of standardising certain preparations according to their chemical content, and we entirely agree that, in the case of certain drugs, standardisation of a physiological type should be adopted; that is, different preparations should be compared with regard to their action upon a constant tissue unit. Such a method has been successfully adopted, under even more complicated conditions, in the comparison of the relative toxicity of certain sera. We must confess, however, that we are in this connection somewhat surprised to read that the cardiac glucosides can be standardised by perfusing the isolated rabbit's heart with Ringer's solution and subsequently adding the drug. The author must either be under some misconception with regard to the composition of Ringer's solution or be in possession of important facts which, so far as we are aware, he has not published.

From chapter iii. on, the book is devoted to descriptions of the characters, preparations, and physiological actions of the official, and some important unofficial, remedies and drugs. The action of each drug is most exhaustively considered, and in most cases illustrated by one or more curves, the result in the vast majority of cases of the author's own experimentation. The amount of space devoted to these curves is certainly a feature of the work, and renders to it, at least from one point of view, a unique value; as, however, usually no discussion of the conditions of the experiment accompanies the curves, the reader has too often to take upon trust the conclusions based upon them.

The mass of the pharmacology of the more purely inorganic substances is prefaced by a short but complete discussion of salt action and some of the chief bearings of modern physical chemistry upon pharmacological action.

The final chapter of the book is devoted to ferments, vegetable toxins, internal secretions, serum-therapy, and antagonism. The work concludes with an exhaustive index.

Dr. Dixon's "Manual" is certainly an important addition to standard pharmacological literature, and if in our opinion its educational value, taken as a whole, is less than that of certain of its contemporaries, this is to some extent due to the curious position its subject-matter holds in the complicated medical education of to-day. We have no hesitation in saying that it should be possessed by every pharmacologist and pharmacological laboratory, if only as containing a number of original experimental results worthy of control and further investigation.

A PIONEER IN BIOLOGY.

Jan Ingen-Housz. Sein Leben und sein Wirken als Naturforscher und Arzt. By Prof. Julius Wiesner. Unter Mitwirkung von Prof. Dr. Th. Escherich, Prof. E. Mach, Prof. R. von Toply, und Prof. Wegscheider. Pp. x+252. (Vienna: C. Kowegen, 1905.)

DR. WIESNER relates that on his becoming professor of plant physiology in the University of Vienna, more than thirty years ago, he resolved to become familiar with the work of the founders of that science. Soon he became peculiarly interested in the labours of Ingen-Housz, and found that his real worth had not been recognised. Much information was gathered that showed how many-sided his activities had been in science and in medicine, and Prof. Wiesner was induced by the meeting of the International Botanical Congress at Vienna to present the results of his labour of love in this volume. It must rank as a classic, admirable as a biography of a leader in research and as a history of scientific progress in a most important field of study.

Jan Ingen-Housz was born at Breda, in Brabant, South Holland, on December 8, 1730, and attended the higher school there until the age of sixteen, after which he continued his education in the Universities of Louvain, Leyden, Paris, and Edinburgh, even after he had graduated (at the age of twenty-two) in Louvain. From 1757 to 1765 he practised medicine in Breda, but, after the death of his father, he went to London, on the invitation of Sir John Pringle, the King's physician. Here he became acquainted with distinguished anatomists and medical men, and made a study of the method of inoculation for small-pox. From London he went to Vienna, by the wish of the Empress Maria Theresa, and introduced the use of inoculation there.

He frequently visited Switzerland, France, Holland, and England. For the last country he had an especial affection, regarding it as the land in which science was most honoured and furthered. He died in 1799, near London, while on a visit to the Marquis of Lansdowne.

Ingen-Housz approached the research which has brought him most fame—the relation of plants to the atmosphere—from the standpoints of the physicist and chemist rather than the botanist, and with a view to the value of green plants exposed to daylight as purifiers of the atmosphere from the products of animal respiration. He had busied himself with the physical problems of electricity, magnetism, optics, and heat, and had made useful contributions to their investigation. His researches in chemistry led to improvements in the preparation of matches and in other matters of practical value.

A very valuable advance in microscopical technique introduced by him was the use of a cover over the drops of water or other fluids in which the objects were included for examination. At first the covers were made of mica, but soon he employed thin glass covers, as is now the custom.

His researches into the nutrition of plants were for the most part carried on during his stay in Vienna, although his first work on the subject was published in London in 1779 under the title "Experiments upon Vegetables, discovering their great Power of Purifying the Common Air in the Sunshine, and of Injuring in the Shade and at Night." It was soon issued in German and Dutch translations.

When Ingen-Housz began the researches that led him to such great results it was generally taught that plants extracted from the soil the materials of which they were in want in the conditions in which they exist in the plant, and that nothing of importance required to, or did, pass off from plants. That gas was given off had been determined by Priestley and by Scheele, who had investigated the relations of green plants with the atmosphere; but Priestley arrived at the conclusion that these plants always freed the atmosphere from the "fixed air" (carbon dioxide) emitted by animals and emitted "dephlogisticated air" (oxygen), and Scheele believed that they always added to the amount of the "fixed air."

Ingen-Housz succeeded in showing that both these eminent chemists were right in part, the green parts in daylight emitting "dephlogisticated air," while parts not green at all times, and even green parts in darkness, like animals, emitted "fixed air." His views were combated, even Priestley joining in attacking them, and by his authority preventing their importance from being recognised as it deserved to be.

The new foundation for chemical investigation afforded by Lavoisier's discoveries was made use of by Ingen-Housz to explain more fully the nutrition of green plants than had been possible until the recognition of the composition of the "dephlogisticated air" and the "fixed air," and he showed that the carbon contained in plants is derived from the carbon dioxide of the atmosphere instead of from the soil as had been supposed by Senebier. He also showed that the carbon could be acquired by green plants only in light, and that carbon dioxide beyond a limited degree of concentration in the atmosphere proved harmful even to plants as well as to animals. He thus distinguished between the respiration and the assimilation in plants, a distinction not fully realised or taught by botanists until many years later. The value of humus and of vegetable manure as food for plants he ascribed, not to the substance being directly employed by the plants as food, but to its effect on the mineral contents of the soil, which were rendered more easy of absorption, and he demonstrated that diluted mineral acids produced similar beneficial effects. His later views on the nutrition of plants are given in "An Essay on the Food of Plants and the Renovation of Soils," which is contained in a collection of essays (in which it is No. 3) issued under the title "Additional Appendix to the Outlines of the Fifteenth Chapter of the Proposed General Report from the Board of Agriculture on the Subjects of Manures," London, 1796.

An appendix stating the sources of information about Ingen-Housz, with extracts from letters and a bibliography of his writings, adds to the value of the volume, and supports Prof. Wiesner's claim that he must be classed among the founders of botany, and that he showed singular ability also as an investigator in physics and in medicine.

ANALYSIS OF PAINTS.

The Chemistry of Paints and Paint Vehicles. By Clare H. Hall. Pp. vi+134. (London: Constable and Co., Ltd., 1906.) Price 8s. net.

THIS book or booklet is not intended to appeal to the artist, the house-painter, or the manufacturer, but to the young analyst who has had little or no experimental acquaintance with the materials discussed in its pages. The scope of the volume is indeed extremely limited, since it deals with the examination of only a few common pigments, and by no means exhaustively even with these; about some vehicles and diluents the information to be found in these pages is less meagre.

There are five chapters in this book, an appendix containing thirteen tables, and an adequate index. Chapter i. is devoted to the determination of certain constituents of common paints, and deals with aluminium, barium, carbon dioxide, chromium, iron, lead, magnesium, manganese, silicon, sulphur, and zinc. In this chapter, which occupies only fourteen pages, we are struck with the inadequate, and even puerile, drawing of the CO_2 apparatus shown in the figure on p. 3, and with the confused nomenclature of the two oxides of chromium. For example, on pp. 4 and 5 we are told that "all chromate compounds must be changed into the chromic state which is indicated by an intense green color," and that this "green color is due to chromic salts." The omission of any caution as to the non-volatile impurities commonly occurring in the hydrofluoric solution used in ascertaining the purity of silica is unfortunate.

The properties of a few common pigments, such as Prussian blue, ultramarine, ivory-black, umber, Vandyke brown, the mixture of lead chromate and Prussian blue wrongly called chrome green, iron-red, genuine and imitative vermilion, a number of white pigments or adulterants, chrome yellow, red lead, yellow ochre, and the siennas are dealt with. This list serves to show how many of the finer and choicer pigments, namely, aureolin, cadmium yellow, viridian, and cobalt-blue, are excluded from consideration. Nor can we agree with everything we find in these pages. Ivory- and bone-black are not "*combinations* of carbon, hydrocarbons, water and mineral matter." Graphite does not possess a "*brownish* gray" colour; and there are many words wrongly spelt in this chapter, such as analine for aniline, and limionite for limonite.

The examination of actual paints, and of such as are mixed ready for use, is dealt with in the third chapter. The preliminary treatment of oil-paints necessary before they can be tested or analysed is duly described. Chapter iv. is concerned with the matching of samples, while the final chapter is devoted to vehicles. Here will be found a more adequate, detailed treatment of the subject. On pp. 89–92, for instance, the curious drying oil called Chinese wood oil is described. This oil is used largely both in China and Japan, and is imported into America and Europe in increasing quantities. It is obtained from the seeds of *Aleurites Fordii* (Hemsley) and of other species of the same genus, as *A. cordata* and *A. trisperma*. Mr. C. H. Hall states (*loc. cit.*) that this oil, if heated to 285° C. to 300° C., suddenly solidifies into a jelly which is no longer soluble in the usual solvents, and cannot be reduced again to the liquid state. Mr. Hall's statement that Chinese wood oil, even in small proportion, confers upon paints the property of drying without gloss, and may be used as a substitute for wax in painting media intended to produce a dull or matt surface, seems to merit particular attention.

The thirteen tables of constants, coefficients, and specific gravities which constitute the appendix to this volume will be found useful by the analyst. There is a full index.

This little book, with all its imperfections and its immaturity, is not destitute of merit.

OUR BOOK SHELF.

British Rainfall, 1905. (Forty-fifth annual volume.) By Dr. Hugh Robert Mill. Pp. 271. (London: Edward Stanford, 1906.) Price 10*s*.

THE forty-fifth issue of this annual volume tells us better than any mere description could do of the healthy and active state of this voluntary rainfall organisation. When it is considered that more than 4000 individuals scattered over the British Isles read their rain-gauges at 9 o'clock every morning, enter their results on a form, and send in monthly returns to the central bureau at 62 Camden Square, and do all this voluntarily, it is impossible not to admire this band of enthusiasts for their united efforts in so good a cause.

The valuable collection of rainfall statistics is not, however, allowed to lie idle, for the energetic head of this organisation, Dr. H. R. Mill, with his small staff, brings all the facts together, and discusses the distribution of this rainfall both in space and time.

The present volume shows how well this work is carried out, and the observers must feel a great amount of satisfaction in seeing their united efforts so ably handled. Fronting p. 64 is a map indicating the positions of the 4096 rain-gauges at present in use, and one can see at a glance the districts where observers are urgently needed. Ireland and north and central Scotland are conspicuously in need of more volunteers, and it is hoped that many of the places mentioned in the text will soon be counted among the recording stations.

As meteorological readers of NATURE are fully acquainted with the general arrangement of the matter in these annual volumes, it is only necessary in this notice to direct attention to some of the discussions on the collected statistics. Thus, after a brief review of the recent important publication on the "Precipitation in the North German River Basins," compiled by Prof. Hellmann, we are presented with some valuable data on the relation of evaporation from a water surface to other meteorological phenomena. The section on heavy falls on rainfall days in 1905 will be found very interesting reading, and the numerous maps show at a glance the distribution of these falls over the country. After sections dealing with the distribution of rainfall in time, and a discussion of monthly rainfall, we come to the relation of the total fall of rain in 1905 to the average. To sum up in a few words the result of this discussion, it may be said that for the whole of England and Wales the general rainfall for 1905 was 16 per cent. below the average. In fact, so low was this figure that "except for 1902 and 1893 there has not been so dry a year in England since the memorable drought of 1887." It will be interesting to see how the present year's rainfall statistics compare with those of 1905. In 1905 Scotland as a whole had a deficiency of 5 per cent., while Ireland suffered to the extent of 12 per cent.

In addition to a great number of tables, the text is well supplied with numerous suitable maps and illustrations, making the volume a valuable summary of British rainfall for the past year.

W. J. S. L.

Technical Thermometry. Pp. ix+62. (Cambridge: The Cambridge Scientific Instrument Co., Ltd., 1906.)

THIS pamphlet contains detailed, illustrated descriptions of the various types of instruments for temperature measurement made or sold by the Cambridge Scientific Instrument Co., which has long been in the front rank in the manufacture of electric thermometers of all kinds.

It deals first with the well-known platinum resistance thermometers of the Callendar-Griffiths type. These are made in many different forms. Among the most interesting of the apparatus used in connection with them is the ingenious direct-reading temperature indicator, which gives without any calculation the direct centigrade or Fahrenheit temperature on the air-scale, with a sensitiveness of considerably less than 1° up to 1200° C. The various types of resistance-boxes used in accurate platinum thermometry are all arranged to be capable of self-verification. We believe that this self-testing type of resistance-box was among the first examples of a high-class physical instrument intentionally arranged by the makers to encourage periodical standardisation by the user rather than complete dependence upon the original adjustment. The Callendar recorders, in their various forms, can now be made to give with very low energy consumption continuous records of resistance, temperature, radiation, E.M.F., current or power within very wide limits.

Among the thermoelectric appliances is a new form of recording millivoltmeter, in which the galvanometer boom is depressed every half minute on to an inked thread, thereby leaving a dotted record on the paper. The instrument can be made sufficiently sensitive for recalescence curves. The radiation pyrometers of Prof. Féry are also described and illustrated. In these the radiation from the object the temperature of which is to be measured is concentrated upon a minute thermocouple at the focus of a mirror or lens, and the E.M.F. set up is measured in the ordinary way by a suitable millivoltmeter.

In an appendix are given an excellent summary of the principles of electric thermometry with tables of constants, and a list of trustworthy melting and boiling points obtained from the National Physical Laboratory; also a good bibliography of recent thermal research.

Astronomischer Jahresbericht. Band vii. Literature of 1905. By A. Berberich. Pp. xxxvii+646. (Berlin: Georg Reimer, 1906.) Price 20 marks.

THIS volume is the seventh issue of a series of most useful compilations, and it is a matter of deep regret that the founder and chief worker of such an admirable publication is no longer with us. Herr Walter Friedrich Wislicenus died last year on October 3, but, as we are told by Dr. Walter de Gruyter in a brief obituary notice, he contributed a considerable portion of the present volume. The frontispiece to this issue, therefore, fittingly presents us with an excellent portrait of the founder, whose place is now taken by Herr A. Berberich.

With regard to the book itself little need be said, except that the high standard of former years has been maintained. The 600 pages of references, with their brief and concise abstracts, cover the domain of astronomical literature for the past year, and a very complete name index concludes the volume. It may be incidentally remarked that the total solar eclipse of August, 1905, is responsible for no less than ninety-five references, which help somewhat to increase the bulk of the present volume.

Zoologischer Jahresbericht für 1905. Herausgegeben von der Zoologischen Station zu Neapel. Redigirt von Prof. Paul Mayer. (Berlin: R. Friedländer und Sohn, 1906.) Price 24 marks.

THE always welcome "Naples Jahresbericht" appears, as usual, well up to time, and its familiar features remain unchanged. Purely taxonomic papers are not included in the programme, but this limitation has been generously interpreted by some of the recorders. Where we have been able to test the lists we have found them full and accurate, and many of the summaries are models of terseness and clearness. If we look at the first section we are at once struck with the rapidly increasing number of important researches on the Protozoa; if we look at the last section we are similarly impressed with the number of papers dealing with Mendelian phenomena. The indefatigable editor, Dr. Paul Mayer, is responsible for the reports on Protozoa, Bryozoa, Brachiopoda, on part of the Arthropoda, and on general biology—truly a heavy piece of work for a man who does so much else. To him and to his *collaborateurs* we offer in the name of zoologists our hearty thanks.

