

THURSDAY, AUGUST 14, 1902.

## THE ENCYCLOPÆDIA BRITANNICA.

*The Encyclopædia Britannica.* The Third of the New Volumes, being vol. xxvii. of the Complete Work. Chi-Eld. Pp. xx + 744. (London: A. and C. Black, and *The Times*, 1902.)

IT is impossible within the limits of a short notice to describe even briefly more than a few of the scientific articles in this new volume of the "Encyclopædia Britannica." Many subjects of interest to men of science are dealt with, the following being among the contributions:—Cholera, Dr. A. Shadwell; chronograph, Rev. F. J. Jervis-Smith; biblical chronology, Prof. S. R. Driver and Mr. C. H. Turner; coal, Mr. H. Bauerman; Cœlentera, Dr. G. H. Fowler; colours of animals, Prof. E. B. Poulton, F.R.S.; combinatorial analysis, Major P. A. MacMahon, F.R.S.; comets, Dr. E. S. Holden; compass, Captain E. W. Creak; condensation of gases, Prof. J. D. van der Waals; conduction of heat, Prof. H. L. Callendar, F.R.S.; copper, Dr. J. Douglas; cremation, Sir Henry Thompson, Bart.; Crustacea, Rev. T. R. R. Stebbing, F.R.S.; Ctenophora, Dr. G. H. Fowler; cuttlefish, Rev. J. F. Blake; cytology, Mr. Harold W. T. Wager; dairy, Dr. W. Fream; Darwin, Prof. E. B. Poulton, F.R.S.; dietetics, Dr. W. O. Atwater; differential equations, Mr. H. F. Baker, F.R.S.; diffraction gratings, the late Prof. H. A. Rowland; diffusion of gases, Prof. G. H. Bryan, F.R.S.; dimensions of units, Dr. J. Larmor, F.R.S.; diphtheria, Dr. A. Shadwell; du Bois-Reymond, Sir Michael Foster, K.C.B., F.R.S.; dyeing, Prof. J. J. Hummel; dynamo, Mr. C. C. Hawkins; analytical dynamics, Prof. Horace Lamb, F.R.S.; dynamometer, Prof. W. E. Dalby; figure of the earth, M. R. Radau; earthquakes, Prof. J. Milne, F.R.S.; Echinodermata, Dr. F. A. Bather; Echiuroidea, Mr. A. E. Shipley; eclipse, Prof. Simon Newcomb; economic entomology, Prof. F. V. Theobald; education, Sir Joshua Fitch and Dr. N. M. Butler; eel, Mr. J. T. Cunningham; Egypt (physical geography), Major H. G. Lyons; and Egyptology, Prof. W. M. Flinders Petrie, F.R.S., and Mr. F. Ll. Griffith; and elastic systems, Prof. A. E. H. Love, F.R.S.

It will be evident from this selected list of subjects and authors that science is well represented in the volume, and that the editors have endeavoured to secure authoritative statements of the position of knowledge of many departments of scientific study. In general, the articles contain good accounts of advances in the departments of intellectual activity with which the writers deal, but there are some in which the view described is not so comprehensive as it might have been.

Take, for instance, the article on eclipse, which is supposed to bring the information up to the present position of knowledge of the subject as regards eclipses of the sun. We find various details referring to the extent and structure of the corona, and the number of lines photographed during various eclipses, but there is no clear view of the subject as a whole. Significant observations are overlooked, while others are catalogued without any attempt at analysis of the material. The article

on comets is just as unsatisfactory, and the only value it has to a student of the subject lies in the catalogues of elements of these bodies. Nothing is said about such important points as the distribution of orbits, the origin of comets or their spectroscopic history.

The article on education, by Sir J. G. Fitch, is worthy of the "Encyclopædia." Its main purpose is

"to trace the gradual growth of what may be called the English system, the forces which have controlled it, and the results it effected during the last quarter of the nineteenth century."

For purposes of comparison, a brief account is also given of the provision made for education in three or four nations of Europe in which the people are less hampered by tradition and the leaders are animated by a progressive spirit. Towards the close of his valuable paper, Sir Joshua Fitch points out some of the problems of the future.

"The motive force which we need," he remarks, "must be found in a higher and truer popular conception of a liberal education, and of its relation to the formation of character and to the duties of industrial, civic and family life. That the acquisition of knowledge, though obviously the prominent business of a school, is not the whole of education, and that knowledge consciously directed to the special professional and industrial needs of life is of far less real value than the knowledge which helps to bring out the best powers of the reflective and accomplished man, are truths which are yet imperfectly recognised."

The scientific study of Egyptian antiquities is reviewed in the article "Egyptology" by Prof. W. M. Flinders Petrie and Mr. F. Ll. Griffith. The latter confines his attention to the ancient language.

Egyptology is a science in the making, and as yet no general scientific systems of Egyptian archæological or linguistic study which command the allegiance of all Egyptologists have been worked out, although in the archæological field great progress has been made in this direction, owing chiefly to the work of Prof. Petrie. Any general article dealing with Egyptological study must, therefore, be in great measure a statement of personal opinion on the subject. So in these two articles by Messrs. Petrie and Griffith we have not so much general reviews of Egyptian archæological and linguistic study as *ex-cathedra* statements of the opinions held by two distinguished Egyptologists. These, however, are stated without any hint being given to the reader that many other equally distinguished Egyptologists disagree with them. For instance, Prof. Petrie's whole reconstruction of the first two Egyptian dynasties, based on the results of his excavations at Abydos, has recently been challenged in almost every point by Prof. Naville, the distinguished Egyptologist of Geneva, in the *Recueil de Travaux*.

Now we do not think that the Genevan professor's challenge is by any means altogether successful, but the fact that it could be made at all is a proof of the uncertainty of the whole matter. But no hint of uncertainty is given by Prof. Petrie on pp. 720, 722 of the "Encyclopædia" where he deals with it.<sup>1</sup> Similarly, the description of the

<sup>1</sup> Prof. Petrie's article was no doubt already set up in type before the publication of that of Prof. Naville, but this makes no difference to the argument; the uncertainty existed from the first.

language given by Mr. Griffith on pp. 726-731, while it contains much matter on which all scholars are agreed, and have been agreed since the time of De Rougé, nay, since the time of Champollion, is, in the main, as he himself makes quite clear, a statement of the views of a particular school of German Egyptologists, led by Dr. Erman, to which Mr. Griffith has attached himself.

Now, leaving English Egyptologists out of account, we find that these views are more or less shared by Prof. Sethe, Prof. Steindorff, Prof. Spiegelberg, Prof. Breasted, Dr. Schäfer, and a few others of less note. They are not only not shared, but are constantly criticised, by Prof. Maspero, Prof. Naville and Prof. Piehl, while Profs. Wiedemann, Lieblein and Schiaparelli, MM. Revillout, Lefébure and others, have not shown the slightest disposition to accept them. In England, Prof. Petrie himself has, so far as we are aware, never yet signified his adhesion to the views which Mr. Griffith expounds. Certainly Prof. Petrie never uses the hideous transliteration of the hieroglyphs, without conventional vowels, which is the shibboleth of the Berlin school. Mr. Griffith does, and he is justified in using it in scientific work, but we regret his use of it in a popular encyclopædia, for no person ignorant of the hieroglyphs can possibly comprehend it, and words written according to its rules cannot be pronounced without the insertion of the necessary conventional vowels, which might just as well be inserted in print. Mr. Griffith uses a transcription which is intelligible to the layman in the publications of the Egypt Exploration Fund; why not in the "Encyclopædia Britannica"?

Scientific opinion is therefore sharply divided on the subject of the language, and, this being so, we are of opinion that Mr. Griffith should not have stated the Ermanian theory without giving his readers any hint of the existence of this division of opinion.

Prof. Petrie's historical summary is, after the debatable period of the earliest dynasties is passed, naturally no longer so much an exposition of his own personal views, although on one or two points (*e.g.* the date of the Antef kings) he seems to differ from the opinion of the majority nowadays. His section dealing with archæology generally is of great interest and value. Fig. 10, giving the principal types of Egyptian pottery from the early pre-dynastic period to the twenty-sixth dynasty, is very appropriate to an encyclopædia.

The existence of differences of opinion on important matters among Egyptologists in no way points to any condition of chaos in Egyptology; on the contrary, it rather indicates the energy and vigour of the study, to the furtherance of which men like Prof. Naville and Prof. Maspero are, no less than Prof. Erman, Prof. Petrie and Mr. Griffith, devoting the best energies of their lives.

In Prof. Driver's article on "Old Testament Chronology," which is, generally speaking, very learned and comprehensive, we have one fault to find. At the beginning of the chronological table (p. 77), the professor, after giving Ussher's date for the Creation, proceeds in a most absurd manner to give the "probable real date" for the creation of man, which date, he opines, is "indeterminable, but much before 7000 B.C." (!) Why 7000 B.C. in particular? Because, in the column "Events in Con-

temporary History" (*sic*), given parallel to the Creation, we find under "Babylonia" the statement "7-6000. Temple of Bel at Nippur founded." So that the Creation Week must have been in a year somewhat anterior to the foundation of the Temple of Bel. Indubitably, but surely in the present year of grace this sort of thing is somewhat ridiculous, and worthier of a theological text-book for the use of Boer predikants (who are credited with also believing that the world is flat and that the sun goes round it) than of the "Encyclopædia Britannica!"

The article on "Earthquakes" contains some valuable sections. Within the compass of two and a half pages, we have accounts of most of the best instruments that have been constructed for the registration of earthquakes, whether of near or of very distant origin. These should be read in conjunction with the article on "Seismometers" in the ninth edition, which as yet is far from obsolete. Following the section referred to are paragraphs in which the results obtained from instrumental records are pithily described, those on velocity being an admirable summary of the important work of recent years. The practical applications of seismometry in the regulations to be observed by builders and engineers in earthquake countries will be read with no less interest than profit. These are all subjects on which the writer of the article is a recognised authority. Other branches of the science are treated in less detail. The sections on the origin and on the frequency and periodicity of earthquakes are hardly representative of our present knowledge on these subjects. Nor are there more than bare allusions to seismic sea waves, earthquake sounds and the changes of surface features produced by earthquakes. In particular, we miss a consecutive account of the phenomena of a typical earthquake. The progress of seismology, however, has been so rapid since the issue of the corresponding article in the ninth edition that to treat all branches in their due proportion within the limits of eight pages would be a difficult task and one requiring very extensive reading.

With the exception of the article "Dynamo," by Mr. C. C. Hawkins, the volume does not contain much of special interest to the electrical engineer. The article on the "Compass," by Captain E. W. Creak, is a useful addition to that in the ninth edition, and that on "Copper" contains a brief summary of the growth and importance of the electrolytic refining industry.

Mr. Hawkins's contribution deserves fuller mention, not only on account of its intrinsic merit, but because it fills a gap more keenly felt, since the references to the dynamo in the ninth edition are very meagre. The present article, however, brings the subject quite up to date. It opens with a brief discussion of the general theory of the induction of electric currents and an account of the development of a practical machine from Faraday's revolving copper disc. The different methods of field and armature winding for continuous-current machines and alternators are then considered more in detail, but not too elaborately. A general summary of the leading types of machine and a consideration of the suitability of each for different classes of work are also given. As a whole, the article forms a valuable contribution to the literature of the subject, and, without going into the matter very deeply, gives an interesting survey of the

present position of the dynamo from both a theoretical and a practical point of view.

The first of the more important biological articles included in the volume is one on Coelentera, by Dr. G. H. Fowler, in which it is shown how much our conception of this group has altered since the date of the previous issue. The colours of animals are treated of by Prof. E. B. Poulton, who lays emphasis on the advance of our knowledge with regard to the object of the general coloration of mammals and birds. Crustacea are described by the Rev. T. R. Stebbing, Ctenophora by Dr. Fowler, and cuttlefish by the Rev. J. F. Blake. In the genealogical table accompanying the latter article it is noticeable that Octopus (or rather Polypus) is regarded as the descendant of an ammonite of the Hoplites group, and also that the author accepts the view of one or two German writers as to the homology of the argonaut shell with that of an ammonite. The Echinodermata (called Echinoderma in the table of contents) are elaborately treated by Dr. F. A. Bather, while Mr. A. E. Shipley is responsible for that small marine group known as Echiurids, and, from the presence of segmentation in larval life, sometimes classed as Annelids.

The very important subject of economic insects falls to the lot of Prof. F. V. Theobald, but limitations of space render his article all too short. Recent investigations into the breeding-habits of the eel and the discovery of the real nature of "leptocephali" have enabled Mr. J. T. Cunningham to render the article "Eel" one of especial interest. The only botanical subject is cytology (vegetable), for which Mr. H. W. T. Wager is responsible.

#### ASPECTS OF MEDICAL SCIENCE.

*Pathologie générale et expérimentale. Les Processus généraux.* Par A. Chantemesse and W. W. Podwysotsky. Pp. xiv + 428; 162 figures. (Paris: G. Naud, 1901.)

*Matière médicale zoologique, Histoire des Drogues d'Origine animale.* Par H. Beauregard, Professeur à l'École supérieure de Pharmacie de Paris. Révisé par M. Coutière, with a preface by M. D'Arsonval. Pp. xxxi + 396; numerous plates and illustrations. (Paris: G. Naud, 1901.) Price fr. 12.

*Chemische und medicinische Untersuchungen. Festschrift zur des sechzigsten Geburtstages von Max Jaffé.* Pp. 472; 7 plates. (Braunschweig: Vieweg u. Sohn, 1901.)