LETTERS TO THE EDITOR.

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

Absorption of the Radio-active Emanations by Charcoal.

PROF. RUTHERFORD in his interesting letter in NATURE of October 25 (vol. lxxiv., p. 634) on the "Absorption of the Radio-active Emanations by Charcoal" has no doubt quite unintentionally mistaken the general results of my experiments, and therefore I feel that some slight addition ought to be made to his communication.

In the first paragraph of his letter Prof. Rutherford says that "the interesting property of certain kinds of charcoal, notably that of the cocoa-nut, of rapidly absorbing gases, *except the inert gases belonging to the argon family*, is now well known since the recent experiments of Sir James Dewar."

Now, the statement made in the part of the paragraph I have italicised is not accurate. In my papers entitled "The Absorption and Thermal Evolution of Gases Occluded in Charcoal" (Proc. Roy. Soc., 1904), "The Separation of the more Volatile Gases from Air without Liquefaction" (Proc. Roy. Soc., 1904), "Nouvelles Recherches sur la Liquefaction de l'Helium" (*Comptes rendus*, 1904), and "New Low Temperature Phenomena" (Proc. Roy. Inst., 1905), I have shown that all the inert gases without exception can be condensed in charcoal as effectively as ordinary gases provided corresponding conditions of temperature, pressure, and concentration are maintained.

In speaking of the "many avenues for future inquiry" opened up by the charcoal method of separating gases, I said (Proc. Roy. Soc., p. 130, 1904):—"The method I have described will be equally applicable to the treatment of the gaseous products from minerals containing helium, hydrogen, &c., and also to the radium products of the same kind. It seems even probable that the separation of the less volatile constituents in the air may be improved by a slight modification in the mode of working." As a matter of fact, at the time of these communications to the Royal Society in 1904, I had made a few experiments on the condensation of the radium emanation by charcoal *in vacua*, and also on the separation of krypton and xenon; but during the last two years my health has been so indifferent that many lines of investigation have had to be abandoned. In my Royal Institution lecture of June 6, 1905, I explained and exhibited the process of separating krypton and xenon, showing that a proportion of less than a millionth of these constituents in the atmosphere can be condensed and concentrated in charcoal cooled to the temperature of liquid air. Turning again to Prof. Rutherford's letter, his surprise about the absorption of the emanation of radium, thorium, and actinium by charcoal on the ground of being inert gases may be dismissed as nothing more than what we should anticipate; but the temperature at which the absorption by charcoal takes place raises some important questions.

To take an illustration (Proc. Roy. Inst., 1905), I have shown that charcoal cooled in solid carbonic acid at the temperature of 195° ab. is capable for a time of absorbing the carbonic acid present in air (amounting to, say, 3/1000 of an atmosphere) until the concentration rises to about 1 per cent. of the weight of the charcoal. If, on the other hand, the separation of the carbonic acid from the air had to be done by cooling alone, then the temperature of the air must be reduced below 129° ab., and about 100° ab. it would for practical purposes be nearly all removed. Thus charcoal about twice the absolute temperature required for condensation by mere cooling is for a small concentration of the gas undergoing absorption equally effective. We can compare now the behaviour of the radium emanation with that of carbonic acid. In the paper of Rutherford and Soddy on the condensation of radio-active emanation (*Phil. Mag.*, 1903) it is shown that the temperature has to be lowered below 138° ab. in order to condense the radium emanation, while it is complete by 123° ab. By analogy, therefore, we anticipate that at twice 138° ab. charcoal would still act as a condensating agent. This, then, brings us up to about the ordinary temperature, just what Rutherford has found to be sufficient. Such comparisons, however, may not necessarily mean that the radium emanation is comparable in volatility with carbonic acid at low temperatures.

The results of Rutherford and Soddy would seem to show that the radium emanation has a high latent heat of volatility, and consequently by all analogy a high boiling point. Thus they say (*Phil. Mag.*, 1903) that the radium emanation begins to volatilise at 118° ab., and by 119°·5 ab. the amount is increased four times. If we accept the view that the partial pressures of the emanation were in the ratio of one to four at the two temperatures given above, then we may apply the Rankin formula ($\log P = A - B/T$, where A and B are constants, P the pressure, and T the absolute temperature) and find the order of the value of the B which is proportional to the molecular latent heat, which in this case comes out 5662. Taking, again, the relative electrometer leaks by the statical method of 5, 3 at 126°·5 ab. and 0, 74 at 124°·5 ab., this gives 6735, which is of the same order of magnitude. The following values of the B constant for different bodies are useful for comparison:—

	B constant
Sulphur (solid)	4599
Mercury (liquid)	3170
Phosphorus (liquid)	2570
Carbonic acid (solid)	1353
Argon (liquid)	339
Xenon (liquid)	669

The calculated value of the B constant of the radium emanation is, then, twice the value for mercury and nine times the value for xenon. We need not press, however, the accuracy of the latent heat constant of the radium emanation too far, so let us divide it by two, which will make it of the order of the latent heat of mercury or phosphorus. Accepting for the moment such a value of the molecular latent heat, we cannot avoid inferring that the boiling point of the emanation may be relatively higher than one at first might anticipate. Even if we assume that the emanation represents a gas two steps higher in the periodic series than xenon, the B constant would by analogy be only a little more than 1000. The latent heat argument supports the view that the molecular weight of the emanation must also be high, and of the order of 200 or above it. Naturally the theoretical argument based on the value of the latent heat constant fails if it is not legitimate to use the electrometer measurements of Rutherford and Soddy as being equivalent to the ratios of the partial pressures of the radium emanation. JAMES DEWAR.

Royal Institution, October 29.

Radium and Geology.

FULLER consideration of the experimental evidence on the effects of concentration on the activity of radium convinces me that, on the whole, this is certainly against the *a priori* probable assumption that a large part of the activity is not spontaneous. I refer more especially to Prof. Rutherford's experiment on dilution, as touched on in my letter in NATURE of October 25. Other considerations lead to the same view.

The conclusion at issue is, however, too important to be left on the existing experimental basis. J. JOLY.

Geological Laboratory, Trinity College, Dublin.

The Evolution of the Colorado Spiderwort.

UNTIL recently the name *Tradescantia virginiana*, of Linnæus, was made to include a multitude of forms, without discrimination. However, as we go from east to west we observe a marked change in the spiderworts, corresponding with an equally marked change in climate. The more eastern forms of moist regions are tall and rank, with bright green foliage. The true *virginiana* has the pedicels and sepals villous, the hairs not glandular, and does not in any way suggest a xerophyte. In the middle west are two forms, *T. occidentalis* (Britton), bright green, but with narrow leaves and usually smaller flowers, the pedicels and sepals with gland-tipped hairs, and *T. reflexa*, Raf., glaucous, the pedicels glabrous, the sepals with a tuft of hairs at the apex. The latter is more especially southern, and is said to extend even to Florida. Still further west we find in New Mexico another form, *T. scopulorum*, of Rose, slender and much branched, glaucous, with glabrous pedicels and smooth sepals. Still again, we have in Colorado a distinct plant, which I have named *T. universitatis*.[1] This is strongly glaucous, robust, but not very tall, pedicels glabrous, with a very few gland-hairs, sepals glandular-pilose. The leaves are broad (the sheathing bases 12 mm. to 13 mm. wide), and the flowers are about 35 mm. across. There is no sign of any tuft of hairs at the apex of the sepals.

In all this we have a series of changes, not always simultaneous, from bright green to glaucous, and from simply villous pubescence to gland-tipped hairs. In some cases the leaves become narrower and the flowers smaller. It is easy to see in all this direct adaptation to drier conditions,[2] but it is not so easy to determine how it came about, or how far it may result from immediate influences modifying individuals of a plastic type. At Boulder, Colorado, the *T. universitatis* is a plant of spring and early summer, and has the characters just referred to. This year, however, a ditch was dug right through a place where the plants abounded, and many of them were covered up by the earth thrown out. To-day, September 30, I find that these plants have managed to sprout through the covering soil, and are now in full bloom. They are typical, except in one conspicuous character—the pedicels and sepals both are profusely gland-hairy. If one received these specimens, with the mere statement that they were gathered on the last day of September, noticing the profuse pilosity as well as the unusual time of flowering, one would readily take them for a distinct thing.

There seems to be some confusion about the plant originally named *occidentalis* by Britton. As first described, it was said to have narrowly linear leaves, and the first locality cited was Wisconsin. Rydberg, in his recent "Flora of Colorado," gives it a quite different range, no further east than Nebraska, and makes it include the Colorado plants. The name must go, however, with the plant originally described. T. D. A. COCKERELL.

University of Colorado, Boulder, Colorado,
September 30.

[1] Type locality, the Campus of the University of Colorado, at Boulder. Also common on the Campus of Colorado College at Colorado Springs.
[2] And, in part, more saline soil?

THE DYNAMICS OF BOWLING.[1]

FOLLOWING up their interesting volume on "Great Batsmen," the accomplished authors of "Great Bowlers and Fielders" have practically completed all that action photography can teach us regarding the methods of great cricketers. The present handsome volume with its 464 action photographs registers for all time the successive positions of the body in the act of bowling of some of the most celebrated bowlers of our day, and also certain very characteristic attitudes of a number of our best fielders. From the purely cricketing point of view the book must ever be of the most enthralling interest, not because it establishes any fundamentally new principle in the art of high-class bowling, but because it proves the wonderful variety of method by which different individual bowlers effect practically the same result. The movements of the body, arm, wrist, hand, and fingers are all coordinated to the one end of imparting to the ball a definite combination of translation and spin. It does not always happen that the bowler hits off the exact combination aimed at, but when he does the future progress of the ball through quiet air and off a good pitch is absolutely definite. There is no difficulty in understanding the dynamics of the "break"; the problem is simply that of a rotating sphere impinging obliquely on a rough surface, and is familiar to everyone who has handled a billiard cue with intelligence. The point of interest to the would-be bowler is how it is effected. This is discussed at considerable length in distinct parts of the book contributed by Messrs. F. R. Spofforth, B. J. T. Bosanquet, and R. O. Schwarz. The introductory chapter by the "Demon Bowler" (to whom the book is dedicated) is capital reading. It is, indeed, rather to be studied than read, and the same remark applies to Mr. Bosanquet's lucid and scientific discussion of the "off-breaking leg-break."

At the very outset it is obvious that no bowler can give to a cricket ball anything like the combined velocity and spin which can be so easily communicated to a golf ball, or even to a tennis ball. The comparative lightness of the latter enables the player to give it sufficient spin (with velocity) so as to call into action the differential air pressure, producing evident swerve. Tait, in his discussion of the golf-ball flight, showed that this swerving force (which acts at right angles to the plane containing the velocity and the axis of spin) may be taken as being proportional to the product of the translational and angular speeds. He estimated that it might attain a value equal to about four times the weight of the ball. In the case of the cricket ball it is doubtful if the deviating force due to air pressures acting on the progressing and rotating ball could ever become more than a small fraction of the weight. Then, as the rotation takes place in all over-hand delivery about an axis which makes at the most a small angle with the horizontal, it is clear that there is very little chance of a cricket ball *beginning* its swerve to right or left for the same reason that a golf ball is sliced or pulled. How, then, is the swerve to be explained? The matter crops up at intervals throughout the book, and is discussed at some length by Mr. Spofforth; but with all due regard to his authority as one of the greatest bowlers of all time, it is difficult to accept his explanation as in every respect sound. He says that "a ball which has check spin (that is, under-spin) on it, loses it through friction against the air during its flight; at the moment this occurs the ball slips the cushion of air it has made, especially in between the seams. What leads me to

FIG. 1.—W. Rhodes at the beginning of his final swing. From "Great Bowlers and Fielders."

this belief is that it is almost impossible to swerve unless the seam of the ball is up and down. The check spin keeps the seam vertical until the air-resistance causes the spin to cease altogether. At this point, especially if the ball has an upward tendency and the earth's power of attraction is asserting itself, the swerve will be great. To swerve, the ball must have some spin on it, but not much. If it has great spin it will never lose it in time to swerve, and I maintain that at the actual time of swerving the ball has ceased to spin, or nearly so." Further on he says that he has "never seen any bowler swerve with the wind," that "a bowler swerves more while the ball is new," that he does

[1] "Great Bowlers and Fielders. Their Methods at a Glance. By G. W. Beldam and C. B. Fry. Pp. xv+547; illustrated. (Macmillan and Co., Ltd., 1906.) Price 21s. net.

not believe "anyone (bowling as is usual twenty-one yards or less) can get the swerve unless he over-pitches the ball." The facts seem to be that for right or left swerving it is essential to have a cross wind blowing, a long-pitched ball, and some initial spin with the seam vertical, but not too much of it. It is difficult to believe that the air's resistance can effectually destroy this spin, seeing that the air has apparently very little effect in cutting down the spin which ultimately produces the break. The very fact that the ball is projected with a smaller spin to begin with will mean less effective frictional moment acting on the ball. Stokes, in fact, agreed with Tait that the frictional decay of spin in the case of a golf ball might be neglected to a first approximation, and we may assume the same for a cricket ball.

There is not the least doubt that spin with the seam vertical must produce "vertical swerve" to some extent, a downward or upward force acting on the ball in addition to gravity according as there is under-spin or over-spin. Probably most bowlers have an average amount of spin which they put on the ball. This will give what the batsman regards as the normally pitched ball of that bowler. Suppose this normal spin to be over-spin. Then it is clear that if the bowler diminishes the over-spin or gives an under-spin the pitch (*other things being equal*) will be lengthened, but if the over-spin is increased the pitch will be shortened. Again, if the normal spin is under-spin, a diminution of that will make the ball appear to drop shorter than the expected normal pitch. This is obviously one way of varying the pitch, and one which must be very deceptive to the batsman. This way of stating it might seem at first sight to be inconsistent with Spofforth's remark that "the vertical spin, unlike others, must have excessive check spin, which naturally impedes the flight of the ball from the start, and keeps it back from its true destination." It is difficult to see how check-spin can keep the ball back from the start. So far as motion through the air is concerned, there will be just as much retardation with the over-spin rotation as with the under-spin rotation. The word check-spin is, in fact, unfortunate, suggesting that it not only checks the progress of the ball after it strikes the ground—and that is the origin of the name—but also that it checks the ball as it moves through the air. In all probability the bowler, when putting on excessive check-spin, projects the ball with a somewhat smaller velocity than the motion of the arm would imply. The hand, in fact, must get ahead of the ball, as very clearly indicated in one of the photographs of R. O. Schwarz. With a pronounced under-spin a smaller velocity of projection is needed for a given length of pitch than when there is no spin, and the velocity of projection is less than what the motion of the arm would suggest. Hence the feeling of a retarded ball both to the bowler and the batsman. The direct effects of varying spins upon the trajectory as described above are true only when other conditions are the same, such as the velocity of projection and the height of the point of projection; but in giving different amounts of spin to a ball it is evident that these other conditions cannot be always the same. The conditions of the problem are indeed difficult to state, and one great merit of Mr. Beldam's action photographs is that they throw so much light on the way in which the ball leaves the hand.

FIG. 2.—J. Tunnicliffe securing a one-handed catch high up in the slips. From "Great Bowlers and Fielders."