*Das Wirbeltierblut in mikrokristallographischer Hinricht.* Von Dr. med. H. U. Kobert. Mit einem Vorworte von Prof. R. Kobert. Pp. 108; 26 figures. (Stuttgart: Ferdinand Enke, 1901.)

THE first book before us is the first volume of a system of general and experimental pathology. In an academically written preface of ten pages, the authors explain the object of the book, pointing out the extreme value of comparative experimental pathology in elucidating the prime problems of morbid processes in the human subject. In especial the authors cite the work of Pasteur on silkworm parasites, and that also of Metchnikoff on the effects of irritants upon low forms of life. Equally well might the recent researches upon

the causation of malaria have found a mention in this connection. M. Chantemesse's Russian collaborator, M. Podwysotsky, has already published in Russian a general experimental pathology covering similar ground to the volume under consideration. The present work, however, is much more extensive, both with regard to the letterpress and figures, and can in no sense be regarded as a translation from the Russian.

It is impossible in a short review to enter adequately into the subject-matter of so compendious a volume, and little more than a table of contents can be given. More than half the space is devoted to the degenerations, which are treated very fully, each having appended to it a copious, we were going to say appalling, bibliography. These huge lists of papers bearing on the corresponding subject are really the more appalling in that upon glancing through them it at once becomes evident that they are more complete with regard to French and Russian workers than with regard to German and English ones. Judging from them and the text, it appears that the authors are not well acquainted with current English scientific literature, as the number of English authors quoted is very small, and the same cannot be said of the English work done upon the subject in question. Certainly one, and in the reviewer's opinion not the least, of the advantages of the book is that it makes accessible to a cosmopolitan public a mass of Russian work, evidently of great value, which otherwise, on account either of its language or its inaccessibility, might have easily escaped the observation of workers in the field of experimental pathology, to their and their readers' detriment.

Under the degenerations are included goitre and cretinism, the authors giving, concerning these affections, an interesting series of experiments upon the effect of the water of the district upon endemic goitre. Saint Jean de Maurienne is apparently one of the most goitrous districts of France, and the waters here have actually the reputation of producing goitre, and are resorted to with success by certain individuals anxious to avoid compulsory military service. Glycosuria is discussed under glycolytic degeneration. An interesting section is devoted to watery and vacuolar degeneration, which includes a detailed description, with very beautiful illustrations, of the vacuolisation of the cells of the central nervous system under the influence of certain toxins and drugs.

The book throughout is written in a most lucid and attractive style, and in a distinctly philosophical manner. The amount of subject-matter treated is very great, and even subjects having little more than an indirect bearing upon the main theme of the book are exhaustively discussed. Some idea of the extent to which this is done may perhaps be formed in noting that no less than fifty pages are devoted to the subject of heredity, and that under this division of their subject the authors include a lengthy discussion of the views of Weissmann. The subject of argyrosis, or general pigmentation following the administration of silver salts, occupies six pages, and has appended to it a copious bibliography.

The reviewer regrets that the references in the bibliographies are not numbered, even when quoted in the text; reference to any given paper is by this fact

rendered very difficult. This difficulty is exaggerated since the position of any given name in the bibliography quoted in the text is not determined alphabetically, but by the date of the corresponding paper. This chronological arrangement of the bibliographies may possibly render them more valuable as entities, but certainly renders them more unwieldy for the purpose of their true function, viz. their reference to the text.

The volume is exceedingly well printed and provided amply with illustrations, often of preparations made by the authors, the execution of which leaves little to be desired. The book will certainly rank as a standard work of reference, and if the high efficiency of the present volume be maintained by its successors will certainly be accorded an emphatic welcome by all pathologists. The authors and the publishers are distinctly to be congratulated upon what can only be the result of labour at once skilful and unremitting.

The second work under notice is a posthumous one. As all interested in pharmacy in France know, M. Beauregard died some months before the publication of his "Matière médicale zoologique." Up to the very last, however, he took the keenest interest in it, and it is pathetic to note from the introduction that the proof sheets were corrected by the author upon the sick bed from which he was never to rise. The author is well known for his researches upon pharmaceutical subjects; these have, further, been in large measure directed to products of animal origin. Especially should his work upon the animal vesicants and upon the animal perfumes find mention here.

The volume which is the object of this review is a compendious book of reference upon all substances used, not only in pharmacy, but also in perfumery, which owe their origin to the animal kingdom. It must be at once observed that the information in the book is for the most part zoological, and that the chemistry of the products in question is not entered into at all fully. In many instances there is little to be said from the chemical side, but it is well to remark that from the chemical standpoint the book cannot be considered as comprising all that is known. Cod liver oil and musk are to some extent exceptions. Under cod liver oil the author gives an account of Gautier's work on the alkaloids contained in this substance, but no mention is made of Hegerdahl's researches on the chemical composition of the fatty constituents of the oil. Under musk an interesting paragraph is added upon artificial musks; nine synthetic substances, mostly butyltoluene derivatives, are mentioned which approach more or less closely to musk in smell. These substances, however, all differ from the natural musk (the preputial secretion from a variety of reindeer) in being less lasting. The extraordinary way in which musk keeps its smell renders this substance very valuable. The trade in this commodity is considerable, and in France is certainly increasing; in 1895, 686 cattie (604 grammes) were imported into France and 465 into London. At the present time musk fetches about 100*l.* a kilogramme.

Amongst other substances which are treated very exhaustively from the zoological side may be mentioned spermaceti, the crystalline fat derived from the head of the sperm whale, and the rare substance ambergris.

The literature of ambergris is very small, and M. Beauregard has certainly added very considerably to it. It appears that this interesting substance is an intestinal concretion occurring in certain whales. Ambergris is not employed in medicine, but is very much prized in perfumery on account of the property it possesses, although itself odourless, of reinforcing the scent of other substances. The chief market for ambergris is apparently at Boston, and some idea of its value may be formed from the fact that it sometimes fetches as much as 280*l.* the kilogramme.

The vesicant insects, *Cantharis vesicatoria* and its immediate allies, are, as was to be expected, treated very fully. The book concludes with a chapter devoted to the sponges.

From the above somewhat disjointed review it will be seen that M. Beauregard has for his last work produced a valuable addition to the literature of a subject concerning which not much has been written. We are afraid the limited number of readers to which the book will appeal will render the sale of it relatively small; be this as it may, the gratitude of those interested in the subject is due to the author for having collected in a most readable volume the scattered work of many observers, among which must be mentioned his own.

The German custom of celebrating the birthdays of professors by publishing a collection of papers by their collaborators and pupils has many advantages. The collection of monographs published to celebrate the sixtieth birthday of Prof. Max Jaffé by his former collaborators and pupils, although not quite so compendious as many of its forerunners, nevertheless contains an interesting collection of papers. The subject-matter may roughly be divided into three parts. The first series of papers is chiefly devoted to clinical medicine, and is written, for the most part, by old collaborators of Prof. Jaffé who have become famous as clinicians. Amongst these may be mentioned Prof. Leyden, who contributes an article upon the therapeutics of oxygen, and Prof. Nothnagel, from whose pen comes a most useful essay upon intestinal hæmorrhage.

The second series of papers, the shortest in the book, comprises three essays upon pathological, morbid anatomical and embryological subjects.

The third part of the book, occupying more than half its entire bulk, is essentially experimental. The first essay seems to be an entirely chemical one. Dr. Salkowski contributes an article upon the chemical composition of hydrocephalus fluid; he draws attention to the fact that the fluid is different in acute and chronic cases in so far as concerns its content of potash salts. He regards the excess in potash salts of acute hydrocephalus fluid as due to the fever which accompanies the acute variety. Normal urine contains, according to this author, only 21 per cent. of the sum of potash and soda salts as potash salts, whereas in fever urine 87 per cent. of this sum consists of potash salts.

An interesting piece of work by Dr. Rudolf Cohn, on the glyocol-store of the organism, comes from the Laboratory of Experimental Pharmacology and Medical Chemistry at Königsberg. It is a contribution to the study of intermediate tissue change. The work consists essentially of a repetition, by other methods, of that of Hugo

Wiener. The fact that benzoic acid is converted by the organism into hippuric acid, and is poisonous only in so far as it is not so converted, is made use of to estimate the quantity of glycol present in the organism under different conditions at any given time. The result of the researches, in the author's opinion, shows that in rabbits the store of glycol is neither small nor constant, and that it bears a constant relationship to proteid katabolism; further, that this relationship appears to be the same whether the proteid material be katabolised in the animal body or by external chemical means.

Prof. Hans Meyer, conjointly with Dr. J. T. Halsey and Dr. F. Ransom, contributes a paper on tetanus. The stimulus to this research appears to have been the work of Courmont and Doyon upon the influence of temperature upon the development of tetanus after the injection of the tetanus toxin. The results of Meyer and his collaborators are in the main confirmatory of those of the earlier observers, and appear to show distinctly that cold has a marked preventive influence upon the development of tetanus in animals after the injection of tetanus toxin. These results point, according to Ehrlich and his school, to the fact that the "toxophore" group, in the case of tetanus, develops slowly, and only at relatively high temperatures. The nearest poison of known chemical composition to the tetanus toxin is strychnine, and Koeninck has shown that the development of the symptoms of strychnine poisoning in animals is independent of the temperature.

The book contains other interesting essays, which the space at our command does not permit us to review.

Dr. Kobert's pamphlet is intended primarily for those interested in the medico-legal detection of blood, and consists for the most part of a compilation of the facts at present known upon this subject, culled from the appropriate original works. In some respects, however, it is original, especially with regard to the description and figure of hæmochromogen crystals, and hence will in this sense be possibly of use to physiological chemists generally. The book apparently owes its origin to a practical course upon the detection of blood stains which Prof. Kobert gave himself, and which in a much less complete form appeared in *Zeitschrift für angewandte Mikroskopie*.

The first few pages of the monograph are devoted to the interesting subject of the mutuality of iron and copper with regard to the blood pigment. It is a known fact that in certain invertebrata the blood performs its respiratory function through a copper compound. This physiological equivalence of copper and iron in this respect is distinctly of interest in connection with the supposed toxic effect of copper.

A considerable space is devoted to the interesting substance hæmatoporphyrin, which occurs in human urine especially after the administration of sulphonal, a very commonly used hypnotic. The relation of hæmopyrrol (methyl propyl pyrrol) to hæmoglobin and chlorophyll is also discussed in the light of the work of Marchlewski and Schunck.

A short section is devoted to blood serum crystals, and the pamphlet concludes with a concise bibliographical and general index.

The booklet is certainly thoroughly written, and will

be found useful by those especially interested in this somewhat limited field, as well as of practical use in guiding the medical jurist with regard to method.

F. W. T.

### CHEMICAL ESSAYS.

*Essays in Historical Chemistry.* By T. E. Thorpe, C.B., LL.D., F.R.S. Pp. xii + 582. (London: Macmillan and Co., Ltd., 1902.) Price 12s. net.

IT is always a pleasure to read any of Dr. Thorpe's essays; in this volume a number of them, delivered on very different occasions, at intervals during the last twenty-five years, have been collected. Some have been published in book form before, but several, which are to be found in the present work, are reprinted from *NATURE* and from the *Transactions* of the Chemical Society.

The first essay—that on Robert Boyle, "the father of modern chemistry"—displays Dr. Thorpe's admirable style at its best. One is struck by the great wealth of allusion to contemporary events, touched lightly, it is true, but none the less giving a clear impression of the times in which the subject of the essay lived, and of the surroundings in which he carried on his work. Dr. Thorpe possesses, too, a happy knack of apt quotation; the particular passage from a writer of prose or poetry which best illustrates the point which he wishes to make flows easily from his pen, and gives much interest and spice to his narratives. The essay on Boyle is a sketch; much that is interesting is omitted, and there is plenty of room for other essays on Boyle; but what is told is written in such an attractive style, and gives such a perfect picture of the quiet, meditative philosopher—*philaretus*, or the friend of virtue, as he calls himself in a passage which might with advantage have been quoted—that to complain of a lack of completeness would be to appear to undervalue what is given.

Dr. Priestley is the subject of the next sketch. Again the same careful delineation of character is to be noted; but perhaps in the life of Scheele, the subject of the third essay, Dr. Thorpe is at his best. It is hardly fair, however, to the shades of Mayow to credit Dr. Priestley with the invention of the pneumatic trough, although the name, doubtless, is due to him; for Mayow's *Tractatus quinque* contain many illustrations of that convenient appliance.

In the essay on Cavendish, a delightful picture is given of an imaginary soirée at the house of Sir Joseph Banks:—

"The portly visitor, with the large frill, makes his way upstairs, to the evident embarrassment of a thin middle-aged gentleman in an old-fashioned Court-dress of faded violet, and a knocker-tailed periwig, who is moving uneasily about on the landing, evidently afraid to face the assembly. The approach of the gentleman on the stairs, however, drives him into the room. He shuffles quickly from place to place, his manner is awkward; his face betrays a nervous irritation of mind, and he appears annoyed if looked at. It is the Honourable Mr. Cavendish. Finding himself close to a group, evidently, from the appearance which their faces wear, speaking of a deeply important matter, he draws near to listen. They are talking of a rumour of some grave disaster which has befallen my Lord Cornwallis and his troops, who it

would seem have been circumvented in some unexpected manner by the machinations of that arch-rebel Washington. Mr. Cavendish is scarcely interested, and he moves aside to catch something concerning, it may be, some fresh eccentricity of poor Lord George Gordon, or perhaps some account of the troubles of the unhappy Mr. Watt, the engineer, who, it is said, is fighting tooth and nail to defend his just rights from a set of unprincipled rogues who pirate his inventions. None of these matters is sufficiently moving to detain him. But his manner quickly alters when he overhears the mention of the name of Mr. Herschel. Mr. Herschel is a musician at Bath, who employs his leisure in constructing big telescopes, with one of which he has just discovered a new planet. Mr. Cavendish is greatly interested; he listens with marked attention; he is even about to put a question, and begins in a nervous, hesitating manner, and in a thin, shrill voice, when his eye catches that of a stranger; he is instantly silent, and retires in great haste, for he has a horror of a strange face. The portly gentleman with the large frill espies him, and comes up with a foreign gentleman, who is formally introduced to Mr. Cavendish. Mr. Cavendish is assured by the portly gentleman that his foreign friend is particularly anxious to make the acquaintance of a philosopher so profound and so universally celebrated—all of which is confirmed by the foreign gentleman, who adds that it was, indeed, his chief reason for coming to London, that he might see and converse with one of the most illustrious philosophers of that or any other age. Mr. Cavendish is speechless; he is overwhelmed with confusion, until seeing an opening in the crowd, he darts through it with all possible speed, and reaching his carriage, is driven home."

This it must be acknowledged is a most graphic piece of descriptive narration; it conveys the man and the age like a living picture. The author would have made a thrilling novel-writer, at all events on the descriptive side.

The sketch of Lavoisier, although giving a fair account of his life and works, possibly treats at too great a length of his tragic death; but this error (if it be one) is partly atoned for in the next essay, in which the rights (and wrongs) of the dispute regarding the share of Priestley, Cavendish and Lavoisier in the discovery of the nature of combustion and of the composition of water are fully discussed. No English chemist will dispute that while Priestley and Cavendish, personally, and through Blagden, furnished Lavoisier with the facts relating to the preparation of oxygen and the composition of water, it was Lavoisier who interpreted them correctly. It is strange that Priestley (in a passage quoted on p. 153) and Cavendish, in his paper in the *Phil. Trans.* for 1784, p. 150, both consider the advantages and disadvantages of using the conceptions given to the world by Lavoisier; and both, after stating arguments on both sides, prefer the method of statement in terms of phlogiston. It is a pity that such international disputes should arise; would that scientific men of all nations would take to heart the words of Pasteur:—

"I find myself deeply impressed by two propositions: first, that science is of no nationality; and secondly, in apparent but only apparent contradiction, that science is the highest personification of nationality. Science has no nationality, because knowledge is the patrimony of humanity, the torch which gives light to the world. Science should be the highest personification of nationality, because, of all nations, that one will be the foremost which shall be the first to progress by exerting

thought and intelligence. Let us strive, for strife is effort, strife is life, when progress is the goal."

The strife should consist in trying to raise one's own nation to the highest pinnacle of intellectual and industrial greatness, and not in disputes as to priority of discovery and invention.

A full analysis is given of Graham's work, and his biography is pleasant reading. The genial, kindly nature of the man is well brought out. The remaining essays, on Wöhler and Liebig, founded on Hoffmann's charming biography; of Kopp and of Victor Meyer, both old friends; and of Mendeléeff and Cannizzaro, enter more into the details of their chemical work, and may therefore prove of less interest to the general reader; but they are fairly exhaustive, and produce the effect which they were intended to produce—a high estimate of the genius and hard work of the subjects of biography.

The progress of chemistry in this country during the nineteenth century was the subject of Dr. Thorpe's presidential address to the Chemical Society in 1900; it is conceived in his best style, and presents a life-like picture of the progress of the science in the early part of the century. A continuation of this sketch is promised, but up to now has not appeared. But it is acknowledged to be easier to paint a distant landscape than a near one; the numberless details, which produce somewhat of confusion when close, merge into broad masses of colour when sufficiently far away.

One conclusion, among many, stands out conspicuous from Dr. Thorpe's pages. It is the enormous influence of the teacher on the taught; how potent is the effect of personal contact with the experienced investigator on the future career of the young student! Scheele with Retzius and Bergmann, Watt with Black, Lavoisier with Rouelle, Faraday with Davy, Graham with Thomson, Wöhler with Gmelin and Berzelius, Liebig with Gay-Lussac, Dumas with De Saussure and De Candolle, Kopp with Gmelin, Victor Meyer with Bunsen. It is rare that a young man has, like Boyle and Cavendish, sufficient initiative and perseverance to forge a way for himself. As Prof. von Baeyer once remarked to the writer of this notice:—"I care not what a young man knows; if he can only *think*, after he has left my laboratory, I feel that I have done my duty by him." When will this elementary view of education influence the action of those who legislate on the training of our youth? W. R.

#### AN ASSISTANT MASTER, AND HIS WORK.

*The Schoolmaster: a Commentary upon the Aims and Methods of an Assistant Master in a Public School.* By Arthur Christopher Benson, of Eton College. Pp. vi + 173. (London: John Murray, 1902.) Price 5s. net.

THIS book is not, and does not profess to be, a manual of pedagogy. The reader in search of help in regard to school organisation, to the allocation of time and subjects, to the methods of teaching generally, the bearing of Herbartian or other philosophical theories on practical problems, or educational politics in any sense, will probably find the book disappointing. The author has little or nothing to say on the relation of

Government or public authorities to the school and its teachers, the influence of external examinations, the place of science in the curriculum of a school, the professional training of school masters, or any of the numerous subjects which form the staple of newspaper controversy or Royal Commissioners' reports in relation to school policy and work. His point of view is simply that of a classical master, whose work has been done only with scholars drawn from the upper ranks of society, whose educational ideals have been formed by Eton traditions and by the requirements of the universities, and who discusses with his readers in an informal and conversational fashion the question how, under the exceptional conditions of a boarding-house at a great public school, the utmost can be done to foster manliness, good scholarship and the characteristics of a Christian gentleman.

But within this limited range of observation and experience Mr. Benson has acquired much valuable knowledge, and his book shows him to be distinguished, not only by literary skill, but also by a genuine love for his profession and by a keen and sympathetic insight into the nature and the needs of boyhood. His view of the spiritual and mental relationship which should be established between a wise teacher and his pupil, his large tolerance for differences in the character and tastes, the virtues and the faults of boys, his belief in Thring's well-known *dictum* that there is no such thing in the world as a good-for-nothing boy, and his insistence on the value of an atmosphere of cheerfulness and intelligence as distinguished from the mere learning of lessons—all give a special charm to the book and will serve to make it peculiarly attractive to young teachers who are not pedants, but who seek to achieve the highest and truest kind of professional success.

The discussion on the prospects of the teaching profession and its disadvantages is marked by much candour:

"No enthusiasm will ever quite succeed in gilding a trade which consists in part of providing food and lodging for a large number of people and charging them rather more than they cost."

On the other hand, to one who is drawn to the profession by a sense of personal fitness and by a liking for the work,

"there is a certain attractiveness about the perpetual exercise of minute control, there is a sense very strong in the British character of pleasure in exercising discipline and showing power"; "there is no profession which is so apt, if exercised faithfully, sympathetically and tenderly, to broaden the character and enlarge the spirit,"

and it often happens that the man who begins as the careless, self-regarding practitioner of a not very dignified "trade discovers that he is in the thick of a very real and vivid life which stirs all sorts of interests and emotions and brings home to him some of the deep realities of life."

The writer of such passages is under no illusions and has no temptation to magnify his office unduly; but he is deeply impressed with its seriousness, and he believes that a young teacher will find, as he acquires new power and stronger sympathy, increased delight in his work.

As to specific training for that work, Mr. Benson is somewhat sceptical. Apparently he is not speaking from any experience of trained as compared with untrained colleagues: but because his own success has been attained by other means than formal preparation, he pronounces boldly that training can never make a man an effective teacher. He thinks that

"a sensible man may learn more in a week from teaching a division of his own when he has no one to depend on but himself than in months spent in a training college."

His plan appears to be to treat a class of boys as the *corpus vile* on whom pedagogic experiments may be tried, and he adds with charming *naïveté*,

"As far as mere methods are concerned, I am sure I could tell a young man in half an hour the simple dodges which have proved in my own case useful and effective."

The author fails to see that while a man endowed with natural gifts such as insight into character and professional enthusiasm may become a valuable teacher without training, it is evident that the rank and file of the teaching profession will find themselves at least helped by some knowledge of the philosophy of the art they profess and by some acquaintance with the methods and performances of famous teachers, and of the reasons for their success or failure.

The best chapters in the book are those in which the author discusses the means by which school lessons may be made interesting and attractive to boys.

"A school lesson," he says, "should be of the nature of a dramatic performance from which some interest and amusement may be expected, while at the same time there must be solid and business-like work done. The aim ought not to be to turn everybody into a literary personage. Literature is only one province of the intellectual life. . . . An intellectual person is one whose mind is alive to ideas, who is interested in politics, religion, science, history, literature, who knows enough to wish to know more and to listen if he cannot talk."

But no man is capable of generating in his pupils a real love for knowledge unless he himself cultivates some intellectual interests apart from the obvious routine of school work.

"The master, out of school, should live in the company of good books and big ideas. Everyone cannot be interested in everything, but everyone is capable of being interested in something, and I do not care very much what the subject is, provided only that there is a little glow, a little enthusiasm in it."

On the well-worn topics of athletics, on holidays, on prizes, on the right use of chapel services and on moral teaching, Mr. Benson speaks with strong conviction and good sense. His aims are high, but he is afraid to set up impossible ideals or to forget that, while temptation is often strong and boys are weak, they

"are in their better moments earnestly and pathetically desirous to be kept from evil, and that no help which the schoolmaster can give them is ever thrown away."

The book abounds with obvious truisms, but they are rendered attractive by the freshness with which they are stated, and by the fact that they are the product of actual experience and of the serious devotion of a life to

duties which the author has learned to enjoy as well as to fulfil. In the midst of much that he and others regard as revolutionary in educational theory, and of many importunate claims on the part of "modern subjects" in schools, it is useful for us all to be reminded, as in this book, of what may be done in connection with the traditional discipline of the great public schools, when the work is undertaken by men who, though standing honestly *super vias antiquas* in regard to the staple of school teaching, are nevertheless profoundly conscious of the needs of our own time, and who look on scholarship, not as an end in itself, but mainly as a means to the higher end of Christian manhood and honourable citizenship.

#### OUR BOOK SHELF.

*The Dictionary of Photography.* By E. J. Wall, F.R.P.S. Revised and brought up to date by T. Bolas, F.C.S., F.I.C. 8th edition. Pp. iv + 656. (London: Hazell, Watson and Viney, Ltd., 1902.) Price 7s. 6d. net.

THE fact that the eighth edition of this dictionary is now published is the best of all evidence of the appreciation that it continues to receive. And this appreciation is deserved, whether one regards the work of the author or the reviser. So far as we have been able to examine the work, the information it gives is sound and useful. Mr. Bolas states that he has added nearly a hundred new pages of subject-matter, as many fresh headings and many new diagrams, but by a process of concentration and elimination has not increased the bulk of the volume so far as to render it unwieldy.

The great difficulty in compiling a book that aims at being something more than a simple guide for beginners and something more handy and less costly than a treatise that aims at approximate completeness, is to satisfactorily apportion the available space to the various subjects. As the needs of no two readers are exactly alike, a very wide margin must be allowed for the discretion of the compiler, but we notice a few cases in which the reviser might with advantage have extended his work of adding to the original, even if it necessitated still more "concentration and elimination." The page and a third devoted to "amphitype," for example, might well have been spared, while the six or seven lines devoted to "hypo-eliminators" might profitably have been expanded to a couple of pages. The getting rid of sodium hyposulphite is a problem that has to be attended to in the production of every negative and silver print, and even if all "eliminators" are regarded as useless, some are still on the market, and every thinking photographer wants to know something as to their mode of action, advantages and drawbacks.

Acetylene is very unfairly treated. After it has been in use for so many years as it has, and has proved to be so convenient, effective and safe, it must be a prejudiced view of it that leads to its consideration in less than a page, half of which is devoted to its endothermic and consequently supposed dangerous character, and the other half to its history and a statement that the "great hopes" concerning it have not been realised!

In the selected bibliography of photography some hundred and twenty books are mentioned, ranging from apparatus makers' pamphlets and beginners' guides to the most comprehensive works; but of the few books recommended for students by the City and Guilds examiners, presumably because of their educational value, we have counted nine in English, including three on general photography, that are not mentioned. This

difference can hardly be dismissed as due to the exercise of a wise discretion.

These are examples of the cases in which the reviser might have gone even further than he has in his additions, concentrations and eliminations. Doubtless he will do so when the next edition is called for.

*Die Entwicklung des Gesichtes: Tafeln zur Entwicklungsgeschichte der äusseren Körperform der Wirbeltiere.* By Carl Rabl. Part i., *Das Gesicht der Säugethiere.* With 8 plates. (Leipzig: Engelmann, 1902.) Price 12s.