But the outstanding difficulty is to explain the right or left swerve, and the action photographs give little help here. The main fact is that all swervers project the ball with the seam as nearly as possible in a vertical plane. In the grip the fingers do not touch the seam, although in some cases the thumb does. But evidently there is little purchase on the ball, which is projected with comparatively little spin. If cross wind is not absolutely essential it certainly greatly facilitates the swerve. With some bowlers the swerve is evident from the start; with others it begins to appear only during the latter half of the trajectory. The seam is really a roughened zone on which the air may be supposed to exert a greater frictional force than on the other parts of the ball, especially if the ball be new. With seam vertical and a cross wind blowing, certain definite dynamical effects will follow. One of these will be a tilting of the axis of rotation, a tilting which will, however, take place very slowly when the spin is excessive. This suggests the question, does the seam remain vertical throughout the flight of a swerving ball? The point might be settled by bowling a swerving ball against a blackened surface and finding which part of the ball first came in contact with the surface. That, however, is outside the purpose of the volume.

The questions of swerve and break have much scientific interest, but they cover only a part of the whole; and from a cricketing point of view much might be said, not only as to the excellence of the pictures, but as to the instruction conveyed by them and by the accompanying letterpress. Mr. Beldam has aimed at getting a succession of positions of each bowler, from the beginning of the final stride before delivery to the follow through after the ball is delivered. In a few cases the series begins even sooner. Where so much is excellent and characteristic it is difficult to choose, but here we have reproduced two pictures which will show to what a high degree of perfection Mr. Beldam has carried his photographic art. The one represents W. Rhodes at the beginning of his final swing, and is chosen partly because of the perfection with which the grip of the ball is indicated. The other is taken from the last quarter of the book, which treats of fielders, and is a remarkably fine picture of J. Tunnicliffe securing a "wide, high up, right-handed catch in the slips." This is one of a series showing Tunnicliffe bringing off difficult catches in most extraordinary attitudes.

Like its predecessor, "Great Batsmen," this volume is a treasure-house of portraits of many of the most conspicuous cricketers of to-day. It is further beautified by a good coloured reproduction of the portrait of F. R. Spofforth painted by H. S. Tuke, A.R.A.

C. G. K.

THE POSITION OF AGATHOCLES DURING THE ECLIPSE OF B.C. 310 *AUGUST* 15.

ON B.C. 310 August 14 Agathocles left Syracuse by sea; at eight o'clock on the following morning he saw a total eclipse of the sun. His exact position is therefore of extreme interest to astronomers. Unfortunately, the course that Agathocles steered is not directly stated. The present paper is an attempt to piece together the various clues contained in the narratives.

We may first briefly glimpse at the way in which Airy handled this question (Phil. Trans., 1853, p. 188). It appears that on August 20, after a six days' voyage, Agathocles landed in Africa at a place that Airy identifies with Alhowareah. Supposing that he went direct, the distance travelled in six days would be 200 miles; if he went round Sicily the distance would be 330 miles. Airy therefore marks off on a map thirty-three miles in a southerly direction and fifty-five miles in a northerly direction. He labels these positions as the "possible southern position" and "possible northern position," and he states in the text that the northern position is the more probable, partly because the distance is greater, and partly because the provision ships mentioned in the narrative probably came from Gela in the south.

To us, however, it appears totally incredible that Agathocles, after running from a superior enemy for twenty-four hours or thereabouts, should have been within fifty-five miles of his starting point. We will now proceed with our own attempt to reconstruct the situation.

The first point is that Agathocles started early in the morning, and to that extent had the more time in which to get to a distance from Syracuse. This is proved by an expression in the narrative of Diodorus:—"After six days and an equal number of nights, as dawn appeared" (ἐξ δ' ἡμέρας καὶ τὰς ἴσας νύκτας αὐτῶν πλευσάντων, ὑποφαινούσης τῆς ἕω). We have no wish to strain this expression to imply that he started at the exact instant of dawn on August 14. It clearly, however, implies that Agathocles was at sea for so great a part of August 14 as to render the phrase "six days and an equal number of nights" more exact than "five days and six nights."

Our second point is that Agathocles had a fair wind. We prove this as follows:—The Carthaginian fleet was blockading Syracuse, when some provision ships appeared in the neighbourhood. The Carthaginians went to attack the provision ships; Agathocles escaped from Syracuse; the Carthaginians left the provision ships and pursued Agathocles; the provision ships then entered Syracuse. It must be remembered that warships could be rowed, and that merchant vessels could only sail; and also that so late as the time of Nelson the power of beating to windward practically did not exist. The mere fact that the provision ships entered Syracuse therefore establishes the fact that the wind was favourable, both for the provision ships approaching Syracuse and for Agathocles flying from Syracuse; but other considerations will prove the same point. The Carthaginians, by leaving the provision ships when they had all but seized them (πλησίον ἤδη τῶν φορτηγῶν ὄντες), clearly had no intention of letting Agathocles escape. Before going to attack the provision ships they probably argued that the occasion would find Agathocles utterly unprepared, and that by the time he had put his men and stores on board they would themselves be back again. Now a stern chase is proverbially a long chase (and, moreover, would have taken them out of sight of Syracuse), and the Carthaginians could not have entertained hopes of getting back in time unless the provision ships lay to windward of them. Even as it was, Agathocles was ready for his opportunity. His men, we are expressly told, had been on board for some days (πληρώσας ἑξήκοντα ναῦς ἐπετήρει καιρὸν οἰκεῖον πρὸς τὸν ἔκπλουν), and he got to sea at exactly the right moment, that is to say, when the Carthaginians had all but reached the provision ships.

Agathocles therefore had a fair wind, and to that extent it is the more probable that he was at a considerable distance from Syracuse by the next morning.

Two minor points may here be noticed, though they are not essential to our main case. When the sixth day dawned Agathocles found himself in the vicinity of a Carthaginian fleet, not necessarily the same one. He rowed hard towards shore, and by virtue of a long start arrived first, although the Carthaginians were rapidly gaining on him, being more accustomed to rowing than the Syracusans (Justin). Possibly, therefore, Agathocles owed his escape on August 14 to the fact that he could sail instead of row. If so, his minimum pace would be seven knots, or otherwise he would have rowed, and the Carthaginians would perhaps have caught him. Again, we are ourselves convinced that Agathocles was expecting the appearance of the provision ships. It may be that he was merely prepared for any favourable opportunity, but there is much to prove that he laid his plans very carefully. He had, for instance, put saddles and bridles on board. He could not take horses with him, but he was prepared to use any he might capture on landing. On a subsequent occasion, thinking that the appearance of owls (as birds of good omen) would encourage his soldiers, he set some free, which he had evidently provided beforehand (Grote).

We have therefore established that by 8 a.m. on August 15 Agathocles had been at sea upwards of twenty-four hours, and that he started with a fair wind. He clearly did not stand out to sea more than was necessary, for to do so would be to abandon part of his start. The last and most important question is, therefore, did Agathocles go north or south?

Our third point is that Agathocles went north. Airy has already noted that the provision ships probably came from Gela, on the south coast of Sicily, since that was the only place still, after the battle of Himera two months previously, friendly to Agathocles (Grote). Airy also notes that even 330 miles is a short voyage for six days, and therefore that the longer course is more probable. Airy also makes a third point. "It is stated by Diodorus that the troops before sailing supposed that they were to make an attack either on Italy or on the Carthaginian part of Sicily; and by Justin, that, while on the voyage, they supposed that they were going on a marauding expedition either to Italy or to Sardinia." The passage in Justin is really stronger than as quoted by Airy; the troops did not realise at the time that it was Africa where they had landed (tunc primum exposito in Africae litore exercitu consilium suum omnibus aperit); they appear to have thought that they were in Italy or Sardinia, and consequently they must have passed through the Straits of Messina, and subsequently kept out of sight of land until Africa was reached.

If, as we believe, Agathocles had really planned events exactly as they turned out, he would have ordered his partisans at Gela to send provision ships directly there was a strong south wind, and he probably gave them to understand that he would come to their assistance, and that there would be a naval battle, in which the provision ships might turn the scale. Agathocles must have had bitter enemies in Gela, as he had just perpetrated an atrocious massacre there, and we may assume that his partisans there were bound to him by self-interest only, and had no idea of being sacrificed to the Carthaginians merely that Agathocles might escape.

Enough of his false plans had been allowed to leak out to the Carthaginians for them to suppose that he was coming out of Syracuse to give battle; it was only at the last moment that the Carthaginians, and perhaps also the men of Gela, realised that he was merely bent on escape from Syracuse. Meanwhile he had allowed his men to think that they were bound for Sardinia. Had they steered south his men would have thought that Agathocles was not acting according to a prearranged plan, but from hand to mouth as best he could. If they steered north his men would have felt the confidence engendered by seeing everything going according to the programme. If Agathocles had laid his plans beforehand, he would probably have collected information as to currents in the Straits of Messina, and would have known that, in the early afternoon of the day preceding new moon, there is a five-knot current running northwards (Mediterranean Pilot). This current may possibly have contributed materially to his escape, for he seems to have been hard pressed (ἀνελπίστου σωτηρίας ἔτυχε). If he went northward, it certainly adds ten miles to the distance he would otherwise have traversed by the time that he saw the eclipse.

P. H. COWELL.

SCIENTIFIC INVESTIGATION IN INDIA.[1]

THE Board of Scientific Advice was constituted in the year 1902 by the Government of India as a central authority for the coordination of official scientific inquiry, its object being to ensure that the work of research was distributed to the best advantage, that each investigator employed by Government should confine his researches to the subject with which he was most capable of dealing, and that energy should not be wasted by the useless duplication of work or misdirected by a lack of interdepartmental cooperation. It was, more especially, hoped by the Government that the Board would materially assist it in prosecuting research in those questions of economic or applied science which are of direct practical importance, and thus contribute towards the solution of those problems and matters on which the progressive prosperity of the country, more especially as regards its agricultural and industrial development, so largely depends.

The Board includes the Secretary to the Government in the Department of Revenue and Agriculture, which controls and administers the various scientific and semi-scientific departments, and the heads of those departments, including the Surveyor-General of India, the Director-General of Indian Observatories, the Directors of the Geological and Botanical Surveys of India, the Inspectors-General of Forests, of Agriculture, and of the Civil Veterinary Department.

It advises generally upon the operations of the departments, discusses the programmes of work and investigation of each departmental head, submits annually to Government a general programme of research embodying the proposals of departmental heads in so far as their subjects are to be exclusively dealt with in one department, and its own proposals when two or more departments are to cooperate, and also at the end of the year prepares a review stating briefly the actual results of the work of investigation carried out during the previous year in the scientific departments. The programmes and reviews are communicated through the Secretary of State to the Royal Society, which has selected suitable committees to consider the reports and advise Government chiefly on the scientific problems presented or indicated by the reports.

The necessity for some such arrangement has forced itself upon the Government of India with the rapid extension of scientific investigation during recent years. Private enterprise in such work is practically nil in India, and hence Government has to initiate all scientific investigation that is necessary for the well-being and progress of the Empire. India is at the present stage a country with limited resources, the development of which depends upon the application of modern scientific methods and knowledge to pressing economic problems. The heads of Government can gauge the requirements and initiate departments of inquiry and research, and state for

[1] Report of the Board of Scientific Advice for India for the Year 1904–5

their guidance the general problems with which they have to deal. In order to control the work of their scientific experts, and to direct it on utilitarian and practical lines, they have found out that it is desirable to obtain the opinion of their scientific officers as a whole, and of a final independent scientific authority, viz., the Royal Society. In this way the Government secures the cooperation of its whole body of scientific officers, and also the execution of the work of research in the most efficient and economical manner, and on the practical lines which it desires. Research is, in fact, directed to practical problems that require early solution, and is not wasted on inquiries which are only of importance from the theoretical standpoint.

The report is full of interest. It shows the wide range of problems with which the departments dealt in the year 1904–5, and the results of their work.

A series of experiments was carried out during the year at the Cawnpore experimental farm similar to those at Rothamsted. It was, for instance, ascertained that of the 43.3 inches of rain which fell during the monsoon period of 1904, 5 inches were required to make up the evaporation during the previous dry period; about 9 inches were taken up by evaporation during the monsoon, 4 inches ran off the surface during a very heavy fall in September, and the remainder, 25.7 inches, percolated. The records also established that the amount of percolation is proportionate to the rainfall, and that the quantity of water lost by evaporation from the soil is greater during the four months of the monsoon than during the eight months of the dry season. These results are in general accordance with the Rothamsted records, and hence probably apply to the whole of the plain of northern India.

The Geological Department issued during the year the results of a special investigation into the Dalhousie earthquake of April 4, 1905. It was one of the most destructive earthquakes which has visited India for many years. At least 20,000 human beings are estimated to have perished. The shock was sensibly appreciable over an area of 1,625,000 square miles. The main focus was at a depth of from eighteen to thirty miles below the surface in the Kangra district. The larger waves reached Bombay and Calcutta at almost exactly the same instant. As both places are at the same distance from Kangra, the rate of transmission in both directions was the same, viz. 1.98 miles per second. The seismograph records of Kodaikanal indicated a speed of 1.95 miles per second, and the Japanese seismographs 2.05 miles. The results hence apparently indicate that the earthquake waves travelled out to the east and south at a rate of almost exactly two miles per second.

The report of the Survey Department is especially interesting. The following extract gives a very brief account of the survey work carried out in Thibet during and after the expedition. "Triangulation was executed connecting Lhasa with India, and fixing all prominent peaks; the country was surveyed and charted on a scale of 4 inches to the mile; the valley of the Brahmaputra was surveyed from Shigatze to its source; the Manasarowar lake region was surveyed, as also the source of the Gartok branch of the Indus and the Thibetan source of the Sutlej. The work was carried out in the face of many difficulties in a country with an average elevation of 16,000 feet and a climate of Arctic severity." One of the interesting results of the expedition was to establish that Everest is, so far as is yet indicated by exact measurement, the highest peak in the Himalayas. Sir Richard Strachey, one of the greatest authorities on Himalayan geography, suggested many years ago the possibility of peaks exceeding 30,000 feet awaiting discovery. All recent investigation appears to establish that it is extremely improbable that there is any peak higher than Everest. It was also ascertained during the Thibetan survey that neither in Nepal nor Thibet is Mount Everest known to the inhabitants by any native name.

The pendulum operations of the Survey of India are furnishing results of great interest. By means of pendulum observations the force of gravity can be ascertained at any place, and as conducted by the survey with the greatest care and delicacy, it can be obtained with a probable error of less than 1 part in 100,000 of its actual value. The earliest observations of this class in India were carried out by Major Basevi upwards of thirty years ago in the western Himalayas. The results of his observations indicated that the force of gravity on the lower Himalayas was considerably less than its value as deduced by geodesists from theory. The deficiency in one case, that of Moré, at an elevation of 15,400 feet, was about 1/2000th part of its theoretical value, and equivalent to the reduction of what may be termed the effective level above the sea of Moré to only 700 feet. It was hence inferred that this deficiency was due to an actual deficiency of matter below, and hence generally that the excess of matter forming the Himalayas is probably, as a whole, compensated by a deficiency of matter in the interior of the earth beneath the mountain mass.

Major Lenox Conyngham recently carried out a lengthened series of pendulum observations. The chief results of his work are that there is a deficiency of gravity (that is, the actual is less than the theoretical value) along and over the outer ranges of the Himalayas. The compensation hitherto assumed to exist as a result of Basevi's measurements is shown by Conyngham's observations to be only partial and not complete. Further south, in the Indo-Gangetic plain, the deficiency disappears and is replaced by an excess. Probably when sufficient data are available it may be possible to formulate a theory of Himalayan structure.

Much valuable work was done during the year in the field of agricultural botany. Amongst the subjects of inquiry was that of the possible deterioration of the jute plant in Bengal. It was ascertained that there is not only no proof of any deterioration, but strong evidence that the plant is now precisely as it was a century and a half ago. The best kinds now, as then, if cultivated liberally, yield excellent crops, and their fibre, if properly extracted, is also excellent. Fraudulent watering in the preparation of the fibre is resorted to with the object of fictitiously increasing its weight for sale. The deterioration of the fibre (not the plant) is due to the fact that the demand for good jute exceeds the supply, and hence that inferior fibre is readily purchased.