THIS, the first of four parts of a comprehensive work, deals with the development of the external form of the head-region in rabbit, pig and human embryo. How many different vertebrate animals the author proposes to make use of for the purposes of the research is not stated, but it may be recognised that the net is cast widely enough when within its meshes so lowly an animal as the lamprey is to be contained. The figures of the eight folio plates, drawn by the author, are certainly exquisite, quite unique, indeed, of their kind. From others previously published they differ in two important respects. While the former rarely exceed a magnification of five diameters, the present ones possess three times this, and—a very important point—they are the first series of the kind to be lithographed by the firm of Werner and Winter. This is a sufficient guarantee that full justice has been done to the originals by the lithographer's art.

In fundamental features the drawings, perhaps, hardly reveal anything not already visible in the well-known pictures of pig and human embryos published by His and Keibel. Possibly novelties may be looked for in subsequent parts of the work. To the figures extant of normal human embryos, those here given will form additions welcome to the anatomist and the embryologist alike. As to the others, the one noticeable deficiency is that they stop short of and do not at all cover the period when, for instance, the pig-embryo first becomes unmistakably a member of the genus *Sus*, a representative of the species *Sus scrofa*, and a pig with a particular individuality of its own. That is to say, the author ignores what His has termed the period of the passage of the embryo into the fœtus, the point when the unfolding of the embryo is about finished.

The work, which with so large a number of fine plates is remarkably cheap, is being published by the aid of the Imperial Academy of Sciences, Vienna.

*Les Fleurs du Midi.* By P. Granger. Pp. viii + 371. (Paris: J. B. Baillière et Fils, 1902.)

THE vast quantity of early flowers which reaches this country in the early spring from the Mediterranean region might lead one to suppose that the conditions of the climate there are entirely favourable to the forcing and rapid development of plants. A perusal of this book indicates that the gardeners of the littoral do not find circumstances by any means so propitious, for the east wind causes drooping of the leaves and withering of the flowers, while the mistral coming from the north-west at times blows with such force that trees are uprooted and shelters overthrown.

The various protective devices, whether hedges or trees, glass frames, straw mats, &c., are fully described and illustrated, together with the conditions under which they may advantageously be employed. Then follows a discussion of various details, such as manures, insecticides, the best methods of gathering and packing, and the cost of freight. The main bulk of the book treats of the plants which lend themselves to cultivation during the winter, with an enumeration of species and varieties which are suitable to the climate and likely to yield a remunerative return for time and money expended in their production. The book is essentially practical and represents the outcome of several years' experience. The



type is good and the illustrations form an important feature, being artistic and at the same time expressive and useful.

*Physiology for Beginners.* By Leonard Hill, M.B., F.R.S. Pp. viii + 124. (London: Edward Arnold, 1902.) Price 1s.

IN this tiny volume the author has set himself the difficult task, as he describes it in his preface, of putting in simple language the essential facts concerning the structure and functions of the human body.

The book is intended for junior students who have no previous knowledge of the subject, and it may be said that the author has put forward the main essentials of the subject in an attractive way such as ought to engage the interest of school children, for whom the book is obviously intended. The author clothes his subject in the homeliest possible phraseology, avoiding technical terms and hard names so far as can be done in dealing with such an abstruse subject, and instead of giving dull definitions he suggests and then answers questions which must arouse interest in the juvenile mind.

Although mainly written for use as an elementary school book, the volume may be recommended to anyone who wishes to obtain some knowledge of the functions of the different organs of the body without the trouble of a detailed or technical study of the subject.

The book is artistically got up and adorned with many clear and well-drawn illustrations of the subject-matter.

B. MOORE.

*Die Philosophie August Comte's.* By L. Lévy-Bruhl. German translation by H. Molenaar. Pp. 286. (Leipzig: Dürr'schen Buchhandlung, 1902.) Price Mk. 6.

THIS is a careful translation into German of a full and sympathetic study of Comte's positivist philosophy in all its aspects. M. Lévy-Bruhl is not one of those more cautious disciples who, like Littré, rejected Comte's religion in the name of his philosophy. He boldly defends the whole later development with its curious substitute for Catholicism as a necessary consequence of the original Comtian conception of a reform of society operating by means of philosophy. The actual subject of his book is, however, the philosophy apart from the subsequent developments. He treats with lucidity and knowledge in his first book of the foundations of the positivist doctrine, the alleged "law of the three stages," the classification of the sciences and the concept of law. In books ii. and iii. he presents a sketch of the natural and social sciences, exhibiting their interrelation. The concluding book is devoted to an exposition of the positivist ethics. The translation reads well and pleasantly, and makes one wish that we in England, where Comte is more talked about than studied, possessed a statement of his doctrine at once so lucid and so concise.

A. E. T.

*Elementary Coal Mining.* By George L. Kerr. Pp. 225. (London: Charles Griffin and Co., Ltd. 1902.) Price 3s. 6d.

THIS volume "is meant as an introductory manual to the larger and more advanced text-books." The subject-matter is dealt with in fourteen chapters, at the end of each of which there are examination questions. The information is given concisely and in a form adapted for easy assimilation by students preparing for the examinations held under the Education Department and the County Councils and under the Home Office for under-managers' certificates. There is no striking novelty in arrangement or in the matter dealt with. The 200 illustrations are good and clear. Several of them appear to have been borrowed from Mr. Herbert W. Hughes's well-known text-book, with no mention of the source.

## 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.]

### Earthquake of May 28 at the Cape, and Coincident Meteorological Effects.

AS certain peculiar meteorological phenomena seem to have been closely associated with the earthquake felt in the Cape Peninsula on May 28, the following particulars of this occurrence seem to deserve notice.

After being practically calm all day, a loud sound resembling a clap of thunder or the rumbling of approaching heavy waggons was heard about 11.45 p.m. (Cape mean time of 22½° east), followed in Cape Town and Green Point by a heavy downpour of rain, and in the suburbs by a severe squall of wind and rain; practically simultaneous with the sound there occurred a shaking and rattling of windows and doors; some state they felt also a distinct shock, others that their beds rocked, while information was received of the cracking of the walls of at least two dwelling houses. The wind-squall was strong enough to uproot or blow down trees in some of the eastern suburbs. One gentleman, whose written account is in our possession, states that "it fairly shook the room and its contents which I occupy at Rosebank; shortly afterwards a similar sound (tremor?) was felt; it lasted only a few seconds and died away." Dogs were apparently conscious of the occurrence, one which was never known to be affected by thunder or lightning moving about and whining in a peculiar manner, while a parrot indicated by its screeching that it was sensible of something unusual happening.

Our meteorological records show that rain fell (except on May 19) every day from May 17 to May 24, amounting to 3.10 inches at the Royal Observatory and to 7.45 inches at Newlands. Between the 24th and 28th, although no rain fell, there was almost an entire absence of drying winds, being chiefly light from the N.W., from which direction comes the bulk of the Cape Peninsula rainfall.

Barometric pressure was high, 30.071 inches at 8 a.m. on May 27, but fell steadily to 29.775 inches at 6 p.m. on May 28, after which it remained stationary, so far as hourly eye-readings showed, until 11 p.m.; between 11 p.m. and midnight it fell to 29.717 inches, and rose rapidly to 29.771 inches at 12.15 a.m. on May 29, to 29.809 inches at 12.25 a.m., and to 29.817 at 12.30 a.m., unusually large and rapid fluctuations for the Cape Peninsula, and suggesting at once the presence of thunderstorms in the neighbourhood. These rapid variations in pressure might account for the rumbling sound, on the supposition of it being thunder, also for the wind-squall, and even for the rattling of doors and windows (not affected by ordinary winds), but fails to account for the "rocking" of the beds, the cracking of walls and the unusual behaviour of the dog already mentioned, all these inducing the belief that an actual "earthquake" was experienced.

No record of any seismic disturbance was, however, shown on the seismometer at the Royal Observatory.

The lightkeeper at Cape Point makes these remarks on his meteorological schedule for May:—"28th: wind S.E. to S.W., light; silent lightning from N. to N.W. at 8 p.m., then thick fog from 10.30 p.m., and a light drizzling shower at 11.45 p.m. Fog and rain till midnight, then thunder and lightning at midnight; again rain off and on from 1.40 a.m. till 8 a.m. on May 29."

Through the courtesy of Mr. D. E. Hutchins, Conservator o. Forests, the writer has been enabled to examine his barogram obtained at Cape Town for the period between Tuesday, May 27, and Sunday, June 1. This record shows a dip in the curve occurring after 11 p.m. on May 28. Similar irregularities are recorded for the early mornings of May 29 and 31; these too were associated with thunderstorms, but may be connected with the West Indian eruptions of about the same date, an account of which is given in your issue of June 5.

In the absence of fuller information than is in our possession at present, no definite connection can be traced, but these phenomena seem to be closely related one to the other. At least, it will be admitted that a comparison of this barographic curve with the diary of events in the West Indies shows some

<sup>1</sup> Corrected to 32° Fahr., but not to sea-level; approximate height of barometer, 40 feet.

most peculiar coincidences:—(1) Renewal of eruption of Mont Pelée on morning of May 28; peculiar atmospheric disturbance at the Cape, simultaneous with earthquake shock there. (2) Renewal of irregularities in pressure curve on May 29 and 31 and early morning of June 1, there being renewed volcanic disturbances in West Indies on or about these same dates. The curve for these last two days is remarkable, resembling closely a series of ripples and suggesting "interference" effects.

Which was cause and which effect, or is there any correlation whatever?

CHARLES STEWART.

Meteorological Commission, Cape Town, July 16.

### A Tripartite Stroke of Lightning.

AT about 6.50 p.m. on August 7, after two or three preliminary low thunder rumblings, which by no means prepared us for what was to come, a most tremendous crash of combined thunder, lightning and electric discharge burst right over my residence here.

My butler, who was looking in the direction of our front gate, 80 yards to the north of our front door, saw a burst of smoke, mingled with a shower of leaves, rise into the air out of the adjoining shrubbery.

My coachman, who was sitting just within the open door of the lodge, close to the front gate, was dazed by a vivid burst of flame at his feet which seemed to leap into the doorway.

My neighbour's gardener, looking out of the lodge opposite, saw a nearly horizontal flash of fire enter the shrubbery close to my front gate.

A subsequent examination of the surroundings of the front gate and my coachman's lodge has revealed:—

(1) A tearing up of the ground close to the massive iron post of the front gate, the splitting of a large flint at its foot, and a litter of ivy leaves on the gravel.

(2) The clean cutting in two of an oak post, 35 yards distant to the north-east, from which an iron hand-gate was hanging.

(3) The scorching of the outside foliage of a horse-chestnut some 15 yards still further off, in a direct line with the other two objects struck.

In thirty years' experience of thunderstorms, which are rather frequent here, I have never observed the simultaneous striking of three different points by the electric discharge. A death-like stillness succeeded the crash, the storm appearing to have exhausted itself in a single tremendous explosion. Heavy rain was falling when the crash occurred. I have measured an inch and a half of rain-fall within the last three days.

Six Mile Bottom, Cambs., August 8. W. H. HALL.

### Colours between Clouds at Sunset.

ABOUT sunset on the evening of Sunday, July 13, being at Ripon with my son, our attention was arrested by an unusual appearance, which I will briefly describe. Two large clouds, covering a considerable portion of the western sky, and separated by an interval leading generally towards the west, were each bordered along this interval by a bright and well-marked double spectrum. The two spectra forming this were together of the width of about one and a half times the diameter of the sun; they followed the foldings of the edge of the clouds, and, which suggests a partial explanation, were at right angles to a fringe of nebulous striæ, which bordered the clouds, so that, except that the spectral colours were parallel instead of consecutive, the phenomenon had in some degree the appearance of the reflection from a grating.

Our observation lasted about twenty minutes, and it was especially noticeable that when, through the fading light, the more refrangible colours had disappeared, the two red lines on the rim of each cloud remained clearly marked to the last.

Never having previously seen or even heard of such an appearance, any information on the subject would be much appreciated. I might also report that on the evening of July 17 the pink streamers mentioned by some of your correspondents could be well observed, and had they been less stable, and had they radiated from the north instead of from the position of the setting sun, the appearance would have much resembled the Aurora Borealis.

JOHN BADDELEY.

Adswold, Bury New Road, Higher Broughton,  
Manchester.

### Retention of Leaves by Deciduous Trees.

ONE of the proofs in favour of this being caused by early frost is that frequently on exposed beech and other deciduous trees only the leaves near the ground are affected and remain brown on the trees until the spring. Leaves higher up escape the frost and fall normally, as these early frosts are usually confined to the strata of air near the ground.

W. R. FISHER.

Coopers Hill, Englefield Green, Surrey, August 8.

### THE WEST INDIAN ERUPTIONS.

AMONGST the last contributions to our knowledge of the eruptions which so recently devastated portions of the West Indies are five preliminary reports to the National Geographic Society. These, with excellent illustrations, appear in the July magazine of the Society.

In the following notes upon these reports attention is drawn to those portions of their contents which are not generally known, and to these are added a few observations made by witnesses, particularly those made by Captain E. W. Freeman, of the s.s. *Roddam*, whose experiences, although he was interviewed by members of the American expedition, have as yet received but slight consideration.

The first report is by Mr. Robert T. Hill, of the U.S. Geological Survey, who, with other scientific investigators, accompanied a relief expedition in the U.S. steamer *Dixie*, which sailed from Brooklyn Dock on May 14.

Notwithstanding the ill-advised introduction of matters foreign to the object of a scientific expedition, the bulk of Mr. Hill's report is well worth consideration. La Montagne Pelée, which has been introduced to our notice as the goddess of Hawaii and as the mountain which is bare or "naked," is now referred to as the "shovelfull," an allusion possibly to its form. In May, 1901, we are told that a picnic party discovered on its summit a small fume rising at one corner of its crater lake. On April 23 three distinct shocks were felt in St. Pierre, and everybody saw a great cloud of smoke rising from the summit crater. Two days later the lower Soufrière was in eruption, and from this date until May 5 the showers of ashes steadily increased. The succeeding sequence of events has already been published in these columns, whilst the observations of April 23 bring us nearer to the seismic disturbances of April 19, which, although they originated in Central America, there are strong reasons to suspect were the primary cause of disturbances in the Antillean fold.

As the introduction to the account of the catastrophe Mr. Hill mentions his witnesses, and here we find for the first and last time in these reports the name of Captain Freeman. Certainly there is a reference to his vessel. According to engineer Evans, of the *Roraima*, which was burned, the *Roddam* was lifted on a wave "so that her anchor chain broke and she was enabled to escape," which is not correct. Now at the time the great and fatal blast swept across St. Pierre and its roadstead, Captain Freeman was on the deck of his vessel—then about three ships' lengths from the shore—and for some time at least could see what occurred, whilst other witnesses whose testimony is referred to had sought refuge in engine-rooms or down below. Captain Freeman says that although there were many minor puffs of clouds from Pelée there was only *one* great eruption, and this came from the side of the mountain. There were no detonations or loud reports, and from his point of view there was no sheet of flame accompanying or following the blast. The force of this, which came with the wind, was so great that he believes it was the cause of the s.s. *Grappler* turning turtle. There was no return blast, neither was there any absence of air. The difficulty in breathing was due to the quantity of fine ash with which the atmosphere was charged and the fetid gases with which it was mixed.

The *Roddam* was not saved by being lifted on a wave, neither was it saved by knocking out shackle pins and slipping the cables. What Freeman did was to free his windlass and then run full speed astern until the cable parted. After that, the steering gear being jammed with ash, he steamed ahead and then astern, close to burning ships, seeing and hearing the cries of those on board and also of those who were running to and fro along the shore. From this it is certain that many of the people in St. Pierre did not die suddenly. Twenty-six of his own men also died, and for the most part they died slowly. At the end of an hour and a half the gear was cleared and he escaped. Then came a shower, not of mud, but of rain. About eight hours later, with 120 tons of fine sand-like ash upon its deck, the *Roddam* steamed into St. Lucia. Notwithstanding the fact that possibly 2 or 3 per cent. of this material consisted of grains of magnetite, and the quantity of ash containing this material above and around his vessel was so great that daylight was replaced by a darkness that could be felt, such compasses as were left in the *Roddam* were serviceable for navigation and did not show any irregularity in behaviour. Before the eruption nothing unusual was observed in the barometer.

These few notes, which bear upon the reports we are considering, but, as will be seen, are not entirely in harmony with the same, come from a man who saw the great explosion, was in the midst of its blast and saw what could be seen from the sea of the events which closely followed its occurrence.

That Captain Freeman, whilst on a burning ship, where he was more than half suffocated with hot ashes, when the boots were burned from his feet, his face seared and his hands so scorched and welted that he worked with his elbows, had the presence of mind to do what he did and the physical and mental power to carry out his intentions under these trying conditions is one of those instances of will-power and endurance possessed by few so well worthy of record. Let it be repeated, the *Roddam* was not saved by accident, but it was saved as Captain Freeman saved it once before whilst eleven other steamers foundered, by good judgment and courage, and it is to be hoped that before long he will receive from underwriters or others substantial recognition, not only for his services on the *Roddam*, but for the example he has placed before the world.

To return to Mr. Hill's report, at 7 o'clock on the morning of May 8 Mr. Ferdinand Clerc observed the needle of a large aneroid barometer pulsating violently, and it was in consequence of this fact that he left the city and escaped. It is, of course, possible that these movements were due to the air disturbances accompanying the outbursts of "smoke" which preceded the great eruption. This eruption, which took the form of a big black cloud, no doubt made up of ash, steam and other gases, issued from "a point fully 1000 metres below the summit" and travelled at the rate of a mile a minute downwards over the surface of the earth upon St. Pierre and its harbour. The ashes which fell upon the deck of the *Roddam* were found still to be warm thirteen days after the eruption.

At the time they fell on the *Roraima* they were hot enough to ignite rope and bedding, but not to ignite wood. This statement, according to Captain Freeman, means that the level surface of a deck would not be fired by a thick layer of such ashes, whilst woodwork round the edges of such a layer might be ignited. At all events the *Roraima* and other vessels were destroyed by fire, whilst the cloud as it passed over St. Pierre set fire to buildings. The *Dominica Guardian* of June 25 writes on this subject as follows:—

"It would appear that a sudden fissure was opened on the side of the mountain overlooking the city; and, near to the Étang Sec on this flank of the volcano, a large

vent belched out lava, superheated steam and acid gases downwards on to St. Pierre and the roadstead. The flashing off into steam of the water imprisoned in the incandescent lava converted that lava into sand and dust before it reached the city, and the radiation of heat from molten rock at a temperature of more than 1000° C. caused an incredibly hot blast that would create a red hot hurricane—if I may employ such a term—that would kill people and animals instantly, and that would cause all inflammable matter to burst into flame. This from what I gather is what really happened, and I do not think that poisonous gases or electrical phenomena are accountable for the destruction of life."

The steam, hot air or gas penetrated clothing without firing the same, but it burned the skin beneath. This seems to have been true for those who were on the seaward side of St. Pierre, but it hardly appears to have been the case with those who were on the side nearest to the eruption.

Those who saw the cloud from the front, Mr. Hill tells us, say that it was not accompanied by incandescence, whilst those who were at the side or behind the same testify to seeing a flash-like flame suggestive of the ignition of a gas. It is quite conceivable that those behind the cloud might see that which was invisible to those in front, but the nuns at Morne Rouge do not appear to have seen the alleged flame.

The total quantity of ash that fell in St. Pierre was less than 1 foot in thickness, and it was piled highest against the northern walls, that is, on the side facing Mont Pelée.

In the blackening of silver and other metal objects picked up in the ruins, Mr. Hill sees evidence of the presence of vapours which were sulphurous. That silver should have been blackened within a burning house is what might be expected, but it does not follow that this blackening was due to sulphur from Mont Pelée. That there were small quantities of sulphurous vapour escaping before the great eruption is exceedingly likely, but when the latter took place it is more likely that the gas which accompanied the steam blast was hydrochloric rather than sulphurous. Since the days of Sodom and Gomorrah sulphur has been associated with volcanic action, and in the popular mind a volcano must always be accompanied by the combustion of this element.

The force of this blast may be judged by the photographs, the most striking of which is that of the monument of Our Lady of the Watch, which, although it weighed several tons, was hurled 50 feet. The blast caused vessels to turn turtle, walls were blown down and almost every standing object was levelled with the ground.

After the first blast, which pulverised buildings on the north side of St. Pierre, there was a return blast to blow over the south end of buildings, and lastly there came what appears to have been a vacuum—witnesses say that they "could get no air to breathe."

The fact that in the clouds which were thrown out in subsequent eruptions there were "tremendous displays of bolts and flashes" suggests that the flash which is said to have accompanied the primary outburst may have been a phenomenon akin to sheet lightning, which could only be seen on one side of the cloud which covered St. Pierre.

With this blast there was practically no noise of a great explosion, neither was there any evidence of marked seismic activity.

People were killed by inhaling hot ashes, some were burned by ashes or steam or flames, and by no means did all die instantly. With the exception of a few trees and plants protected in deep ravines, the country around St. Pierre was denuded of vegetation, but it is satisfactory to read that "nineteen-twentieths of the area of Martinique is as green and beautiful to-day as ever it was." Out of an area of 380 square miles only 12½

square miles have been devastated. No lava flowed, but only streams of mud, and to this it is added that neither the land nor the sea bottom has subsided or been uplifted—a statement in which we cannot concur.



[Photo by Israel C. Russell.]

FIG. 1.—Mud-plastered landscape, south end of Morne d'Orange.

Evidences of lightning strokes have been found in St. Pierre by Prof. Heilprin, but they are not numerous. The time at which the city was overwhelmed was at 7.50 a.m. (local time). At 7.53 and 7.55 magnetic disturbances commenced at Cheltenham, near Washington, and at Baldwin, in Kansas, and disturbances were also recorded in Paris and Hawaii.

In the *résumé* of the report Mr. Hill tells us that the fatal explosions were not from the old crater of Mont Pelée, which is 5 miles from St. Pierre, but from a lower vent about 2½ miles distant, and it is therefore a Soufrière which has created destruction both in Martinique and in St. Vincent.

The report furnished by Prof. Israel C. Russell refers to both of these islands. It commences with a list of those who were fortunate in obtaining berths on board the *Dixie*, amongst whom was Mr. Borchgrevink, who conversed on "the desolate wilds of the Antarctic Con-

ejected in Martinique was much finer than that thrown out in St. Vincent, where stones 5 and 6 inches in diameter fell at a distance of about 5 miles from their origin.

Mr. J. S. Diller describes the rocks of Mont Pelée as hypersthene and hornblende hypersthene andesites. The material forming the peak of Mont Carbet is a dacite or quartz andesite. The pumice from the recent eruption is hypersthene andesite. Eight chemical analyses show differences in ejectamenta from different eruptions and in the character of the materials which fell near and at a distance from the craters from which they originated.

The lavas from St. Vincent are also hypersthene andesites, but are peculiar in the fact that they contain olivine. In the ejecta from St. Vincent sulphur, which is absent in that from Mont Pelée, is a marked constituent. In a separate report Mr. W. F. Hillebrand points out other differences between the lavas and lapilli from these two islands which are sufficiently marked that the product of Pelée can be easily distinguished from that of La Soufrière. In referring to Dr. Pollard's analyses (see



[Photo by Israel C. Russell.]

FIG. 3.—A river of mud pouring from La Soufrière.

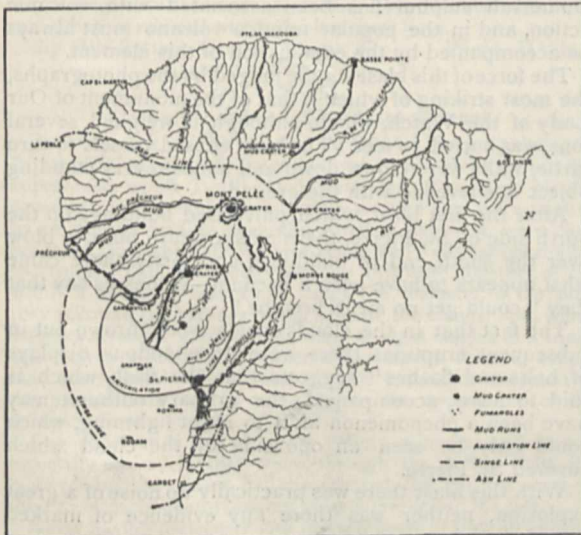


FIG. 2.—Map prepared by Mr. Robert T. Hill showing zones of devastation in Martinique.

NATURE, vol. lxxvi. p. 130) indicating the presence of nickel and cobalt, Mr. Hillebrand remarks:—"Either we of the Survey have overlooked traces of nickel . . . or Dr. Pollard has counted as nickel something which was not that element."

Although we have here and there ventured a few critical remarks upon these reports, we cannot but regard them as a valuable contribution to vulcanology, and anticipate pleasure in the perusal of their continuation.

In the August number of the *Century Magazine* we have read with interest two articles on "The Last Days of St. Pierre," each of which is founded upon documentary evidences. The first of these is a letter written in the form of a journal by the Very Rev. G. Parel, vicar-general of Martinique, to his Bishop, and the second a series of extracts contained in *Les Colonies*, a daily paper published in St. Pierre. Although, as might be anticipated, a large portion of these documents refer to the attitude taken by the inhabitants of the stricken districts, and furnish details of local rather than of general interest, much may be extracted from them of scientific value.

Now we learn that Mont Pelée showed its cap of white vapours as early as April 25, and that excursionists who were attracted by the spectacle reported that the Étang Sec, "which has the shape of an immense basin inclined towards St. Pierre," was filling up with boiling water.

Prior to the eruption of 1852 this cirque was also filled

continent," but whose report is held back for a future publication. Mr. Russell's photographs are excellent, and without these the instructiveness of his and other reports would have lost much in value. The material

with water, but subsequently it dried up. Although sulphurous vapours escaped from its bed, which led to its being named La Soufrière, we read that it was more or less covered with vegetation.

On May 2, in addition to vapours, Pelée erupted ashes to cover Le Prêcheur. At 11.30 that night there were terrifying detonations, and "cinders" covered the country as far as Fort de France. These detonations, but varying in intensity, were continuous. With these sounds were mixed those of thunder, which followed the flashes of lightning in the dust cloud, the general rumbling in the crater, and the roar of many torrents. Thirty streams round Mont Pelée rose at once, and yet not a drop of rain had fallen on the coast. On May 5 the Rivière Blanche became a threatening and muddy torrent. Suddenly a column of vapour was seen to rise from the valley that expands below the crater of Mont Pelée, following which a "boiling water-spout" burst in the mountain, and this, laden with rocks and earth, buried the Guérin Sugar Works and rushed seawards, to founder two yachts, one of which was 150 metres off the shore, and to sink eight lighters.