As showing the value of the cooperation of the Board of Scientific Advice and the advisory committee of the Royal Society, it is sufficient to mention that they both suggested the necessity for increase of officers in the Geological Department in order to carry out the survey of the geology and mineralogy of Burma. The Government of India accepted the suggestion, and recently sanctioned the addition of four officers to the strength of that department.

The Board is, as shown by the report, doing valuable service in India by coordinating and promoting scientific work, and it is much to be wished that the English Government would adopt some similar plan, and revise the scheme of operations of its chief observatories at Greenwich, Kew, and South Kensington.

NOTES.

THE Bureau des Longitudes of France has decided to send to Samarkand a scientific expedition to observe the eclipse of the sun which will be visible in Central Asia on January 13, 1907. M. Stefanik, astronomer attached to the Meudon Observatory, who accompanied the director, Dr. Janssen, in the expedition for the observation of the solar eclipse of August, 1905, has been selected as the chief of next year's expedition. M. Hansky, of the Pulkowa Observatory, will join him at Samarkand, and will be in charge of the Russian expedition for the same eclipse. M. Stefanik, who is now completing his preparations for departure, will take a kinematograph to reproduce the principal scenes of the observation of the eclipse by the French, Russian, and other missions.

WEATHER prophecy in the United States promises to make a distinct step in advance with the commencement of November. Arrangements have been made with the Central Physical Observatory at St. Petersburg for reports practically covering the great land area lying between the Russian capital and the Pacific—a region embracing nearly one-half the girth of the globe. Cable communications with Iceland, together with the facilities now afforded for weather messages by wireless telegraphy, will complete the information for the entire zone of the earth's atmosphere. These facilities will enable the U.S. Weather Bureau to extend considerably the area covered by its present forecasts, and to issue them for a longer period in advance. In winter, which is the stormy period of the year, Iceland embraces about the centre of the Atlantic low-pressure area, and the barometer changes experienced will afford much useful information. Indian meteorologists have long gauged the importance of the weather conditions over Asia for the framing of long-period forecasts, and a careful study of the minor atmospheric changes over-riding the more permanent seasonal conditions of this vast continent will doubtless aid much in advancing our knowledge of atmospheric circulation.

REFERENCE has already been made (October 11, p. 591) to the banquet given to Sir William Perkin in New York on October 6. *Science* of October 19 contains a paper read on that occasion by Dr. Hugo Schweitzer describing the influence that the discovery of the mauve dye has had upon the progress of chemical science, and a report of Sir William Perkin's own account of the discovery of this dye and the development of the coal-tar colour industry started by it.

THE *British Medical Journal* announces that a congress of practical hygiene will be held in Paris on March 26–31, 1907, under the presidency of Prof. R. Blanchard. The work of the congress, which will deal with food, alcoholism, the rearing of children, the workshop, country life, and the colonies, will be distributed among eight sections. The general secretary of the congress is M. Schaer-Vézinet.

BEFORE leaving South Africa, Sir David Gill, K.C.B., F.R.S., who will retire in February next after occupying the post of Astronomer Royal at the Cape since 1879, was entertained at a farewell dinner. Science, art, politics, literature, commerce, and other spheres of human activity were represented, and many testimonies were borne to the services rendered to science and to South Africa by Sir David Gill. The Hon. E. H. Walton, in proposing the toast of "Our Guest," referred to the active part taken by Sir David Gill in founding the Association for the Advancement of Science in South Africa, his work in laying the foundations of a complete, accurate survey of the Cape peninsula, and his contributions to the progress of astronomical science by observations at the Cape Observatory established by him. In his reply, Sir David Gill took the opportunity to insist that all progress in the arts has followed the pursuit of pure science, and incidentally directed attention to his own efforts in organising new work and in urging the Government to provide funds to carry out necessary improvements.

THE *Home and Counties Magazine* for October contains an article, with portrait, on "Peter the wild boy," who was found in the forest of Hertswold, near Hanover, in 1725, and was brought to this country by order of Queen Caroline in the following year. After ineffectual attempts had been made to get him to speak and to educate him, he was ultimately established, first at one and then at a second farm near Northchurch, Herts, where he died in 1785. The current statements as to his great climbing powers and his habit of going about on all fours were denied by the then headmaster of Berkhamsted Free School, to whom Peter was well known. Various matters connected with local history, architecture, church-plate, monumental brasses, &c., form the subjects of the other articles in the same issue.

IN the course of an address delivered at the eighteenth annual meeting of the Association of Economic Entomologists, and published in Bulletin No. 60 of the Entomological Section of the U.S. Department of Agriculture, Mr. H. Garman alluded to the prominent position now occupied by the economic entomologist. He it is, the speaker claimed, who has enlisted the attention of the public and educated it to the importance of entomology as applied to agriculture and other human concerns. "The pure science worker would never have done this, and it thus has happened that the entomologist who was at one time looked down upon by his fellow-worker with something in the nature of disdain, has taken first place in the estimation of the general public and demands attention when the recluse laboratory worker gets little consideration. And this is as it should be. The economic entomologist can claim all entomology as his." The rest of the issue is mainly devoted to an account of the work of the U.S. Bureau in fighting insects injurious to man and cattle, or harmful to crops and trees in the United States and its dependencies. The attention of those concerned may be directed to the fact that, on account of preoccupation, the generic term Pyrosoma (see p. 17 of the Bulletin) is not available for the organism of Montana spotted fever.

Two additions to the literature arising out of the British Association visit to South Africa have recently reached us. One is a small illustrated handbook by Dr. Haddon, F.R.S., published by the Union Castle Company, and dealing with the general features of South Africa and his impressions formed during the visit. The other is a contribution by Mr. C. F. Rousselet on the Rotifera of South Africa in the Journal of the Royal Microscopical Society for August. It contains lists of all the known species of South Africa. As the author points out, collecting, except at such places as the Victoria Falls, was difficult owing to the shortness of the visit and the general dryness of the country, but if one may judge from the large ratio which Mr. Rousselet's specimens bear to the total number of recorded species there must be plenty of work for any residents who will search for ponds and ditches in any part of South Africa. On the ship, going and coming, Mr. Rousselet took daily observations of the plankton contained in the hose-water.

"EDIBLE Earth in New Guinea" is the title of a communication by Mr. W. Meigen published in *Briefe der Monatsberichte der deutschen geologischen Gesellschaft* (1905, pp. 557–564). The earth in question is found on the east side of New Mecklenburg, where it is associated with decomposed coral; its main constituents are oxides of silica and aluminium; there is a smaller quantity of ferric oxide and traces of other substances, including ammonia. Mineralogically, the earth is composed of kaolin, hydrargillite, and ferric oxide; it is a fatty clay of yellowish colour, not unpleasant to the taste, and composed of very small particles. It is used for medicinal purposes, and may well counteract the laxative effects of the fish diet of dwellers on the coast. The article mentions the more important previous contributions to the discussion of the question of edible earths, of which, however, but few analyses have been published. A recent paper was noticed in NATURE of September 27 (p. 543); in vol. xxxiii. of the Journal of the Royal Society of New South Wales was published the analysis of some kaolinite from Fiji.

THE Bulletin of the Johns Hopkins Hospital for October (xvii., No. 187), in addition to articles of medical interest, contains an account by Mr. D. I. Macht of Moses Maimonides, a celebrated Jewish philosopher of the thirteenth century, who was physician to the Sultan Saladin and his successor, and the author of many religious, philosophical, and medical works. In his "Ethics" a complete system of practical hygiene is given which would well compare with the most recent text-books on the subject; lack of exercise, over-eating, alcohol, and excess are summarised as the causes of most diseases. Dr. T. R. Boggs describes a simple method for the quantitative estimation of the proteids in milk. The diluted milk is precipitated with phosphotungstic acid in hydrochloric acid solution, and the volume of the precipitate is read off in an ordinary Esbach albuminometer tube as used in wine analysis. The method is accurate to within 0·3 per cent. to 0·7 per cent., according to controls made by Kjeldahl determinations.

As agriculture in the Virgin Islands is dependent upon small cultivators, progress is hampered by the want of capital. In the annual report for 1905–6 of the experiment station maintained at Tortola, the curator, Mr. Fishlock, notes that the peasants are gradually realising the advantage of planting such permanent crops as cacao, limes, and rubber. The department also fosters cotton cultivation by supplying seed, buying seed-cotton, and preparing the lint for market.

THE July number of the Trinidad Bulletin contains the annual report for the past year, by Mr. J. H. Hart, on the Botanical Department. Seedling canes, rubber, and cacao form the largest items under plant distribution; there was also a considerable demand for young trees of Honduras mahogany, *Mimusops globosa*, that furnishes *balata*, and *Cedrela odorata*, the West Indian cedar. With the view of popularising its cultivation, a large number of plants of *Coffea robusta* was given away. In a note on the nests of Trigona bees, it is observed that the peculiar trumpet-shaped entrance is connected with the danger to returning bees of being caught by a spider that lurks near the opening.

THE second number of the Memoirs of the Department of Agriculture in India is devoted to the subject of Indian wheat rusts. Three distinct species, *Puccinia graminis*, black rust, *Puccinia glumarum*, yellow rust, and *Puccinia triticina*, orange rust, are commonly found. It was observed in 1904 that the first was most rampant in Central India, while the latter two predominated further north, and therefore nearer the district where barberries are found. The authors, Mr. E. J. Butler and Mr. J. M. Hayman, have at present no explanation to offer for the origin of the disease year by year. The results obtained by inoculating barley with rust spores taken from wheat plants and *vice versâ* show a considerable degree of specialisation, as very few of the inoculations succeeded.

THE superintendent of the Indian Museum, Calcutta, mentions in his annual report for the year 1905–6 that a number of Tibetan and Bhutanese specimens, chiefly robes, brass ware, and religious objects, was added to the art and ethnological collections, also various agricultural instruments from Assam. The report of laboratory work by Mr. D. Hooper contains, as usual, several interesting analyses. From the shoot of the common bamboo a food product is prepared, known in Assam as *gass-tenga*, that is eaten with rice; this contains an acid similar to aspartic acid that is probably derived from asparagin. Specimens of the bark of *Picrasma javanica*, used by the Karens as a febrifuge, yielded a bitter principle allied to quassiin. The analyses of latices from a number of different species of Ficus show that of those examined *Ficus elastica* alone furnishes rubber of commercial importance.

ATTENTION is directed in the Journal of the Society of Arts (vol. liv., No. 2812) to the soda lakes of Mexico on the great desert south of Yuma. These vast lakes of crystals of carbonate of soda are within 3000 yards of the sea. They are the property of the Mexican Government, and it is believed that they may become sources of enormous income to the country.

THE British Commercial Agent in the United States reports that the plan of storing coal under water is being adopted at a new plant west of Chicago. Twelve large cement-lined pits have been constructed with a bottom of clay soil. Their storage capacity is 14,000 tons. A 12-inch water pipe opens to the pits near the top, so that the coal can be flooded when required.

IN the *Engineering Magazine* (vol. xxxii., No. 1) Mr. Alfred Sang urges the practical value of industrial museums as exemplified by the Conservatoire des Arts et Métiers in Paris, and what was originally the Patent Office Museum at South Kensington. While satisfactory results must depend upon a board of management composed of experts in the various branches of science and of industry represented, the author gives examples of exhibits that would prove of special benefit to students.

IN the Journal of the Franklin Institute (vol. clxii., No. 4) Prof. Alfred J. Henry, of the U.S. Weather Bureau, gives an account of weather forecasting by synoptic charts. The method is based on two well-established facts, the general eastward drift of the atmosphere in temperate latitudes in the northern hemisphere, and the close relation that subsists between the weather and the distribution of atmospheric pressure. Within recent years there has been an appreciable gain in the accuracy of the forecasts. The period covered by the forecasts has been extended from eight to forty-eight hours, and instead of forecasts expressed in very general terms for large areas, definite forecasts are now made for all the larger towns and for each of the States and territories. The most important gain however, is in the adaptation of the forecasts to the needs of special industries, the perfection of the system of flood warnings, and the general improvement in the warnings of severe storms and cold waves.

THE second part, dealing with labour, of the General Report on Mines and Quarries, has been issued by the Home Office as a parliamentary paper (Cd. 3179, price 10*d.*). It shows that the total number of persons employed at British mines and quarries in 1905 was 982,343, of whom 887,524 were employed at mines and 94,819 at quarries. During the year, 1103 separate fatal accidents occurred at mines and quarries, causing the loss of 1304 lives. Compared with the previous year, there is a decrease of fifty-five in the number of fatal accidents, and an increase of 102 in the number of lives lost. The general death-rate from accidents at mines was 1·358 per 1000 persons employed. Of the fatal accidents at mines, 44·0 per cent. were caused by falls of ground. Five fatal accidents were caused by the use of electricity underground. A very unusual accident is reported at Llanhilleth Colliery, where one man was killed and six men injured by the sudden blast of air caused by a fall from the side of a cavity. Some interesting statistics are given showing that gunpowder constituted more than 67 per cent. of the total weight of explosives used in collieries. About 30 per cent. of the weight used consisted of permitted explosives, those most largely used being bobbinite, saxonite, ammonite, roburite, and westfalite. Other statistics show that there were 295 collieries where coal-cutting machines were at work, the total number of machines being 946. The total quantity of coal obtained by the aid of these machines in 1905 was 8,102,197 tons.

WE have received from the director of the Geological Commission, Cape Town, South Africa, the first separately issued sheet of the geological map of Cape Colony. The geology is by the director, Mr. A. W. Rogers, Mr. E. H. L. Schwartz, and Mr. A. L. Du Toit. The colour printing is clear, and there is not too much detail. The size of the imprint is 21½ inches by 27 inches; the scale is 1 inch = 1600 Cape roods, which is equivalent to about 3·7 miles to the inch. The commission is to be congratulated upon the production of an excellent map.

PART i., vol. xxxiv., of the Records of the Geological Survey of India contains two reports upon occurrences of coal, one in the foothills of Bhutan, by G. E. Pilgrim, the other in the Kotli Tehsil of the Jammu State (Dandli coalfield), by C. M. P. Wright. Mr. Pilgrim contributes also some notes on the geology of Bhutan; Dr. Diener supplies notes on some fossils from the Halorites limestone of Bambanag Cliff, in which he describes a new genus, Martolites, near to Celtites of Mojsisovics, and a new species of Halorites, *H. trotteri*. He also describes the Upper Triassic fauna of Pishin. In the appendix, analyses are given of three samples of muds from the Travancore coast.

THE *Rendiconto* of the Bologna Academy is sometimes rather late in appearance, but the three last numbers (1902–5) contain one or two papers of more than passing interest. Prof. Guido Tizzoni, in the name of Dr. Bongiovanni, read a note on the influence of radium on the virus of rabies. It was shown that radium rays rapidly destroyed the virus, both when contained in tubes and when applied to animals within an hour or so of their infection, and methods were found by which animals already suffering could be cured with certain results. The previous number (vol. viii.) contains an account of the botanical results of the two scientific expeditions to Montenegro organised by the Italian Government in 1902 and 1903.

A PAPER by M. Edouard Collignon on the solution of the cubic equation is published in abstract in the Proceedings of the Edinburgh Mathematical Society, xxiv. (1906). It is based on the property that every cubic can be reduced to one of the three forms $x^3 = \text{constant}$ or $x^3 \pm x = \text{constant}$. By tabulating the values of $x^3 + x$ and $x^3 - x$ for different values of x, the roots may be found in the same way that antilogarithms are taken from a table of logarithms. The properties of the roots are discussed in connection with the graphs of $x^3 \pm x$, and it will be noticed without going further into the details of the paper that the turning points of the curves determine very simply the conditions for three or one real roots. The author examines how far a similar method is applicable to curves of higher degree.

WE have often directed attention to the excellent series of monthly volumes entitled the *Practical Photographer*, edited by the Rev. F. C. Lambert, and published by Messrs. Hodder and Stoughton. It was found that the size of page was rather too small to show off effectively the fine reproductions from well-known photographs which were a distinct feature of the series. In April last the size of page was doubled, and since that date we have received the monthly issues, which indicate the wise policy of such a change. The present series is now termed the *Practical and Pictorial Photographer*, and is issued as a library series, the price being the same as the previous volumes, namely, one shilling. The October number is full of interesting matter, and is illustrated by seventeen reproductions.

FROM Messrs. Newton and Co. we have received a simple convex lens of 2·5 inches diameter, having a focal length of about 6 feet. On a small portion of the periphery of the lens is firmly sealed a metal base carrying a small screw, which enables the lens to be easily fixed to the end of a walking-stick or umbrella. The lens and attachment are enclosed in a neat leather case, which can be comfortably carried in the waistcoat pocket. This "unilens," which has recently been patented by Major Baden-Powell, serves the purpose of a low-power pair of opera-glasses without the trouble of carrying them. The use of such a lens in this manner is not new, but the present form of mounting will make it of more general service than hitherto. Those who possess approximately normal eyesight would find great comfort in having ready at hand such an easy means of magnifying distant objects. When placed on the end of a stick, and the latter held out at arm's length, the object observed is seen at the greatest magnification, and even at less distances the object is always in focus, but not so much enlarged. The simplicity and portability of this "unilens" should find favour with many who are in search of a pocket telescope.

THE first part, comprising no less than 1437 titles, of a valuable catalogue of important works, chiefly old and rare, on mathematics, astronomy, physics, chemistry, and kindred subjects, has just been issued by Messrs. H. Sotheran and Co. This "Bibliotheca Chemico-mathematica" will be completed in three or four parts, which will be issued at intervals of a few months each. The part just received has on the first page works by Ernst Abbe, Abel, and Abercromby, and the last titles are of works by Galileo. Among numerous other volumes and memoirs included in the catalogue are a copy of the very rare first edition of the great work of Copernicus, "De Revolutionibus Orbium Cœlestium" (1543), which commenced a new epoch in the history of astronomy; the first printed edition of Euclid's "Elementa Geometriæ" (1482); the first edition of de Caus's "Les Raisons des Forces mouvantes" (1615), to which, according to Arago, is due the invention of the steam engine; Daguerre's description of his invention of the Daguerreotype process of photography (1839), and the earliest works on ballooning. Bibliophiles and librarians looking out for scientific works of great rarity and interest, or for volumes of Proceedings of scientific societies and standard books on the exact sciences, will find it an advantage to consult the interesting catalogue the first part of which Messrs. Sotheran have just published.

MESSRS. GEORGE PHILIP AND SON, LTD., will shortly issue a novel perpetual calendar invented by the Rev. J. W. Wiles. It is claimed that by a simple arrangement the calendar will show the day of the week of any day in any year from the beginning of the Christian era to the end of time.

MR. W. A. SHENSTONE, F.R.S., has revised, and in some instances amplified, the essays he recently contributed to the *Cornhill Magazine*, and they will be published by Messrs. Smith, Elder and Co. to-morrow under the title of "The New Physics and Chemistry: a Series of Popular Essays on Physical and Chemical Subjects."

MESSRS. ARCHIBALD CONSTABLE AND CO., LTD., will publish very shortly a volume by Prof. E. Ray Lankester, F.R.S., entitled "The Kingdom of Man," containing a statement of the present position of scientific knowledge and the promise of the future.

THE second quarterly number of *Science Progress in the Twentieth Century* has now been published by Mr. John Murray. The ten articles included in this issue of the new scientific quarterly review range over many departments of science, and should appeal to a wide circle of readers.

THE first parts of two works of science which are being published serially by Mr. Fritz Lehmann, Stuttgart, have been received. "The Macrolepidoptera of the World," by Dr. Adalbert Seitz, is to be completed in 100 parts, and "Das Mineralreich," by Dr. Reinhard Brauns, in seventy-five parts. Both works are illustrated by excellently produced coloured plates. Messrs. Williams and Norgate are the agents of the publishers in this country.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN NOVEMBER:—

Nov. 5. 11h. 24m. to 12h. 34m. Moon occults ν Geminorum (mag. 4·1).
9. 9h. Mercury at greatest elongation (E. 23° 0').
10. 12h. 17m. to 13h. 33m. Transit of Jupiter's Sat. IV. (Callisto).
11. 7h. 15m. to 10h. 15m. Transit of Jupiter's Sat. III. (Ganymede).
15. Saturn. Major axis of outer ring $=41''·27$; minor $4''·64$.
,, 9h. 33m. Minimum of Algol (β Persei).
15. Venus. Illuminated portion of disc $=0·070$; of Mars $=0·959$.
15–16. Epoch of November Leonids (Radiant $151° + 23°$).
17–21. Epoch of November Andromedids (Radiant $25° + 43°$).
18. 6h. 21m. Minimum of Algol (β Persei).
18. 10h. 45m. to 13h. 46m. Transit of Jupiter's Sat. III. (Ganymede).
19. 5h. 30m. to 6h. 34m. Moon occults o Sagittarii (mag. 3·9).
25. 14h. 11m. to 17h. 12m. Transit of Jupiter's Sat. III. (Ganymede).

GREENWICH OBSERVATORY AND THE POWER STATION.—At the meeting of the Astronomische Gesellschaft recently held in Jena (September 12–15) Dr. Foerster directed attention to the erection of the large generating station near to Greenwich Observatory, and the consequent interference with the work of the institution. After Prof. Dyson had described the unfavourable position in which the observatory is situated, a resolution having the following effect was passed:—That the convention of the International Astronomische Gesellschaft, meeting in Jena, in view of the communication made in the latest report of the Greenwich Observatory, expresses the hope that the loss which would be occasioned if the observatory were removed may be averted. The resolution also expressed the hope that, as Greenwich has succeeded in establishing itself as the standard place, all future proposals to remove it may likewise be averted (*Astronomische Nachrichten*, No. 4127).

LUNAR CHANGES.—In No. 588 of the *Astronomical Journal* Prof. W. H. Pickering discusses Mr. Stebbins's observations of the lunar crater Linné, made during the eclipse of the moon which took place on February 8, 1906, and compares them with the similar observations made at the same time by Prof. Frost. Although some slight doubt exists as to the precision of one or two of Mr. Stebbins's measures, the curve showing the change in diameter of the spot surrounding Linné, according to his observations, agrees in general with the similar one obtained by Prof. Frost. Both show a substantial increase in the diameter immediately after the passing of the earth's shadow. Prof. Pickering ascribes this increase of diameter to the deposition of hoar-frost, or something analogous to it, caused by the drop in temperature consequent upon the screening off of the sun's rays by the opaque body of the earth. This phenomenon has now been observed by six observers working quite independently, several of whom were originally prejudiced against it, therefore Prof. Pickering considers that it may be accepted as confirmed.

The variation of the diameter of the spot during the ordinary course of lunation has similarly been confirmed by several observers, one of whom, Dr. C. W. Wirtz, discusses his observations at some length in No. 4118 of the *Astronomische Nachrichten*.

ECLIPSE OBSERVATIONS.—In No. 9, vol. xxxv., of the *Memorie della Società degli Spettroscopisti Italiani*, Prof. Riccò concludes his account of the eclipse observations made by the Italian expedition to Alcala de Chivert in August, 1905. Among other matters he discusses "white prominences," and describes those seen during the eclipse in question as faint and indistinct, especially in the lower parts, and appearing as little more than a whitish shadow projected on to the background of the corona. He also suggests that these objects are in nature somewhat of an intermediate stage between the prominences and the true coronal streamers.

Estimating the height of the various layers of the solar atmosphere by two independent methods, Prof. Riccò found that that which he calls the "reversing layer," or the stratum producing the so-called "flash spectrum," extends to some $3''$ or 2000 km. (1250 miles). That part of the chromosphere which emits D_3 and F especially has a height of about $7''$ to $9''$, whilst the calcium vapours of the chromosphere extend to about $15''$ from the base. Photographs taken on special plates with a prismatic camera show that the maximum brightness of the continuous spectrum of the corona occurs in the yellow and red regions.

THE ZODIACAL LIGHT.—During the past summer Prof. Barnard, at the Yerkes Observatory, made a number of observations of the zodiacal light, the results of which he now publishes in No. 2, vol. xxiv., of the *Astrophysical Journal*. On June 22 he paid special attention to the phenomenon, and found it to be much more extensive than he had previously supposed. He concludes that the light extends at least 65° north and south of the sun (assuming the southern extent to be the same as the northern), a value considerably larger than that arrived at by Prof. Newcomb, observing in Switzerland, in the summer of 1905.

THE MIRA MAXIMUM OF 1906.—In No. 4110 of the *Astronomische Nachrichten* Prof. Nijland publishes the results of his observations of Mira made during the period August 24, 1905, to February 24, 1906. The curve accompanying the paper shows that a sharp maximum occurred on January 3, when the star's magnitude was 3·9. This was preceded by a very flat minimum of about the ninth magnitude, extending from the commencement of the observations until November 9, 1905, and then a steep ascent to the maximum. The lowest magnitude, 9·05, occurred on September 23, 1905.

METEOROLOGY OF THE NILE VALLEY.[1]

THE Egyptian Survey Department, constituted some years ago, is adding largely and rapidly to our knowledge of the hydrography, geology, and meteorology of the Nile basin. The director-general, Captain Lyons, R.E., has prepared and issued a monograph dealing very fully with the physiography of the Nile basin. In this work, which was reviewed in NATURE of September 6 (vol. lxxiv., p. 461), he combines the results of former observers and investigators with the data accumulated during the past ten or twelve years by his department. It is a storehouse of information relating to that most remarkable, and until recent years most mysterious, of rivers.

We propose to give a brief statement, based on the information contained in the monograph, of the more important features of the meteorology of the Nile Valley and their relations to the physiography of the whole area.

The river obtains its supplies from two collecting areas, one the equatorial lake plateau (between lat. 5° S. and lat. 5° N., and long. 28° and 35° E.), and the second the Abyssinian mountain and plateau area (between lat. 7° N. and 14° N., and long. 35° and 40° E.).

The former is the larger catchment basin, and includes the Victoria, Albert Edward, and Albert Lakes, which serve as reservoirs to store the rainfall of the whole region. The Victoria Lake (equal in area to Scotland) is about 4000 feet above the sea, and is slightly lower than the mean level of the plateau. The ground rises slightly to the south and east, and rapidly to the west to the elevated peaks of Ruwenzori, which separate it from the rift valley, in which are situated the Albert Edward and Albert Lakes connected by the Semliki River. The catchment area of the Victoria Lake is only of comparatively small extent, not more than twice the area of the lake, the level of which hence varies very slightly with the season. The Victoria Nile, which issues from the north of the lake, is precipitated over the Ripon Falls, and thence passes over flat, marshy ground to the Choga Lake Swamp, and descends by a series of rapids, and finally by the Murchison Falls, to the lower level of the Albert Lake at its northern extremity in lat. 2¼° N.

The Albert Edward and Albert Lakes, with their tributaries, appear to collect a larger volume of water than the Victoria Lake. The Victoria Lake discharges by the Victoria Nile a nearly constant amount, averaging 500 cubic metres per second, and the Albert Lake amounts varying between 500 and 1100 cubic metres per second.

The discharge of the lake system is carried off northwards from the Albert Lake by the Bahr-el-Jebel, or Albert Nile, as it is called by Sir William Willcocks. It descends rapidly from a level of 2300 feet to 1500 feet at Gondokoro (lat. 5° N.), in a narrow channel with numerous falls and rapids, and thence to Lake No (lat. 9½° N.) through an extensive flat and swampy region. It is joined at Lake No by the Bahr-el-Gazal, and about eighty miles further down stream by the Sobat. The former drains a large portion of the Soudan, its head-waters being chiefly in the equatorial belt. The Sobat is formed partly by drainage from the same belt and partly from the southern face of the Abyssinian plateau.

Between Lake No and Khartoum, the main stream is now known as the White Nile. The discharge of this river below Lake No varies to a slight extent during the year, and averages only 350 cubic metres per second, and hence considerably less than the supply passing into the river from the Albert Lake. The difference represents the loss by evaporation in the extensive swamp region through which these streams flow. That of the Sobat is only considerable during the rainy season, from April to December, ranging between 380 cubic metres and 1470 cubic metres per second. The White Nile below the junction of the Sobat (lat. 9½° N.) to Khartoum (lat. 15½° N.) receives no affluent, and flows in a broad valley as a wide stream of moderate velocity. This part of the Nile plays a subordinate but important *rôle* with respect to the Nile floods. From May to September the flood water brought down by the Sobat River is ponded up or held back in this reach of the Nile, and hence does not contribute to the Lower Nile flood. Captain Lyons states that this action stores up an average of about 1500 million cubic metres from the Sobat flood, which is supplied to the Nile in October, November, and December, thus prolonging the period of the Nile flood, and delaying the fall of the Nile to its low-water stage.

The main flood water of the Nile is brought down by the Blue Nile and the Atbara from the Abyssinian plateau. The rainfall occurs between June and September, and is immediately discharged down the hills into the valleys, the greatest portion down the Blue Nile, which joins the White Nile (there forming the Nile) at Khartoum. The maximum flood of the Blue Nile is about 12,500 cubic metres, and of the Atbara 5000 cubic metres, per second.

The Nile flood proper is hence due solely to rainfall in the Abyssinian and adjacent Soudan area. It commences in June, and reaches its maximum about the end of August or beginning of September. The maximum height of the Nile flood, or the total discharge during the flood period, may hence be accepted as a measure of the total rainfall over that area, just as the variations of the Victoria and Albert Lakes represent the seasonal variations of the rainfall in their catchment areas.

The Nile below the junction of the Atbara (lat. 18° N. to lat. 34° N.) receives no affluents, and flows in a comparatively narrow valley, over which the flood waters, with their rich alluvial contents, are distributed by means of a vast system of canals.

The Nile basin may hence be divided into three areas or regions, not differing greatly in breadth from south to north. The most southerly is the equatorial lake belt between lat. 5° S. and 5° N., an intermediate region between lat. 5° N. and lat. 18° N. includes the Soudan and Abyssinia, and the northerly region comprises the lower Nile basin from lat. 18° N. to the Mediterranean in lat. 34° N. The low river supply (January to May) is chiefly due to discharge from the equatorial lake area, and the summer flood supply to discharge from the Abyssinian region.

The following gives a sketch of the more important features of the meteorology of the Nile basin, based on the important information and data of Captain Lyons's monograph.

Temperature is remarkably uniform in the equatorial lake region. Thus at Entebbe, on the north shore of the Victoria Nyanza, it ranges only between a mean of 72°·7 in January and 70° in July. In the Nile basin north of about lat. 5° N. temperature is lowest in January, and attains its maximum in May in the southern half of the valley south of Khartoum, and in July in Nubia and Egypt. The annual range of temperature increases northwards from the equatorial belt to northern Egypt. The greater part of the Nile basin is within the tropics, and is throughout the whole year characterised by high temperature. That portion of it between lat. 15° N. and lat. 18° N. (in which are the meteorological stations of Khartoum, Berber, and Dongola) is the hottest and driest area in the Nile basin. It has an elevation of about 1200 feet. To the south is the comparatively damp and cooler region of the Bahr-el-Gazal, the Albert Nile, and the lake plateau, whilst to the north the valley descends slowly to the relatively cool Mediterranean coast. This—the Soudan hot area—is one of the hottest regions in the world. The following gives a comparison of the mean monthly maximum temperature of Berber in that area, and of Jacobabad, the hottest station in India, and also of Massawa, on the Red Sea, in the same latitude as Berber :—

[1] "The Physiography of the River Nile and its Basin." By Captain H. G. Lyons, R.E., Director-General Egyptian Survey Department.

Mean Maximum Temperature.