Near the site of the factory this mud is at least 6 metres in depth. It appeared to Prof. Landes, who contributed to the last issue of *Les Colonies*, that the contents of the Étang Sec had broken their barrier and avalanche-like had rolled 700 metres downwards to the sea. The origin of this disaster, like that which on May 8 destroyed St. Pierre, is therefore to be found on the flanks of Pelée rather than at its crater.

Those who on April 27 visited the Étang Sec describe the same as a bowl 300 metres in diameter at the bottom and 800 metres at the top. The surface of the lake within this bowl was covered with black cinders, whilst the trees round the crater were covered with a "metallic black coating."

On the eastern side of the basin there was a cone 10 metres high and about 15 metres in diameter at its summit. From this new crater "smoke" rose in great puffs, water spouted from the borders of the basin and poured downwards to the lake, and there was a sound of boiling. The temperature of the water in the lake was that of the body, but where it entered it was probably very much higher. It deposited a fine slate-coloured powder, and contained sulphurous gas which blackened silver. Here and there green leaves could be seen in the lake, which the guides affirmed were on the upper branches of trees probably 20 metres in height.

The vicar-general says that about 4 a.m. on May 7 he saw on the flanks of Pelée two red craters, and these were visible for half an hour. On May 8, about 4 a.m., there was a violent thunderstorm, and torrents of rain fell in Fort de France.

At about 8 o'clock there was a hail of stones and hot cinders, and the sea retreated three times a distance of several hundred metres. Whilst this fiery tornado was obliterating St. Pierre, two atmospheric currents—one from the south-east and the other from the north—showered rain upon its flanks.

On May 1 *Les Colonies* told its readers that on April 29, between 3 and 5 p.m., there had been several shocks of earthquakes, but nothing is said about volcanic eruptions.

On May 2 it advertises an excursion to Mont Pelée, but it is not until after the eruption which took place the same night that any serious reference is made to the volcano. Next day (Saturday, May 3) *Les Colonies* is filled with details relating to a cinder rain that never ceases, the closing of houses, the difficulty of obtaining vegetables, the obliteration of roads, the muddy rivers, the dead birds and dying animals, and the flight on the steamers of the Compagnie Girard.

Great fear seems to have existed lest an earthquake should occur. The issues of May 6 and 7 continue the

gruesome story. In his last issue the editor inserts a note that Thursday, May 8, being the Feast of the Ascension, his offices would be closed, and the next number of *Les Colonies* would appear on Friday. But for St. Pierre Friday never came.

A second paper in the *Century Magazine* gives the narratives of two eye-witnesses of the eruption in St. Vincent. The first of these is from Captain Calder, chief of the police in that island. From his account it appears that La Soufrière showed signs of eruption on May 5. On May 6, at 8.30 p.m., Captain Calder left Kingstown by boat for Chateau Belair, and about midnight he saw the whole top of the mountain burst into "flame." This was followed by a heavy explosion.

At 2.30 a.m. (May 7) there were similar explosions, with but little "flame." About 10 a.m. there was a terrific explosion, and in the "smoke" cloud there was a little pale flame. At 1.30 p.m. this cloud had reached a height of at least two miles. Next he describes the flight of the population holding boards above their heads to prevent injury from falling stones, following which are detailed accounts of the varying phases of the volcanic activity and the destruction which it wrought.

The second personal narrative is from Mr. T. McGregor McDonald. From this it appears that at Chateau Belair the first notice of an eruption was at 2.40 p.m. on May 6. At first the Soufrière erupted columns of white vapour without explosions. At 7.30 p.m. the vapour was accompanied with flame, and explosions took place at intervals of about two hours.

On May 7, at 6 a.m., black "stuff" was erupted. About 7.45 columns of vapour rose to a height of 30,000 feet in one minute. From 11.10, when there were thunder and lightning, Mr. McDonald made entries in his notebook of what was occurring almost every five minutes. This he did until 2 p.m., when beneath a rain of stones he escaped to Walliabout, where the diary was recommenced and continued up to 9.30 p.m. on May 14.

J. MILNE.

#### A TEXT-BOOK OF MAMMALS.<sup>1</sup>

FEW branches of zoological science have made greater advances during the last ten or a dozen years than has the study of mammals. Investigations with the microscope and the section-cutter have revolutionised our ideas as to the homology and succession of the dentition of the marsupials, while our conception of the relationship of that group to the monotremes on the one hand, and to the typical placentals on the other, has been totally altered by the discovery of a vestigial placenta in the bandicoots, and also by the apparent evidence of a connection with the creodonts afforded by certain extinct types from the South American Tertiaries. Then, again, the systematic part of the subject has been enriched by the discovery of a number of totally new and unexpected living generic types, such as *Notoryctes* and *Cænolestes* among the marsupials, *Zenkerella* and *Idiurus* among the scaly-tailed African squirrels, and *Ocapia* among the ungulates. Our conceptions of species and local races have undergone an equally profound change in the group under consideration, and the number of such new forms—some good and some bad—which have been added to our lists during the last few years is little short of astonishing. Moreover, trinomialism has been introduced into the science, and is largely adopted by a considerable number of eminent writers; and nomenclature itself has undergone a change which, while in many respects regrettable, could scarcely have been avoided, at least to a certain degree, if zoology is to maintain any

<sup>1</sup> "The Cambridge Natural History." Vol. x. Mammalia. By F. E. Beddard. Pp. xii+605. Illustrated. (London: Macmillan and Co., Ltd., 1902.) Price 17s. net.

semblance of consistency. Neither have the palæontologists been idle during the period referred to, the wonderful extinct mammalian fauna of Patagonia—inclusive of the ground-sloth, whose skin was recently found in a cave at Ultima Esperanza—having been to a large extent described during the last decade, while many interesting forms of extinct mammalian life have been made known from other parts of the world. If to the above be added the change of view with regard to the limits of zoological regions and the extent to which lands now widely sundered have been connected in past epochs of the world's history, there is little cause for wonder if the majority, or all, of the standard text-books dealing with mammals are more or less completely out of date.

Accordingly, it may be taken for granted that a trustworthy and up-to-date technical text-book on the study of mammals is a desideratum at the present time, and that the author has thus an unusually favourable opportunity before him. But this is not all that may be said in his favour, apart from the contents of the work itself. Mr. Beddard, from his official position at the Zoological Society's Gardens in the Regent's Park, has special, and probably unrivalled, opportunities of making himself acquainted with the anatomy of the soft parts of mammals—a subject too often neglected, or treated in insufficient detail in works of this nature. In addition to devoting a large amount of attention to the external glands of mammals, as well as to their internal anatomy in general, Mr. Beddard has made a special study of the mammalian brain, the results of which are incorporated in the volume before us. On this, if on no other, account his work must have an exceptionally high value for the students of mammals, as containing an enormous amount of information on this branch of the subject which can be obtained elsewhere only by laboriously searching through a long series of original memoirs.

A special feature of the volume is the large amount of space devoted to the consideration of extinct forms of mammalian life; and this is the more to the author's credit since, we believe, he is not himself a student of the palæontological aspect of the subject. He has, however, doubtless realised that the extinct forms afford the only key to the true relationship of their modern descendants; and he is to be congratulated that his work stands apart from all text-books on the same subject published in this country on account of the large amount of detailed information concerning extinct types. For one who is not himself a palæontologist, the author appears to have succeeded remarkably well in the treatment of this portion of the subject. He has, however, unfortunately quite failed to realise the nature of the dental succession in elephants and mastodons. Otherwise we should not have met with the statement on p. 220 that *Elephas planifrons* is the only member of its kind in which milk-molars are developed, and that in mastodons these teeth are more common; or the further and contradictory statement on p. 230 that these teeth occasionally persist throughout life. He should, of course, have known that milk-molars are always present, and that in one elephant and several mastodons they are succeeded by pre-molars.

As regards zoological regions, it is satisfactory to find that Mr. Beddard has adopted the view that the land surface of the globe is divisible, from this point of view, into three primary divisions, or realms, at least one of which is capable of being split up into regions. The division of the northern part of Arctogæa into a palæarctic and a nearctic region is, however, retained; and it is somewhat regrettable to find that the author is unable to convince himself of the necessity of a Sonoran region. Even greater matter for regret is his refusal to allow the rank of a region to Madagascar. Still, of course, the author has a perfect right to his own opinion,

and cannot be condemned for following the same. In the introductory chapters a noticeable feature is the large amount of space allotted to the consideration of the structure and development of the milk-glands of mammals, in the course of which the author takes occasion to refer to the remarkable circumstance that the egg-pouch of the monotremes does not appear to be homologous with the nursing-pouch of the marsupials. Hair-glands are likewise discussed at some length, some countenance being given by the author to Dr. Weber's theory that the ancestral mammals were scaly creatures.

Teeth, as might have been expected, receive a large share of attention in the same section of the work, their cusps being named on the American system based on "trituberculism." Speaking generally, the author's treatment of the difficult subject of dentition is decidedly good; we believe, however, that on p. 48 he has written fifty-four in place of forty-four as the normal maximum number of mammalian teeth, while he has omitted to mention that the replaced tooth in marsupials, which he identifies with the last premolar, has been regarded by at least one recent writer as corresponding with the



FIG. 1.—A Flying Fox (*Pteropus poliocephalus*). From Beddard's "Mammalia."

third of that series. Allusion is made to the mammalian resemblances of the dentition of the African Anomodontia (a group-name which, by the way, the author, on p. 48, credits to Huxley instead of Owen), but the question whether the one type is directly derived from the other is not discussed.

Passing from the introductory to the systematic portion of the work, we find Mr. Beddard differing from the majority of his predecessors in dividing the Mammalia into two, in place of three, primary groups—namely, the Prototheria, now represented only by the monotremes, and the Eutheria, including both marsupials and the true placentals. In view of the discovery of a vestigial placentation in marsupials, to which allusion has been already made, as well as from other considerations, we are inclined to think that the author is fully justified in the innovation, and hope to see the new departure followed by other writers. The absence of a corpus callosum in the brain of monotremes is regarded by the

author as important, in spite of the reduced size, or even absence, of that structure in marsupials.

The author's classification of the latter calls for no special comment, although attention may be directed to certain remarks on p. 128 as to the origin of the two chief groups, in which the view of the northern origin of the entire order is adopted without hesitation. As to whether diprotodonts came into existence as early as the Jurassic or the Cretaceous, Mr. Beddard maintains a cautious reserve, although we think he might have expressed a definite opinion on this point without undue risk. It is, perhaps, a pity, in the light of modern discoveries, that Owen's footless figure of the skeleton of Diprotodon is reproduced; and it rather puzzles us to reconcile the statement on p. 146, as to the close affinity of this creature to the kangaroos, with the assertion on the opposite page that its hind-foot could not be more unlike that of a kangaroo than it actually is.

But Mr. Beddard seems to take a delight in puzzling his readers by statements that to the average mind appear absolutely contradictory. For instance, on p. 160, after stating that the extinct Patagonian Prothylacinus and Amphiproviverra "are not merely polyprotodonts, but definitely dasyures," in the very next paragraph it is suggested that they are not marsupials at all.

The Edentate order is taken to include the pangolins and aard-varks as well as the typical American forms, although it is stated that the aard-varks do not show marked signs of affinity with the pangolins. A strong point in favour of the author's system is that the pangolins are stated to possess a muscle found elsewhere only in the American edentates. Fossil forms are treated at some length, but it would have been better had the author reproduced one of the figures of Glyptodon published by the La Plata Museum instead of the cut of an imperfect example from one of Owen's works. The inclusion of the North American Eocene ganodonts among the edentates is, we believe, a feature which appears for the first time in an English text-book.

The chapter on ungulates commences with a well-written description of the foot-structure of the different groups, followed by an interesting discussion on horns and antlers. Mr. Beddard was fortunately able to introduce a brief account of the okapi, although he was, of course, unacquainted with the fact that the adults are horned. This being so, it is somewhat curious to find no mention of Dr. Andrews's description of ancestral Proboscidea from Egypt, which was published about the same time as the announcement of the discovery of the okapi. We have already had occasion to allude to the author's unfortunate error in regard to the nature of the dentition of fossil elephants, and we are obliged to say that the whole chapter on ungulates, especially as regards recent forms, is far from being as satisfactory as it ought to be. In pointing out certain deficiencies and errors in this and other parts of the work, it may be well to state that it would be scarcely worth while to allude to these, were we not impressed with the high value and importance of the work as a whole, which makes it the more to be regretted that such blemishes should occur.

As regards the Equidæ and Tapiridæ, we have little or no fault to find, but when treating of the rhinoceroses, the author should have been aware that the white species has been recorded from Central Africa, while the affinity to this species of the extinct so-called *Rhinoceros tichorhinus* should have been indicated. More severe criticism is called for with regard to the chapters on the deer and hollow-horned ruminants, which are everywhere "scrappy" and in many cases absolutely misleading. To include among the typical deer such a widely different animal as Père David's deer is at the present day little short of absurd. But, unfortunately, the author appears quite unable to recognise the essential difference between the "brow-tined" and the "forked"

types of antlers, otherwise we should not have, on p. 301, the absurd statement that the antlers of the extinct *Cervus* (properly *Anaglochis*) *sedgwicki* are "like those of a red deer exaggerated." It would be just as true to say that a leopard is coloured exactly like a tiger! The account of the species rightly included in the genus *Cervus* is, moreover, altogether inadequate, the reader not even being informed that the species incorrectly called *C. luehdorfi* is one of several Asiatic representatives of the wapiti. The treatment of the antelopes, although brief, is fairly satisfactory, but in describing the wild oxen the author states that the gaur and the gayal have a white rump-patch, whereas that feature is distinctive of the banting alone; and he aids in perpetuating the error that the British white park-cattle are the nearest relatives of the extinct wild ox of Europe.

The sheep and goats are very unsatisfactorily treated, both as regards description and illustration, some of the figures being those of immature animals, while the distribution and nomenclature are in several instances incorrect. As an example, it will suffice to mention that (on p. 324) one and the same sheep is stated, under the name of *Ovis nahura*, to be Tibetan, and, as *O. burrhel*, Indian. Again, in the description of the goats, after stating that the horns are never spirally curved, Mr. Beddard writes that the markhor (the horns of which are spirally twisted) is confined to certain parts of Afghanistan!

Little need be said with regard to the treatment of the other mammalian orders, which follows to a great extent the usual lines, and is generally satisfactory. Details connected with the characters or distribution of species are, however, in several instances not altogether correct. For instance (p. 418), it is altogether misleading to write of the South American *Canis jubatus* as the red wolf of America; while *Enhydriodon* (p. 440)—of which, by the way, the name is misspelt—has nothing to do with the sea-otter. Again, the statement on p. 569, that the monkeys of the genus *Rhinopithecus* have "also a long, but more definitely upturned nose," seems to suggest that in certain instances the author has no practical acquaintance with the animals of which he is writing. Probably the recent transference of the Tibetan *Eluopus* from the bears to the raccoons was not published soon enough to allow of the animal finding a place among the latter in Mr. Beddard's volume.

To turn to another consideration, even careless readers will scarcely fail to notice that while the figure of the polecat (on p. 436) is lettered *Mustela putorius*, the animal is alluded to in the text as *Putorius foetidus*. Whether this is due to carelessness, or whether it is an instance of a remarkable hesitation displayed by the author as to which name to adopt for certain genera, it is not for us to say. Such hesitation is, however, very noticeable throughout the book, the author frequently using one name, although stating that an alternative title is the proper one. It is, indeed, very difficult to decide what has been his guide in this matter. Sometimes he follows modern ruling, as in the substitution of *Microtus* for *Arvicola*, while in other cases he retains discredited names, such as *Cariacus* for the American deer. In regard to the wide sense in which generic terms are for the most part used, we are in full accord with Mr. Beddard.

As the result of a somewhat lengthened perusal of his work, we are glad to be able to say that the author has succeeded in producing a volume which cannot fail to be of very high value to all students of the Mammalia, especially from the standpoints of morphology and palæontology. It has failings (many of which might have been remedied by the exercise of a little more care on the part of the author and his editors), but these occupy a very subordinate position in comparison to its merits; and, with this reservation, the work may be said to maintain the high standard of excellence of the series of which it forms a part.

R. L.

HYDROGRAPHICAL OBSERVATIONS ON THE  
"PRINCESSE ALICE."

THE yacht *Princesse Alice*, with the Prince of Monaco on board, left Monaco on July 18 and arrived at Gibraltar on the evening of July 22, having been detained some hours by the pursuit of a school of *Orca gladiator* and the capture of one of them. The whale hunt took place within sight of the rock. Having coaled, the ship left Gibraltar on the evening of July 23, and shaped a course for the Azores. On July 24 an interesting sounding was made in lat.  $36^{\circ} 6'$  N., long.  $10^{\circ} 16'$  W. (Paris). The depth was 1473 metres, and the temperature of the bottom water was  $9^{\circ} 4$  C. As this thermometer was mounted so as to be overturned by the motion of a small screw propeller, its indication was not entitled to complete confidence; but when the dredge, coming from the same depth, brought a quantity of mud which had a temperature of about  $8^{\circ} 75$  C., it was evident that the conditions as regards temperature were very different from those which obtain in the open waters of the North Atlantic. At the above depth the temperature could not be expected to be above  $4^{\circ} 5$  C. It is evident that this sounding struck one of the main drains out of the abysmal regions of the Mediterranean, and furnishes evidence of the *brining down*, to use a stoker's expression, of the waters of that sea, of which a more particular description can be found in the article "Mediterranean" of the "Encyclopædia Britannica."

Unfortunately, no sample of the bottom water was procured, and confirmatory evidence of its salinity is lacking, but the excess of temperature is so great that we may use it with perfect confidence in estimating the composition of the water, considered as a mixture of the deep water of the Mediterranean with that of the neighbouring regions of the North Atlantic.

If we take the original temperature of the Mediterranean water in the mixture to be  $13^{\circ}$  C. and that of the Atlantic water to be  $4^{\circ} 5$  C., it consists of 50 per cent. of Mediterranean and 50 per cent. of Atlantic water. This is a spot where, with adequate means, with the necessary skill and experience, and, above all, with sufficient patience, a very fine piece of oceanographical work can be done.

Continuing westwards, the ship's course passed close to the Gorrige or Getsyburg bank. As the former *Princesse Alice* spent July 25, 1894, on this bank, when enormous quantities of fish were taken with the line, the Prince decided to spend July 25, 1902, on the same spot. The fishing was about equally successful, but there was not the same surprise or novelty about the experience. The depth of water on the bank is very uneven and the surface of the bottom very rough. The following soundings, taken when searching for the shallowest part, are given in the order in which they were made: 192, 146, 200, 122, 83, 177 metres. In the evening the westward course was resumed, and it was shaped so as to pass over the position of the Josephine bank. This bank was discovered a short time before the *Challenger* sailed, and at the beginning of the cruise it was a question whether she should not make a station on it; but, on the one hand, it was felt that the ship had been fitted out for the investigation of deep and not of shoal waters, and on the other the bank did not lie in her route either from the Channel to Gibraltar or on that from Gibraltar to Madeira. Moreover, the interest which attaches to oceanic shoals and to their study was not, and could not be, at that time recognised.

On July 26 soundings were obtained, gradually shoaling to 1038 metres with hard bottom. This was taken to be on the eastern escarpment of the bank, and one of the Prince's latest *nasses* or traps, made of wicker-work, was sent down and buoyed, with lights. The ship was kept near during the night, and early in the morning the pro-

cess of heaving up was begun. It was continued with much patience, but the cable had evidently hooked on the rocky bottom, and it finally carried away. Had it been the *nasse* which had got fixed, it would have come away quite easily, because it would have been torn to pieces. The remainder of the day was spent in sounding over the bank, in so far as time permitted, and the results are rather remarkable.

In sharp contrast with the Gorrige bank, the depths on which are so uneven, the soundings made on the Josephine bank revealed a uniformity of depth which is astonishing. The superficial area of the bank is evidently very considerable, but in the time at disposal it was impossible even roughly to delineate it. An area of about three miles square was sounded over, and the depths are here given in the order in which they were obtained: 218, 230, 220, 219, 211, 216, 218, 215, 212, 215, 189, 190, 204, 208 metres. The descriptive value of these figures cannot be excelled. A successful, but in no way very remarkable, dredging was made in this water. In the evening the route was continued in the direction of Ponta Delgada, in the island of St. Michael. Soundings were obtained in 4275 and in 2589 metres, and the writer was enabled to attach to the sounding lines piezometers of two different and rather novel patterns, and thus to resume the experiments on compressibility at great pressures which he began on the *Challenger*. The instruments acted quite satisfactorily, and it is hoped that useful results will be obtained with them. On the morning of July 31, when only a few miles off the coast of St. Michael, the dredge was put over in 1189 metres, and a very rich haul was obtained.

Although no very definite or detailed programme exists, it is the Prince's intention to work among the islands for a week or two, then to make an excursion southwards to the very deep water which lies between this archipelago and the Canary Islands, and thence to work homewards so as to arrive at an European port by the middle of September. Up to the present date the weather has been everything that could be desired, and the bright, bracing climate of these islands is invigorating and refreshing.

J. Y. BUCHANAN.

Yacht *Princesse Alice*, August 1.

NOTES.

THE impressive rite of the coronation of King Edward was performed on Saturday last in circumstances of unequalled splendour. All who witnessed the spectacle must have been moved by feelings of loyalty and love for their Sovereign and country, and of pride in the history of the British race. Few men of science appear to have been invited to the function, though the nation owes so much to them. Scientific knowledge combined with medical skill has brought the King safely through a period of great danger and suffering, and given us all cause for thankfulness at our monarch's return to health. The modern science of electricity contributed as much as the mediæval pageantry to make the day memorable. But the ceremony belongs more to the past than to the future; it is the symbol of unity between the King and his people, and it shows the basis of liberty of thought and action which is our national heritage, and without which progress is impossible. The past has truly been glorious, but the future needs the development of new attributes of national character if we are to maintain our position among the peoples of the world. We trust that the reign of King Edward VII. will not only be long and happy, but that it will be characterised by the cultivation of the scientific spirit which will promote its prosperity.

A SPECIAL number of the *Atti* is devoted to the anniversary meeting of the Reale Accademia dei Lincei, held at Rome on June 1 under the patronage of the King and Queen of Italy.



Prof. Pasquale Villari has been recently elected president of the Academy. The report of the vice-president, Signor Blaserna, shows that in the past year the Academy has issued three volumes of *Proceedings*, containing 192 pages and notes, a volume containing memoirs relating to moral sciences, and notices of excavations, brought out under the auspices of the Minister of Public Instruction, and four parts, with 160 plates, of the "Codex Atlanticus" of Leonardo da Vinci. The Academy has taken part in the meetings of the International Association of Academies, and in work connected with the Royal Society's "International Catalogue of Scientific Literature." The observatory on Monte Rosa has been considerably enlarged, a fund for this purpose having been founded by Queen Margherita, whose name the edifice bears; it is now available for researches in meteorology, physics and physiology. A fresh field of study has been opened up in the island of Crete, and an expedition, presided over by Prof. Halbherr, has taken a prominent part in the excavations proceeding in that island.

OF the three royal prizes offered by the Reale Accademia dei Lincei for the year, that for physics has been awarded to Prof. Cantone, of Pavia, for his researches in the phenomena of elastic equilibrium outside the limits of Hooke's Law. Prof. Cantone has obtained phenomena in elasticity closely resembling the phenomena of magnetic hysteresis, which are appropriately described as "elastic hysteresis," and the laws of which account for a large number of observed facts. The prize for archaeology has been conferred on Prof. Gherardo Ghirardine, of Padua, whose work, while covering an extensive range, has been of especial interest in connection with the antiquities of the Veneti. The prize for history is unawarded. Under the Santoro foundation, an extraordinary prize has been awarded to Mr. Marconi, who, Signor Blaserna remarks, "is generally recognised as the first who had the fertile idea of making use of Hertzian waves, not for sending signals to a distance of a few metres, as had already been done by Righi, Lodge and other investigators, who deserve the credit for having first started in this direction, but for making them the basis of a system of telegraphy properly so-called." Of the two prizes offered by the Minister of Public Instruction, that for history has been divided, awards of 700 lire being made to Profs. Cogo (Genoa), Segre (Massa) and Sorbelli (Bologna), and premiums of 400 lire to Profs. Luiso (Lucca), Santini (Florence) and Strazulla (Messina). The Ministerial prize for mathematics has been divided into two prizes of 1300 lire, awarded to Profs. Giuseppe Bagnera (Messina) and Domenico de Francesco (Naples), and a premium of 700 lire has been assigned to Prof. Michele de Franchis (Melfi). The division of these prizes affords ample evidence of the activity of members of the Italian teaching profession in the matter of research. The proceedings of the meeting concluded with an address by Prof. G. Gloria on "The Position of the World in Modern Astronomy."

THE Advisory Committee appointed by the King in connection with the erection of a sanatorium for tuberculosis in England announces that 180 essays were sent in in competition for the three prizes. The Advisory Committee consists of Sir William Broadbent, Sir R. Douglas Powell, Sir Felix Semon, Sir Hermann Weber and Dr. Theodore Williams. The prizes have been awarded as follows:—First prize, value 500*l.*, Dr. Arthur Latham, with whom is associated as architect Mr. W. West (London). Second prize, value 200*l.*, Dr. F. J. Wethered, with whom are associated as architects Messrs. Law and Allen (London). Third prize, value 100*l.*, Dr. E. C. Morland, with whom is associated as architect Mr. G. Morland.

GILBERT WHITE'S house at Selborne is again for sale, and the suggestion is made by Mr. E. A. Martin, member of the council of the Selborne Society, that it should be purchased as

a permanent memorial of the father of British naturalists. The house, known as The Wakes, is situated in the main street of the village of Selborne, and is in much the same condition as it was in White's time.

THE British Pharmaceutical Conference is being held at Dundee as we go to press. The members were formally received by the Lord Provost of Dundee on Monday, and on Tuesday the opening meeting was held at the University College, when an address was delivered by the president.

REUTER'S AGENCY is informed that the Prince of Monaco has presented a quantity of deep-sea apparatus to Mr. W. S. Bruce for the Scottish Antarctic Expedition, including trawls, nets, water-bottles for obtaining samples of water from great depths for physical examination, thermometers and other similar apparatus.

THE annual meeting of the French Association for the Advancement of Science was held last week at Montauban, in the South of France, when an address on the development of wireless telegraphy was delivered by M. Carpentier, president of the Association. Electric traction was the chief subject of discussion at one of the general meetings. Since the last meeting the Association has received a legacy of two thousand francs from M. E. Lamy, and one of thirty thousand francs from M. Guilleminet.