	Berber, Lat. 15° N.	Jacobabad, Lat. 28° N.	Massawa, Lat. 15° N.
	°	°	°
January	86·7	73·6	84·2
February	90·0	77·9	85·3
March	96·6	91·1	87·1
April	106·0	103·1	90·5
May	110·5	111·6	94·5
June	112·1	112·7	99·5
July	108·5	107·8	101·6
August	110·3	103·8	101·5
September	108·5	103·5	97·7
October	104·0	98·6	95·0
November	96·0	86·8	89·6
December	89·6	76·7	86·9

The data show that at the hottest period, from May to September, the high-temperature conditions are as intense in the Soudan hot area as in Upper Sind, and are more prolonged and persistent. This hot area plays a very important part in the meteorology of the Nile basin. It is throughout the whole year much hotter than Lower Egypt. The difference between the mean day temperature at Berber and Alexandria increases from 8° in January to 16° in April and May. It thence diminishes under the influence of the monsoon rainfall in the Soudan region to 8° in August, and increases to a second maximum (12°) in November. It is undoubtedly due to the presence of this permanent hot area in the central Nile basin that northerly winds prevail almost continuously in the northern half of the basin (*i.e.* north of Berber). The Massawa data also indicate that the hottest portion of the Red Sea is from 10° to 16° cooler during the day hours from March to October than the land area to the west. As the width of the Red Sea in lat. 15° to 20° N. is about 300 miles, it is evident that the presence of this relatively cool area will modify considerably the air movement and pressure distribution in the adjacent land areas, more especially the Soudan comparatively low-lying area.

Much less is known of the pressure distribution than of temperature in the Nile basin. Barometric observations are being taken at a considerable number of stations. When the elevations of the observing stations have been accurately determined by the Survey Department, it will then be possible to give, for the first time, a satisfactory statement of the changes of the distribution of pressure during the year. It is to be hoped that this information will be available in Captain Lyons's monograph on the meteorology of the Nile basin, which we believe he has under preparation. Comparison of the temperature conditions of northern India and of the Nile basin suggest the probable pressure scheme. Pressure in January and the following three or four months is probably lowest in the interior regions of Africa to the south of the equator. An independent local low pressure begins to form in the Soudan hot area in March, and intensifies to some extent in April and May. This low-pressure area limits the advance of the monsoon winds in that region in the same manner that the low-pressure area in Baluchistan and Sind, and the Himalayan mountain barrier, limit the northward extension of the south-west monsoon winds in India. During the period from June to September, an extensive low-pressure area extends from the Soudan across south-west Asia to Upper India, but it is probable that the Soudan depression, due to the local thermal conditions, maintains an independent existence from the Upper India depression, and is separated by a belt of somewhat higher pressure across the Red Sea. This is not confirmed as yet by observation. Captain Lyons, however, indicates in the chart of the mean distribution of pressure in northern and central Africa in July his conviction that a local belt of low pressure stretches across central Africa between lat. 12° N. and 18° N. This either fills up in October and November or is transferred southwards.

The air movement in the Nile basin is on the whole comparatively simple. It is almost continuously from north to the north of lat. 17° or 18° N. (Berber), and is hence a drift up the valley due to permanent temperature and pressure differences between the east Mediterranean and Upper Nile valley. Also in the extreme south of the basin (in the basin of the Victoria and Albert Lakes) it is, so far as is indicated by the available data, almost equally persistent, but from the opposite direction, that is, from south and south-east. That region is hence, during nearly the whole year, within the sphere of the south-east trades. The movement is apparently for a short period in the early months of the year light, variable, and irregular, but chiefly from north.

The air movement in the intermediate region between the equator and lat. 16° N. to 18° N. is typically monsoon. During one period of the year dry land winds (from the north) prevail, followed during the remainder of the year by humid oceanic winds (from south or west). The influence of the Soudan hot area begins to be shown in March, and winds alternate between northerly and southerly directions in April and May. Thus at Khartoum the percentage of steadiness decreases from about 90 per cent. in January to 40 per cent. in May. In the beginning of June a change similar to that occurring in India in that month is initiated. Steady winds, the continuation of the south-east trade winds, which have previously given heavy rain to the equatorial lake area, prevail during the next three months. The direction of the air movement rapidly changes in proceeding northwards from south to west, determined by the position of the Soudan low-pressure area and action due to the earth's rotation. The current hence advances directly to the Abyssinian mountain or plateau area, the axis of which runs due north and south, its forced ascent over which gives rise to the heavy precipitation over the greater part of the plateau. No rain falls at this time in the Red Sea coast districts on the lee side of the plateau. The plateau hence plays (but much more completely) the same part for the Abyssinian branch of the south-west monsoon current that the West Ghats play with respect to the Bombay branch. This movement holds steadily until September, when the monsoon current contracts southwards, and light, northerly winds extend slowly to the neighbourhood of the equator. There is hence a clearly marked monsoon alternation of winds and of season (dry and wet) in the intermediate area between lat. 5° N. and lat. 18° N.

The distribution of the rainfall in the Nile basin is very clearly exhibited in a series of monthly charts in Captain Lyons's monograph. A chart showing the amount and distribution of the average annual rainfall would have been a useful and valuable addition to the series. Charts of annual or seasonal rainfall are, as a rule, even more valuable for comparison than charts of monthly rainfall.

The air movement has shown that the Nile basin may be divided meteorologically into three areas, viz. the area of dominant northerly winds (north of lat. 17° N.), the area of alternating monsoon winds between lat. 17° N. and the equator, and the area of dominant south-easterly winds south of the equator. The rainfall differs greatly in its characteristic features in these three areas. In the northerly region it occurs during the winter months, as in Syria, the Euphrates valley, and the Iran plateau, and is small and very variable in amount. The average annual fall at Alexandria and Suakim is about 5 inches, at Port Said 2 inches, and at Suez ½ inch. In the intermediate monsoon region practically no rain falls from November to April. Thunderstorms occur in May, chiefly in the southern districts, and frequent heavy rain from June to September or October, according to position. The rainfall is heaviest on the western and central portions of the plateau. In the Himalayas the rainfall is, as a rule, heaviest at an elevation of about 4000 feet. The Abyssinian data are too scanty to show whether there is any line of maximum rainfall lower than the level of the interior plateau or higher mountain ranges, where the highest elevations exceed 15,000 feet.

The precipitation in the equatorial lake region has a double maximum and minimum in its annual variation, related, as Captain Lyons points out, to the apparent movement of the sun. The rainfall is small in amount during the period of heavy rainfall in the monsoon region from June to September. It is heavy from October to December, and again in March and April, and is light to moderate during the intervening months of January and February, and moderate in May.

The following summary of the annual rainfall in the Upper Nile basin is taken from Sir William Willcocks's "Nile in 1904." In the catchment basin of the Victoria and Albert Lakes, the mean annual rainfall may be taken as 50 inches, with large fluctuations between good and bad years; over the Albert Nile region it is about 40 inches, with severe droughts occasionally and excessive rain in some years. In the catchment basin of the Sobat River it probably averages 40 inches, and in that of the Bahr-el-Gazal region 30 inches. The rainfall over the Abyssinian plateau may be taken as 50 inches, and in the lower reaches of the Blue Nile and Atbara 30 inches. These are undoubtedly rough estimates, but, so far as can be judged from the exact data given for a number of individual stations in Captain Lyons's work, they are approximately correct values. They also indicate that the mean annual rainfall over the Upper Nile basin differs little from 40 inches. This is a somewhat remarkable result, as it agrees closely with the average rainfall in India, which, according to Blanford, is 42 inches.

The rainfall in the equatorial lake belt resembles in its seasonal distribution that of Ceylon, and that of the intermediate region (the Soudan and Abyssinia) that of western India. In western India, as in the East African monsoon region, the cool and dry season is rainless, with clear skies and light to moderate land winds. The rains in each agree in period, in the comparative suddenness of the change from the dry to the wet season, in the occurrence of almost daily heavy rainfall, and also in the rapid withdrawal of the humid currents at the end of the season. The meteorological data indicate clearly that the rainfall in both areas is due to the rapid extension of the south-east trade winds northwards from the equatorial belt at the same critical epoch, and probably under the same general conditions. There is one very important difference. The monsoon current in the Nile basin does not extend beyond lat. 16° to 18° N., being bounded to the north, not by a range of mountains, but by an area of permanent low pressure during the season, due to thermal actions. It curves rapidly from south to west, and is hence determined directly to the western face of the Abyssinian plateau and mountain masses, which in their highest points attain an elevation of 15,000 feet. The Bombay current in India extends as far northwards as the East Punjab (lat. 30° to 35° N.), where its further progress is barred by the Himalayas. The Abyssinian plateau exhausts the humid current much more completely than the West Ghats, as the rainfall at Massowa and other towns on the Red Sea to the east of the plateau is practically nil.

It would be interesting to determine whether the humid current is converted into a vertical movement over the plateau or whether it continues to march eastwards, and perhaps to contribute to the monsoon rainfall (of the same period) in the mountain region of Yemen, in south-west Arabia.

Captain Lyons has devoted considerable attention to the question of the variations of the Nile flood, and hence of the rainfall in the Nile basin, from year to year. The data show that very large variations occasionally occur amounting to ±35 per cent. of the mean. He infers from the data of years that they do not exhibit any regular cyclical variation, and hence that they cannot be directly correlated with the eleven-year sun-spot period or the thirty-five-year Bruckner period.

It is now, we believe, fully established that Abyssinia, India, and Burma, with the Malay Peninsula, receive nearly the whole of their rainfall from the same vast reservoir and evaporating area, the Indian Ocean and seas, and under the same general meteorological conditions, and by means of the same general air movement. These facts, on the one hand, indicate a probable similarity or parallelism of the seasonal variation of rainfall in all three areas due to general conditions in the contributing oceanic area, and, on the other, an unequal and unlike variation due to variation of local conditions in the three large areas of distribution; also as the rainfall of the Abyssinian plateau is due to the same branch of the monsoon current as that of western India, any parallelism of variation is more likely to be exhibited by these two regions than by either compared with Burma or north-eastern India (dependent on the Bay monsoon current). The actual variation in any one year will hence be due to the resultant of the general and of the local conditions. It is also probable that the largest variations will be due to the general variation over the whole area of supply. The data furnished by Captain Lyons are, on the whole, in full agreement with these inferences. The most remarkable case of similarity of seasonal variation is exhibited by the data of the past fourteen years. The following gives comparative data of the rainfall of India and of the Nile floods from 1892 to 1905. The former data are obtained from the Indian meteorological publications, and the latter from Captain Lyons's memoir:—

Year	Ratio of mean actual to normal rainfall in India	Ratio of actual to normal Nile flood
1892	1·12	1·20
1893	1·21	0·99
1894	1·15	1·22
1895	0·95	1·15
1896	0·88	1·06
1897	0·99	0·89
1898	1·01	1·07
1899	0·73	0·63
1900	0·99	0·89
1901	0·90	0·87
1902	0·95	0·63
1903	1·05	0·89
1904	? below	0·75
1905	much below normal	0·65
Period 1892–4	1·16	1·14
,, 1895–8	0·94	1·05
,, 1899–1903 or 1905	0·93	0·78

It is a noteworthy fact that the Abyssinian rainfall, as indicated by the Nile floods, is subject to much larger range of variation than the rainfall of India, as might perhaps have been anticipated. The data show that from 1892–4 the rainfall in India and in Abyssinia (assumed to be roughly proportional to the total Nile flood) was in considerable excess from 1892–4, about normal from 1895–7, and more or less in defect from 1898 to 1905. The parallelism would have been more exact if the rainfall of western India had been given instead of that for the whole of India. The 1896 drought in India was due chiefly to the weakness of the Bay current, and not of the Arabian Sea current. It may be noted that the data for the variations of the level of the Victoria Lake agree generally with those of the Abyssinian rainfall, as indicated by the Nile floods. Thus, according to Captain Lyons, 1892–5 was a period of high level, 1896–1902 a period of falling level, and 1903 a year of rising level. This remarkable parallelism, strictly in accordance with the general simple inferences stated above, suggests two problems for the consideration of meteorologists. These are, first, the causes of the large variations from year to year of the rain supply over the immense land area of India, the Soudan, and Abyssinia, and, secondly, the determination of any invariable antecedent conditions which may serve as indications and be utilised for forecasting these variations. Captain Lyons in the last chapter of his memoir takes up both of these problems, but acknowledges that his investigations are only in the introductory stage. It is, however, interesting that his present conclusions on the whole agree with those of Indian meteorologists. He shows, for example, that pressure in the Egyptian region is below the normal in seasons of good Nile floods and *vice versâ*. This is the usual relation between pressure and rainfall in India, and is also in accordance with theory. Captain Lyons also points out that the monsoon variations of pressure are frequently, if not invariably, the continuation of similar conditions which have prevailed for some time previously. This is also in accordance with Indian experience. He also points out that they are probably in some cases related to the widely distributed variations of pressure studied by Sir Norman Lockyer and Dr. Lockyer, and also to the long-period variations in India. The latter are marked by or accompany prolonged abnormal variations or anomalies of the Indo-oceanic air movement. He also considers that they are occasionally determined by variations in the position and intensity of north-east Atlantic anticyclones. This is by no means improbable, but until more is known of the actions that determine the displacement of the more or less permanent anticyclones, it is doubtful whether an occasional coincidence could be accepted as sufficient evidence to establish a relation. Some meteorologists, we believe, consider anticyclones to be comparatively inert masses, and others, on the contrary, as sources of action. They are remarkably persistent in position and character, and their variation of position from one period to another in south-western Europe is closely related to the abnormalities of weather. Where theoretical opinions differ so largely it is almost certain that it will require twenty-five to fifty years' data at the least to test the relation between the Abyssinian rainfall and the position of the anticyclone in south-western Europe or the adjacent Atlantic.

NEW PHYSICAL AND ENGINEERING DEPARTMENTS OF THE UNIVERSITY OF EDINBURGH.

THE new buildings for the natural philosophy (Prof. MacGregor) and engineering (Prof. Hudson Beare) departments of the University of Edinburgh were opened on October 16 by Dr. Andrew Carnegie in the presence of a large and influential gathering. The proceedings took place in the large lecture theatre of the natural philosophy department, and were presided over by the Chancellor, the Right Hon. A. J. Balfour. Part of an address entitled "A Plea for Science Teaching," delivered by Dr. Carnegie before declaring the buildings open, was printed in last week's NATURE (vol. lxxiv., p. 648).

The Chancellor then moved a vote of thanks to the benefactors. He was glad to have the opportunity of mentioning the work of the friends and admirers of the late Prof. Tait, who had instituted a fund to encourage research, which he hoped would make these walls illustrious to all time. No more fitting tribute to Prof. Tait's memory could possibly have been contrived. Though Prof. Tait worked in what he could hardly call a laboratory, ill-equipped and wholly inadequate to the work of modern research, yet he left a name which for all time would be associated with the great development of physical knowledge which marked the last fifty years of the recent century—a movement which he believed would be conducted with ever-increasing acceleration through the earlier years of the present century. He was glad also to have an opportunity of saying to Lord Elgin that the work he had done as chairman of the Carnegie Trust was a work for which he had earned the gratitude of every man interested in the fate of the Scottish universities, and in the maintenance of the position which Scotland had held for more than 150 years in the world of learning. Proceeding, the Chancellor referred to Dr. Carnegie, whose munificent beneficence to many great causes, and, so far as they were concerned, especially to the Scottish universities, was known, and was destined to leave a permanent mark and do permanent good in Scotland.

Sir William Turner, in seconding the motion, referred to the great kindness of Sir Donald Currie, who, he said, had taken a great weight off his mind when he told him he need not be under any difficulty in finding the money to hand over to the municipality for the site on November 11 two years ago. He also desired to thank Sir John Jackson for his generous gifts, and stated that before long he hoped they would be in a position to receive from him a very handsome addition to the Tait memorial fund.

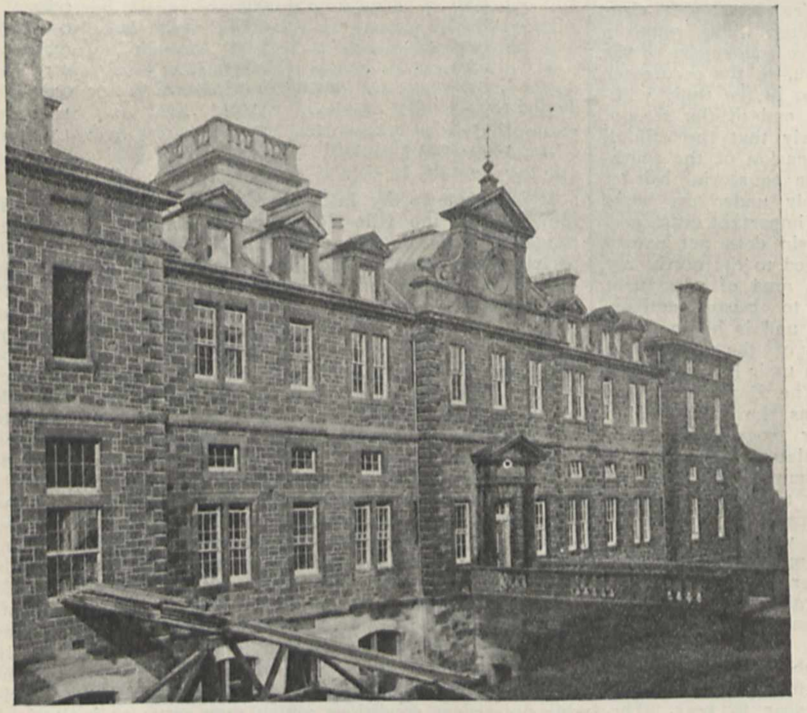

FIG. 1.—South front of new Natural Philosophy Buildings, University of Edinburgh.

Natural Philosophy Buildings.

The accompanying illustration (Fig. 1) shows the south front of this block of buildings. The building which has been transformed into a physical institute—the old surgical hospital of the infirmary—consisted of a main block 107 feet by 43 feet running nearly east and west, with wings at both ends 62 feet by 38 feet, and a block 71 feet by 51 feet running north towards the new engineering buildings, this north block including at its junction with the main building a tower 89 feet in height. The outer walls have been almost entirely utilised as they stood, with one important exception—on the southern side of the main building, by terracing the ground and piercing the lower part of the wall with large windows, the old dark basement rooms have been converted into lofty, well-lighted laboratories. The interior has been largely reconstructed, and all the floors are now concrete, supported on east and west steel girders.

The principal floor, entered directly from Drummond Street, contains the lecture theatre, apparatus rooms, library, professor's research rooms, &c. The lecture theatre, 45 feet long, 46 feet wide, and 32 feet in height, with seating accommodation for 250 students, is lit entirely from an opening in the roof, and is ventilated by an electric fan. The lecture table is 30 feet long, standing in an experimental area 15 feet wide; it is supplied with hot and cold water, high-pressure water, steam, gas, vacuum, air-blast, oxygen, and a number of electric circuits, and a heliostat has been placed in a window of the apparatus room so as to send a beam of sunlight along it. Opening off the lecture theatre is a preparation room with the necessary work benches; this room contains also the main switchboard, from which current will be distributed throughout the building from the town mains and from the accumulators. The apparatus room has a corridor entrance immediately opposite that of the preparation room; it is intended only for lecture apparatus. On the west side of the apparatus room provision has been made for a smaller lecture room, capable of accommodating about eighty students, and on the ground floor there is another small lecture room for the department of applied mathematics. The library and reading room is 37 feet by 29 feet, with a southern exposure, and opens off the entrance hall.

The upper floor and the ground floor are devoted to the laboratories and research rooms; the east wing of the upper floor is reserved for arts and science students, and the west wing for medical students. The junior arts and science laboratory has accommodation for forty-five students, and is fitted with tables, benches, and wall apparatus for introductory experimental work; on one side is a long gallery for optical work. The senior laboratory will accommodate forty students, and consists of three rooms for mechanical, thermal, and electrical work, two rooms for optical work, and two for sound. Between these two sets of laboratories is a research room for the chief laboratory assistant, and adjoining them is a small workshop with benches, lathe, glass-blowing table, &c.

On the ground floor are the research rooms; at present only five are to be fitted up; the remainder will be equipped and brought into use as funds permit. These rooms have firm concrete floors, have stone shelves built into the thick, solid walls, and are supplied with high- and low-pressure water, gas, electric currents, &c., and in certain of the rooms, by the use of copper and brass piping, and by other precautions, provision has been made for work with delicate electrical instruments. On this floor are also the accumulator room, a large workshop and forge room, and a constant-temperature room.

The tower, 89 feet in height, has been utilised for suspension of long wires, mercurial pressure-gauge, and other purposes requiring considerable height, and, lastly, on the roof a floor space, 24 feet by 12 feet, has been arranged for open-air experiments.

Engineering Buildings.

The accompanying illustration (Fig. 2) shows the west end of the block of buildings for the engineering department.

The building is T-shaped, the head of the T facing west. In the head of the T, on the ground floor, are provided large laboratories for the testing of materials (42 feet by 30 feet) and for hydraulics (51 feet by 30 feet). The first floor is devoted mainly to a laboratory for experimental work, which does not require heavy machinery (73 feet by 25 feet). On this floor are also a small lecture room, the departmental library, and the private rooms for the staff.

The back block of the building is also divided into two floors—the lower forms the lecture theatre and the upper the drawing office. The lecture theatre will seat about 120 students, and on the lecturer's table are all the needful appliances for experimental demonstrations, there being steam, gas, and electrical connections. There are also the necessary appliances for darkening the room in order to allow of the free use of lantern demonstrations. The drawing office is a fine room, about 45 feet square, lit entirely from the north and east, the roof being of the saw-tooth pattern, the floor space giving room for about sixty independent drawing tables. Special rooms have also been set aside for blue-print work and photography.

A workshop and heat laboratory (48 feet by 42 feet) has been provided for by roofing in and connecting to the main building a piece of ground lying in the north-east angle between the front and back blocks. The workshop and laboratory contains examples of all the ordinary machine-tools, gas-engines, steam-engines, and other plant for experimental research in connection with thermodynamics.

The building is heated by hot water and by steam; an independent boiler house has been constructed for this purpose, with two large boilers.

A considerable amount of additional apparatus has been installed in these new buildings. The testing laboratory now contains a 100-ton Buckton machine, with the necessary electric motor, pump, and accumulator; a 60,000-lb. Riehle machine; an Amsler 100-ton machine, specially designed for compression and bending work; and a complete installation for the testing of cements, mortars, &c.

In connection with the hydraulic laboratory, a water tower has been constructed at the south-east corner of the building; at the top of this tower is a large cast-iron tank holding about 10,000 gallons, and giving a head of 65 feet above the floor-level of the laboratory. The floor of the laboratory is on two different levels; on the upper level are placed the various turbines, water-wheels, and other hydraulic machines on which experimental investigations will be carried out. The water discharged from these machines passes into one or other of three rectangular channels formed in the floor, and the quantity is measured by allowing the water to pass over weirs. The water then flows into one or other of two large rectangular tanks, each 11 feet square by 5 feet deep, sunk below the lower floor-level of the laboratory, where it is measured again by floats, with rods moving in front of carefully graduated vertical scales. From these lower measuring tanks the water is lifted by an electrically driven 20 h.p. centrifugal pump back to the storage tank in the water tower. The hydraulic equipment includes a Venturi meter and other forms of meters, and a considerable amount of other apparatus for experimental work.

FIG. 2.—Entrance and West Front of new Engineering Department, University of Edinburgh.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The geographical scholarship for 1906 has been awarded to Mr. N. de Lancey Davis, Jesus College.

Mr. J. A. Brown, New College, has been appointed demonstrator in the laboratory of the Wykeham professor of physics.

The following elections have been made at Jesus College:—to scholarships in natural science, G. I. Wishart, Wilson's Grammar School, London, S.E., and H. E. Jones, County School, Towyn; to exhibitions in natural science, R. Atkin, Nottingham High School, and A. D. Phoenix, Grove Park School, Wrexham.

CAMBRIDGE.—The following recommendations, contained in a report of the special board for mathematics on the mathematical tripos, received the sanction of the Senate at a congregation held on October 25:—(1) A student may be a candidate for part i. of the mathematical tripos at a date not earlier than his second term and not later than his seventh term. (2) A student who fails to obtain honours in part i. of the mathematical tripos may be a candidate on a second occasion, provided he then be otherwise qualified. (3) The examination for part i. shall comprise the subjects in the schedule annexed to the report. (4) The list of successful candidates in part i. shall be arranged in three classes, the names in each class to be arranged alphabetically. (5) The examination for part ii. shall comprise the subjects in the Schedules A and B annexed to the report, together with certain questions partly on the subjects of the schedule for part i. (6) The list of successful candidates in part ii. shall be arranged in the three classes of wranglers, senior optimes, and junior optimes, the names in each class to be arranged alphabetically. (7) In the examination for part ii. the class in which a candidate is placed shall be in general determined by his performance in the papers on the subjects of Schedule A, a mark of distinction and a mark of proficiency being awarded to those candidates who acquit themselves with sufficient credit in the subjects of Schedule B.

The Senate will be asked on Saturday, November 3, to assign a site in Free School Lane for the proposed extension of the Cavendish Laboratory, and to appoint a syndicate to consider the assignment of a site for the extension of the chemical laboratory. Lord Rayleigh's munificent gift of 5000*l*. out of the Nobel prize will go toward the cost of the new building for physics. It will be remembered that the balance of the prize was given by Lord Rayleigh to the University library fund. The extension of the chemical laboratory is called for because Gonville and Caius College are proposing to close their chemical laboratory at the end of the academic year.

THE Cairo correspondent of the *Times* states that considerable interest has been aroused there by a proposal to found a national university, modelled on European lines, and independent both of the Ministry of Public Instruction and of the mediæval foundation of Al Azhar. A committee, which includes the leaders of the progressive Mohammedan school of thought, has been formed to draft a programme of courses and to raise the sum of at least £E500,000 which will be required to make the university a reality. In an appeal for public support, Kassim Bey and the other promoters of the scheme outline its features. The courses of the proposed foundation are to be literary and scientific, open to all without distinction of nationality or creed. Diplomas will be granted to students fulfilling conditions of attendance and passing the requisite examinations, and no attempt will be made at the outset to encroach upon the primary, secondary, and technical instruction imparted by the various Government schools.

LORD ROSEBERY, as Chancellor of the University of London, on October 26 performed the ceremony of opening the library of the University. After expressing the gratitude of the University to the Goldsmiths' Company, which spent 15,000*l*. in securing and supplementing Prof. Foxwell's library, and explaining the growth of the University library as a whole, Lord Rosebery, among many other subjects of wide interest, spoke of the functions of a library. He said there is no greater misconception of a library than to think that it can take the place of a university. "No doubt a student must be fed by books; it is impossible for the student to proceed far without books; but I will urge a further consideration which I should think the experience of those of my age who are present will tend to confirm—that the mere habit of reading, and often of reading copiously, without any exercise or output for their knowledge, is injurious rather than beneficial to the mind. It is apt to produce a condition of mental debility, if not of mental paralysis. I hope that no students will ever believe that the library of this University is intended as more than a staff and an assistance, and not in any degree as the object of their training at this University."

MR. HALDANE, as is appropriate to the president of the British Science Guild, avails himself of every opportunity to insist upon the value of knowledge and of scientific habits of thought in every sphere of human activity. Distributing the prizes and certificates to the students of Birkbeck College on October 26, Mr. Haldane said there is a danger which is inseparable from a college such as the Birkbeck College. It is largely attended by those who have their bread to win, and whose main concern must be to win it and to win the leisure for learning. The temptation becomes very strong in such a case to look upon learning as being what the Germans call a *brotwissenschaft*—a scientific means of increasing the opportunities for earning a living. That is a very cramping view, and one fatal to the higher learning. But it is the higher learning that pays in these times—not the learning which is a means to an end, but the learning which is an end in itself. Learning for learning's sake, that is the key to a career. Not every person who has learning is necessarily successful in his career; but, other things being equal, the man who is penetrated with the spirit of the scholar has a far better chance in the race of life than the man who is not so penetrated. What is true of individuals is true of nations. A few years ago Japan was reckoned with those who were not civilised. To-day, by singleness of purpose, by concentration upon science, by the dominant purpose of the nation to fashion its national character according to the highest ideas, Japan has leapt, at a bound almost, into the front rank. Germany, too, has gone forward stride after stride on the basis of scientific re-organisation. These are lessons that we do well to bear in mind.

A NEW hall and buildings in connection with University College, Reading, were opened on October 27 by Mr. Haldane, Secretary of State for War. As has been noted in these columns, the new site was secured as a gift of Mr. Alfred Palmer, and the new buildings now opened bring the council an important step nearer the completion of its scheme for a fully-equipped college. The principal feature of the new buildings is the great hall in which the ceremony took place. The science laboratories and art studios consist of seven separate buildings, and accommodation is provided for theoretical and practical work in biology, agriculture, physics, chemistry, and geography. Mr. Haldane, in the course of his speech declaring the new hall open, said:—"It is impossible to set up technical education successfully on anything but the broadest basis of culture. It is distressing to consider, not only how small a part the State has played in higher education in this country, but how misplaced its intervention at times has been. The present Government proposes to spend an extra 1,000,000*l*. a year on elementary instruction, and the late Ministry spent more than that sum additionally for the same purpose, but these payments arose out of controversies which had little to do with education. The Government is doing something for the higher teaching, but its capacity is limited by what the people will allow. There is already a great awakening in this country with reference to higher instruction, but it is due to private donors far more than to the public generally. The War Department wants several things dependent on education. It desires a great reserve of officers, and one thing that it is considering at this moment is how to get the universities and university colleges to assist it. A great misfortune has come to the Army of late through the revelation, in relation to the South African War, of an altogether inadequate organisation and training, inadequate to cope with the great business of supply in time of war and the period following war. Supply is a science by itself, which requires high training if the country is not to be victimised by contractors and everything is to be placed where it is needed. The Army has organised its General Staff, which requires officers with the highest class of instruction for strategy, tactics, and general command. This is one side of military education, but there is an administrative side also, and up to now no steps have been taken to give the highest education to administrative officers. The Government has decided to train a school of administrative officers up to the high level that it is trying to attain for staff officers. A certain number of officers will study at the London School of Economics, and it is hoped that they will form the nucleus of an administrative staff as capable as the general staff, whether of our Army or any other.

SOCIETIES AND ACADEMIES.

LONDON.

Chemical Society, October 18.—Sir W. Ramsay, K.C.B., F.R.S., in the chair.—The Longstaff medal was presented to Prof. W. Noël Hartley, F.R.S., of Dublin, for his researches in spectrochemistry.—The description and spectrographic analysis of a meteorite stone: W. N. **Hartley.** This stony meteorite was seen to fall in the Kangra Valley, Northern Punjaub, in 1897. The principal constituents of the metallic portion are iron, nickel, cobalt, and chromium, with small quantities of copper, lead, silver, and gallium. Manganese, calcium, potassium, and sodium are only present in minute proportions.—Malacone, a silicate of zirconium containing argon and helium: S. **Kitchin** and W. G. **Winterson.** This mineral, found at Hitteroe and Arendal, Norway, is radio-active, and gives off a mixture of helium and argon when heated. The analysis, discounting ferric oxide, uranium oxide, &c., points to the ratio $3ZrO_2 : 2SiO_2$ between the zirconia and the silica.—The relationship of colour and fluorescence to constitution, part i., the condensation products of mellitic and pyromellitic acid with resorcinol: O. **Silberrad.** One of the chief interests of this work lies in its bearing on the quinone theory of the structure of the phthaleins. Many of the compounds described do not admit of formulation on the quinone type, but are nevertheless intense colouring matters, and strongly fluorescent.—Separation of αα- and ββ-dimethyladipic acids: A. W. **Crossley** and Miss N. **Renouf.**—Action of alcoholic potassium hydroxide on 3-bromo-1 : 1-dimethylhexahydrobenzene: A. W. **Crossley** and Miss N. **Renouf.**—The conversion of morphine and codeine into optical isomerides, preliminary communication: F. H. **Lees** and F. **Tutin.** The facts obtained permit of the following conclusions respecting the constitution of morphine:—(1) the isomeric codeines are the result of the racemisation of two asymmetric carbon atoms in a molecule which must necessarily contain a third asymmetric system; (2) the carbon atoms which undergo racemisation are most probably those in the reduced phenanthrene nucleus to which the alcoholic hydroxyl group and the nitrogen atom are respectively attached; (3) The possible isomeric codeines must be represented by the configurations $++-$, $+--$, $-+-$, $---$.—The aminodicarboxylic acid derived from pinene: W. A. **Tilden** and D. F. **Blythor.** Details are given for the preparation of the acid and its hydrochloride, nitrate, acid oxalate, copper salt, ethyl ester and its hydrochloride, and the acetyl derivative.—The preparation and properties of dihydropinylamine (pinocamphylamine): W. A. **Tilden** and F. G. **Shepheard.** Dihydropinylamine is the chief product of the reduction of nitrosopinene by means of boiling amyl alcohol and sodium. The hydrochloride, platinichloride, picrate, nitrate, oxalate, also the acetyl and benzoyl derivatives and the carbamide, have been prepared and analysed.—Determination of nitrates: F. S. **Sinnatt.** It is shown that Knecht and Hibbert's method for the estimation of picric acid (*Ber.*, 1903, xxxvi., 1549) may be applied to the estimation of nitrates.—The nature of ammoniacal copper solutions: H. M. **Dawson.** The experimental data obtained indicate the existence in solution of a dissociating complex compound containing four molecules of ammonia per atom of copper.—The colouring matters of the stilbene group, part iii.: A. G. **Green** and P. F. **Crosland.** It is shown that all the dyestuffs of the stilbene series are true azo-compounds. Their chromophor being an azo-group, their dyeing properties are now satisfactorily explained. They differ, however, from most other azo-dyestuffs in the entire absence of auxochrome groups.—Interaction of succinic acid and potassium dichromate. Note on a black modification of chromium sesquioxide: E. A. **Werner.** When a mixture of finely powdered potassium dichromate (1 mol.) and succinic acid (6 mols.) is heated, a compound having the composition $Cr_4(C_4H_4O_4)_5,7H_2O$ is formed which has not the properties of a chromo-organic acid. The chromium hydroxide produced from it by decomposition with sodium hydroxide leaves a jet-black modification of the sesquioxide after ignition.—Derivatives of polyvalent iodine. The action of chlorine on organic iodo-derivatives, including the sulphonium and tetra-substituted ammonium iodides: E. A. **Werner.**—The so-called "benzidine chromate" and allied substances: J. **Moir.** This substance, which resembles cœrulignone, results on mixing solutions of benzidine and chromium trioxide. It is the chromate, not of benzidine, but of a complex oxidation product of the latter.—New derivatives of diphenol (4 : 4′-dihydroxydiphenol): J. **Moir.** By the sulphonation of diphenol the author has prepared the 3 : 3′-disulphonic acid, the 3 : 5 : 3′-trisulphonic acid, and the 3 : 5 : 3′ : 5′-tetrasulphonic acid.—The interaction of the alkyl sulphates with the nitrites of the alkali metals and metals of the alkaline earths: P. C. **Rây** and P. **Neogi.** By the interaction of the sodium, potassium, barium, and calcium salts of ethyl sulphuric acid and the nitrites of the alkali metals and metals of the alkaline earths, both ethyl nitrite and nitroethane were formed.—The electrolytic preparation of dialkyldisulphides. Preliminary note: T. S. **Price** and D. F. **Twiss.** By the electrolysis of a concentrated aqueous solution of ethyl sodium thiosulphate, commonly known as Bunte's salt, diethyldisulphide is formed at the anode. Similar results were obtained by electrolysing solutions of benzyl sodium thiosulphate, dibenzyldisulphide being produced.—The direct union of carbon and hydrogen at high temperatures: J. N. **Pring** and R. S. **Hutton.**—The action of nitrogen sulphide on certain metallic chlorides: O. C. M. **Davis.** When nitrogen sulphide dissolved in dry chloroform is added to the tetrachlorides of tin and titanium, the pentachlorides of antimony and molybdenum, and also tungsten hexachloride dissolved in the same solvent, interaction readily takes place. The compounds formed are represented by the formulæ $SnCl_4,2N_4S_4$, $SbCl_5,N_4S_4$, $MoCl_5,N_4S_4$, $WoCl_4,N_4S_4$, and Ti_2Cl_6,N_4S_4.—The determination of halogen: J. **Moir.**

PARIS.

Academy of Sciences, October 22.—M. H. Poincaré in the chair.—The work stored up in the trochoidal wave: Emile **Bertin.**—Distillation and desiccation in a vacuum with the aid of low temperatures: MM. **d'Arsonval** and **Bordas.** The vapours given off pass into a condensation tube cooled either with liquid air or a mixture of solid carbon dioxide and acetone, according to the vacuum required. After a preliminary exhaustion with a water-pump, the exhaustion is completed by a tube filled with charcoal immersed in liquid air or acetone and carbon acid snow, a Crookes's tube being used as a manometer. The vacuum is maintained by the charcoal tube in spite of any slight leakages through the connections. A diagram of the apparatus is given, together with full details for its use. The following advantages are claimed for the method:—the evaporated liquid can be weighed directly, the evaporation taking place at the ordinary temperature, and in the absence of air the dried substance is obtained without alteration, and the time required for the whole operation is much reduced. Thus to obtain the dry residue from wine, which required three days when evaporated in a vacuum by the ordinary method, three hours are sufficient.—Contribution to the study of the calorific emission of the sun: G. **Millochau** and C. **Féry.** Details are given of the calibration of the apparatus described in a previous paper. Basing the constant of the instrument on the calibration with an electric furnace, the temperature of which was taken as 1673° absolute, and correcting for atmospheric absorption, the temperature of the sun as given by observations at the summit of Mt. Blanc is 5620° C.—Researches on atmospheric lines: Milan **Štefánik.** By the application of the method of coloured screens, the author has been able to study the telluric lines in the infra-red. A description is given of the instruments employed, observations being made at the Observatory of Meudon, Chamonix, Grands-Mulets, and the summit of Mt. Blanc.—Isothermal surfaces of the first class: L. **Raffy.**—Isothermal surfaces: R. **Rothe.**—The conditions of complete integrability of certain differential systems: M. **Riquier.**—The liquefaction of air by expansion with external work: Georges **Claude.**—A safety apparatus for providing against accidental sparks in the effects of wireless telegraphy: Édouard **Branly.**—The aurora borealis. A reply to M. Störmer: P. **Villard.**—The existence of chloride of bromine: Paul **Lebeau.** The author has repeated the experiments of earlier workers under varying conditions on the so-called chloride of bromine, and comes to the conclusion that no such compound really exists. The crystals which can be obtained by cooling sufficiently a solution of bromine in liquefied chlorine have a composition depending on the temperature at which they are formed, and are mixed crystals of the two halogens.—Protoxide of cæsium: E. **Rengade.** It is possible to prepare the oxide of cæsium Cs_2O in a pure and well-crystallised condition by admitting a limited quantity of oxygen to a weighed amount of the metal. When about two-thirds the amount of oxygen necessary to form the Cs_2O has been admitted, the excess of the metal is slowly distilled off in a vacuum at 200° C. The oxide remains in the form of orange-red crystals, reacting violently with water, and decomposing at about 500° C. in contact with silver, and in the cold in the presence of liquefied ammonia, the latter giving a mixture of the amide and hydrate of cæsium.—The pure alloys of tungsten and manganese, and the preparation of tungsten: G. **Arrivaut.** In the reduction by aluminium a suitably high temperature of reaction is obtained by using Mn_3O_4, WO_3, MnO_2, and WO_2 in varying proportions. Manganese-tungsten alloys can be prepared containing from 12 per cent. to 60 per cent. of tungsten. By preparing an ingot containing 45 per cent. of tungsten and submitting this to the action of hydrochloric acid, the residue was nearly pure tungsten, 99·5 per cent.—The products of condensation of acetylenic esters with amines: Ch. **Moureu** and I. **Lazennec.** The products of the condensation of the acetylenic esters $R-C\equiv C-CO_2R'$ with amines are non-basic bodies, easily hydrolysed by acids. Hydrolysis regenerates the amine, with formation of the ketonic ester $R-CO-CH_2-CO_2R'$. The reaction furnishes a new method of passing from the acetylenic esters to the β-ketonic esters.—The atomic weight of dysprosium: G. **Urbain** and M. **Demenitroux.** A set of determinations, carried out on the products of different fractions, gave 162·54 (O=16) as a mean of twelve very concordant results.—The presence of formol in certain foods: G. **Perrier.** By applying the very sensitive reaction proposed by Voisenet for the detection of minimal proportions of formol, the author has proved the presence of this substance in various articles of food, the formaldehyde arising from the mode of preparation, and not having been specially added. In view of these results the author discusses the advisability of altering the existing law, which absolutely prohibits the presence of formaldehyde in food, substituting a maximum limit.—The azo colouring matters: heat of combustion and constitutional formulæ: P. **Lemoult.**—The liquid crystals of cholesteryl propionate: Fred. **Wallerant.**—The action of copper salts on the germination of Penicillium: M. **Le Renard.**—The variations of assimilation with light and temperature: W. **Lubimenko.**—The swimming mechanism of *P. maximus*: Fred **Vles.**—*Mesoglicola Delagei*, a parasite of *Corynactis viridis*: A. **Quidor.**—The unity of the hæmatozoa of paludism: M. **Thiroux.**—The Dolichopodidæ of amber from the Baltic: Fernand **Meunier.**

DIARY OF SOCIETIES.

THURSDAY, NOVEMBER 1.

ROYAL SOCIETY, at 4.30.—On Intravascular Coagulation in Albinoes and Pigmented Animals, and on the Behaviour of the Nucleo-proteids of Testes in Solution in the Production of Intravascular Coagulation: G. P. Mudge.—Nitrification of Sewage: Dr. G. Reid.—A General Consideration of the Subaërial and Freshwater Algal Flora of Ceylon: Dr. F. E. Fritsch.—The Anæsthetic and Lethal Quantity of Chloroform in the Blood of Animals: Dr. G. A. Buckmaster and J. A. Gardner.

CHEMICAL SOCIETY, at 8.30.—A Development of the Atomic Theory which correlates Chemical and Crystalline Structure and leads to a Demonstration of the Nature of Valency: W. Barlow and W. J. Pope.—The Explosive Combustion of Hydrocarbons, ii.: W. A. Bone, J. Drugman and G. W. Andrew.—Contributions to the Theory of Solutions: (1) The Nature of the Molecular Arrangement in Aqueous Mixtures of the Lower Alcohols and Acids of the Paraffin Series; (2) Molecular Complexity in the Liquid State; (3) Theory of the Intermiscibility of Liquids: J. Holmes.—The Hydrolysis of Nitro-cellulose and Nitro-glycerol: O. Silberrad and R. C. Farmer.—The Determination of the Rate of Chemical Change by Measurement of Gases Evolved: F. E. E. Lamplough.—Experiments on the Synthesis of the Terpenes Part IX., The Preparation of δ-Ketohexahydrobenzoic Acid (δ-Keto*cyclo*hexanecarboxylic Acid) and of γ-Keto*cyclo*pentanecarboxylic Acid: F. W. Kay and W. H. Perkin, jun.—Experiments on the Synthesis of the Terpenes, Part X., Synthesis of Δ^1-*m*-Menthenol (8) and of Carvestrene: W. H. Perkin, jun., and G. Tattersall.—Some Derivatives of Catechol, Pyrogallol, Benzophenone and of Other Substances allied to the Natural Colouring Matters: W. H. Perkin, jun., and C. Weizmann.

LINNEAN SOCIETY, at 8.—The Structure of Bamboo Leaves: Sir Dietrich Brandis, K.C.I.E., F.R.S.—On a Collection of Crustacea Decapoda and Stomatopoda, chiefly from the Inland Sea of Japan, with Descriptions of New Species: Dr. J. G. de Man.—On *Hectorella caespitosa*, Hook. f., with Remarks on its Systematic Position: Prof. A. J. Ewart.—*Exhibitions*: Young Plaice Hatched and Reared in Captivity: the President.—Abnormal Specimens of *Equisetum Telmateia*, Ehrh.: George Talbot.

CIVIL AND MECHANICAL ENGINEERS' SOCIETY, at 8.—Bridge Work Design: P. J. Waldram.

FRIDAY, NOVEMBER 2.

GEOLOGISTS' ASSOCIATION, at 8.—Conversazione.

MONDAY, NOVEMBER 5.

SOCIOLOGICAL SOCIETY, at 8.—Psychological Factors in Social Transmission: Dr. J. W. Slaughter.

LONDON INSTITUTION, at 5.—Earthquakes and Volcanoes: Sir Robert Ball, F.R.S.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Advantages of Investigating the Unlikely: Sir William Ramsay, K.C.B., F.R.S.

TUESDAY, NOVEMBER 6.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Address by the President, Sir Alexander B. W. Kennedy, and Presentation of Medals and Prizes Awarded by the Council.

WEDNESDAY, NOVEMBER 7.

ENTOMOLOGICAL SOCIETY, at 8.—A Permanent Record of British Moths in their Attitude of Rest: A. H. Hamm.

GEOLOGICAL SOCIETY, at 8.—On the Upper Carboniferous Rocks of West Devon and North Cornwall: E. A. Newell Arber.—The Titaniferous Basalts of the Western Mediterranean: H. S. Washington.

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Analyst and the Medical Man: Dr. F. Gowland Hopkins, F.R.S.

THURSDAY, NOVEMBER 8.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Note on the Continuous Rays observed in the Spark Spectra of Metalloids and some Metals: Prof. W. N. Hartley, F.R.S.—The Composition of Thorianite, and the Relative Radio-activity of its Constituents: Dr. E. H. Büchner.—On a Compensated Micro-manometer: B. J. P. Roberts.—Experimental Investigation as to the Dependence of Gravity on Temperature: L. Southerns.—A Numerical Examination of the Optical Properties of Thin Metallic Plates: Prof. R. C. Maclaurin.

MATHEMATICAL SOCIETY, at 5.30.—Annual General Meeting.—Presidential Address: Partial Differential Equations; some Criticisms and some Suggestions: Prof. A. R. Forsyth.—Harmonic Expansions of Functions of Two Variables: Prof. A. C. Dixon.—The General Solution of Laplace's Equation in n Dimensions: G. N. Watson.—On Sub-groups of a Finite Abelian Group: H. Hilton.—On Bäcklund's Transformation and the Partial Differential Equation $s=F(x, y, z)$.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Presentation of Premiums awarded for Papers Read or Published during 1905–06.—Inaugural Address by the President, Dr. R. T. Glazebrook, F.R.S.

FRIDAY, NOVEMBER 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.—Exhibition and Description of Experiments Suitable for Students in a Physics Laboratory: G. F. C. Searle.

MALACOLOGICAL SOCIETY, at 8.—Description of a New Species of Calliostoma from S. Formosa: E. A. Smith, I.S.O.—Description of a New Sub-genus and Species of Alycæus from Ke-lan-tan: H. B. Preston.—Description of Six New Species of Shells and of *Leptomya lintea*, Hutton, from New Zealand: H. Suter.—Descriptions of some Tertiary Shells from New Zealand: H. Suter.

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