THE following papers will be brought before the Section of Physiology at the Belfast meeting of the British Association:— "The Estimation of Small Quantities of Urea," Mr. Barcroft; "Nerve-Regeneration," Prof. W. D. Halliburton, F.R.S., and Dr. F. W. Mott, F.R.S.; "The Morphology of the Camel's Brain," Dr. W. Page May; "The Hydrolysis of Glycogen," Dr. W. A. Osborne and Mr. S. Zobel; "Some New Features in the Intimate Structure of the Human Cerebral Cortex," Dr. John Turner; (1) "The Paths of Conduction for Volitional Impulses," (2) "The Functions of the Pituitary Body," Prof. E. A. Schäfer, F.R.S.

THE committee entrusted by the Society of Arts to award the Shaw prize for industrial hygiene has awarded a gold medal, or a prize of 20*l.* to Mr. James Tonge, jun., of West-houghton, Lancashire, for his hydraulic mining cartridge—an appliance for breaking down coal in mines without the use of explosives. The prize, under the conditions laid down by the testator (Mr. Benjamin Shaw), is given "For any discovery, invention, or newly-devised method for obviating or materially diminishing any risk to life, limb or health, incidental to any industrial occupation, and not previously capable of being so obviated or diminished by any known and practically available means."

ON August 5 a statue erected to the memory of Pasteur was unveiled at Dôle, the birthplace of the great chemist. The following account of the ceremony is given by the French correspondent of the *Chemist and Druggist*:—Nineteen years ago, on July 14, 1883, the Doloise municipality commemorated the fact by placing a marble slab on the modest house where he was born on December 27, 1822, in the Rue des Tanneurs, now called Rue Pasteur. For the inauguration of the statue the townspeople had made extensive preparations, and all the local notabilities, including the members of Parliament, were present. The Government was represented by M. Trouillot, Minister of Commerce, who made the distribution of medals and decorations that is customary here on such occasions. He afterwards proceeded to the ceremony of unveiling the monument, and made an interesting speech, in which he traced the life of Pasteur. The Minister referred to it as an incessant struggle against death and suffering, which ended in victory for the *savant*. He also spoke of the advantages suffering humanity

al over the world had derived from Pasteur's discoveries. Never has the saying "genius is patience" been so truly proved as in the case of his life. In concluding, M. Trouillot said: "Pasteur's native place shows itself worthy of his memory and faithful to his teachings when it affirms its faith in the definite triumph of the ideas of peace, unity and justice." The Dôle statue of Pasteur is by the well-known sculptor M. Carlès, and was shown at the Paris Salon of the Artistes Français this spring. Mme. Pasteur and various members of her family attended the ceremony, and in the evening they were present at a banquet given in honour of the event.

A REUTER telegram from New York reports that a severe earthquake shock was felt at Skagway on Sunday last, August 10.

LOYD'S agent at Havre states that the steamer *Homer*, on arrival at that port, reported that on July 20, in latitude  $0^{\circ} 30'$  north, longitude  $29^{\circ} 36'$  west, she spoke the German four-master *Christine*. Whilst speaking this vessel she felt a severe earthquake shock. The compasses all oscillated violently. This lasted about 40 seconds. The German vessel also signalled the same experience.

ON October 30, 1901, a strong earthquake felt in the neighbourhood of Lake Garda and especially at Salò gave an interesting record on the photographic tromometer at the Collegio della Querce in Florence. From the two component traces Father Melzi has drawn a diagram representing the resultant movement of the ground during the first forty seconds. For twenty-one seconds the oscillations took place chiefly along a line directed E.  $37^{\circ} 34'$  N. and W.  $37^{\circ} 34'$  S. At the end of this time the direction suddenly changed, through very nearly a right angle, to N.  $54^{\circ} 22'$  W. and S.  $54^{\circ} 22'$  E. The cause of the change is unknown, but, from the long interval that elapsed, it was clearly unconnected with the arrival of transverse vibrations.

DR. HANS REUSCH, director of the Geological Survey of Norway, has sent us a letter received by him from Dr. W. J. Branch, of Basse-Terre, St. Kitts, one of the Leeward Islands, containing an account of the effects observed there during the recent volcanic eruptions in Martinique and St. Vincent. The volcano Mount Misery, the highest point of the island, exhibited a few indications of sympathy with Mont Pelée and the Soufrière, but no remarkable effects were noticed at the time of the eruptions of these volcanoes. A fortnight after the destruction of St. Pierre, however, a loud explosion was heard by labourers working on the side of Mount Misery; flames seemed to leap out of the ground, and a strong wind swept by, overturning two small houses. At the same time a heavy thunderstorm occurred, with vivid lightning flashes. Though the actions of Mont Pelée and the Soufrière are apparently in sympathy, Dr. Branch's idea is "that Mount Misery is more in league with the volcanoes of Guadeloupe, Montserrat, Dominica and St. Lucia. Their history in the past as well as in the present time seems to me to favour this idea."

It has long been known that unhygienic conditions favour the occurrence of the disease known as beri-beri, and it has been surmised that it is dependent upon defective food. Major Rost, I.M.S., claims to have discovered a bacillus in fermenting rice and rice-liquor which he believes to be the specific organism of this disease. It produces in fowls many of the symptoms resembling beri-beri in man. Moreover, fowls feeding upon fermenting rice develop similar symptoms. The disease is therefore ascribed to the use of fermenting rice and especially rice-liquor, to which beverage the coolies, who are the main sufferers, are much addicted. Children never, and women rarely, drink the rice-water liquor, and hence the in-

frequency of the disease in these subjects. Interesting as Major Rost's observations are, they do not throw much light on the remarkable outbreak of disease, believed to be beri-beri, at the Richmond Asylum, Dublin, some years ago, the cause of which has never been explained. (See *Ind. Med. Gazette*, July 1901 and 1902).

AIDS to practical navigation, however small they may be, should always be welcome. In the "single-handed dividers" patented by Mr. F. Howard Collins and sold by Mr. J. D. Potter, an improvement has been made on the dividers ordinarily in use for measuring distances on a chart. These new dividers are provided with two finger-holes, into which the thumb and forefinger can be inserted in a manner similar to that of using an ordinary pair of scissors, thus enabling the navigator to open and close them readily with one hand and giving a greater command over the instrument. The joint, which is made a round ball, is also of a very good form for handling. This instrument is strongly made in German silver and is suitable for the ordinary service of a sea-going vessel.

PROF. G. HELLMANN has published the fourteenth volume of his remarkable reproductions of notable old papers and charts relating to meteorology and terrestrial magnetism. The present work deals with meteorological optics during the years 1000 to 1836, and is, as usual, accompanied by valuable bibliographical notes, the result of laborious researches which we think we may safely say have never been excelled and are possibly unequalled. Meteorological optics may be said to be a somewhat neglected branch of the science, and this renders the investigation the more welcome. The work contains four important papers on the rainbow and allied phenomena, including the classical treatise of the late Sir G. B. Airy "On the Intensity of Light in the Neighbourhood of a Caustic," three papers on halo phenomena, with others on mirage, twilight, &c. For readers wishing to study the early history of the subject, the author gives references to the works of Kämtz, Clausius and the recent important contributions of Dr. Pernter. As one instance of Prof. Hellmann's persistent researches, we may refer to the first of the papers now described, "De Radialibus impressionibus" (1311), by Theodorich, a remarkable work on atmospheric phenomena, which was supposed to have been buried for 500 years and lost to science until it was published by Venturi, at Basle, in 1814; but Dr. Hellmann discovered that Theodorich's theory was taught at the Erfurt University up to the beginning of the sixteenth century. At the present time only two copies of the original manuscript are known to exist, one at Basle and the other at Leipzig (the latter being not quite perfect).

THE Imperial Department of Agriculture for the West Indies has just issued the following reports:—On the Botanic Station, Dominica, for the twenty months to the close of November, 1900; and on the Agricultural School, for the year 1901. On the Experiment Stations at Montserrat, for the fourteen months to the close of March, 1901; and on the Botanic Station, Agricultural School and Land Settlement Scheme, St. Vincent, for the year 1901. The reports are generally of a favourable character, and show that much useful work was accomplished in the distribution of plants and seeds, in experimenting with new plants, &c., which may be introduced for profitable cultivation, and so on. Details are given of the courses of practical instruction in the agricultural schools. The 1900 season in Dominica was a dry one, the rainfall of 57.75 inches being 23.95 inches less than the average. In St. Vincent, 1901 was fairly wet, the rainfall of 125.69 inches being 12.43 inches above the average. It would considerably enhance the value of these West Indian reports if the Imperial Commissioner could arrange for each series issued to cover the same period throughout

the islands, instead of, as indicated above, each island adopting its own and often very irregular period.

THE question of the existence of a portrait of Gilbert White is discussed by Mr. R. Holt-White in a letter to the August number of *Nature Notes*, with the result that there is no good reason to believe that any such picture is known.

WE have received from Prof. H. F. Osborn a budget of papers on vertebrate palæontology and kindred subjects, two of which, "The Law of Adaptive Radiation" and "Homoplasy as a Law of Latent Homology," were mentioned in this Journal as they appeared in the *American Naturalist*. Special interest attaches to a communication on the Eocene Primates and rodents of North America (*Bull. Amer. Mus.*, vol. xvi. art. 17), in which it is stated that presumed representatives of the former group from the basal Puerco Eocene bear no sort of ancestral relationship to the undoubted Primates of the overlying Wasatch beds. Whether the latter forms are anthropoids or lemuroids, or whether they include members of both groups, or, finally, whether they constitute a primitive group by themselves, is left undecided. Three American families are recognised, the first of which (*Hyopsodontidæ*) is believed to be nearly related to the Hampshire *Microchoerus*. Of even greater importance, if well founded, is the author's recognition of a group of primitive rodents in the Bridger and Wasatch Eocene, for which the name "Proglires" is suggested. These forms had canines and rooted incisors, and their lower jaws lacked the backward-and-forward motion characteristic of their supposed descendants. They are typified by Cope's genus *Mixodectes*.

IN the autumn of 1900 a gardener of Hundsheim, in German Altenburg, Lower Austria, brought to the high school at Vienna part of the lower jaw and an upper cheek-tooth of a rhinoceros which he said had been found in the vineyard where he worked, in association with other remains, not improbably including the entire skeleton. Recognising from the structure of the teeth that the remains did not belong to the ordinary woolly rhinoceros, Prof. F. Toulou, to whom they were submitted, proceeded to Hundsheim, and was fortunate enough to disinter the almost complete skeleton of the animal, which has now been mounted. Unfortunately, the terminal third of the skull is missing, but sufficient remains to show that the animal was a two-horned species belonging to the same group as the living Sumatran rhinoceros. In a preliminary notice Prof. Toulou proposed the name *Rhinoceros (Ceratohinus) sumatrensis* for the new species, and in a recent issue (vol. xix. pt. 1) of the *Abhandlungen* of the Austrian Geological Survey he describes the skeleton in detail, figuring the various bones in no less than twelve plates. The breccia at Hundsheim in which the skeleton was found is of Pleistocene age, and is notable for containing the remains of a goat allied to the tahr (*Hemitragus*). Rhinoceroses of the *R. sumatrensis* group were previously unknown from the European Pleistocene.

A BRIEF report on the disintegration of building stones in Egypt, by Mr. A. Lucas, has been issued by the Survey Department, Public Works Ministry, Cairo (1902). The decay of the building stones, which consist of limestone and sometimes of calcareous sandstone, appears mainly at or near the surface of the ground, and is often accompanied by an incrustation or efflorescence of sodium chloride. The cause of the disintegration is the entry into the stone of moisture and soluble salts, chiefly from the soil, which is always in a more or less saturated state.

THE coal, lignite and asphalt rocks of Texas are dealt with in a *Bulletin* published by the University of Texas (1902), the Mineral Survey being under the direction of Mr. W. B. Phillips. The Eocene lignites, the Cretaceous and Carboniferous coals are

described, mainly from an economic point of view. The lignite industry has felt the competition of fuel oil more keenly than that of the bituminous coal, but as there is a marked tendency to increase the price of oil, there is hope for the lignite miners. The asphalt rocks comprise sandstones, alternating sands and clays, and limestones impregnated with bitumen, and they occur in the Cretaceous formation sometimes where it impinges upon the Carboniferous, and also in the Tertiary strata.

WITH a view to stimulate planters in New South Wales to undertake the cultivation of the cork oak, the director of the Sydney Botanic Gardens has issued a pamphlet in which are embodied notes on the economic value, suitable soil and position for growing, and other details of management of this tree.

IN the recently published "die Organographie der Pflanzen," want of space prevented Prof. Goebel from treating at any length the question of "regeneration in plants." A series of articles on this subject is now appearing in the *Biologisches Centralblatt*. The discussion is limited to regeneration in so far as it relates to the development of new parts or latent rudiments, and illustrations are taken from the ferns *Anemia rotundifolia*, *Asplenium obtusifolium*, from the genus *Bryophyllum* of the *Crassulaceæ*, and from *Nymphaea stellata*, var. *bulbillifera*. In the case of the ferns, it will be noticed that the tendency is to push the formation of buds towards the apex, while in *Bryophyllum* the cutting off of supplies from the apex stimulates the growth of lateral buds. *Cyclamen persicum* affords an instance of the formation of new members induced by the stimulus caused by mutilation. If in the young seedling the stem apex is cut off just at the junction with the single cotyledon, one or more leaves are developed in various positions, perhaps more generally from the base of the petiole.

A POPULAR paper on thunderstorms and lightning discharges, by Mr. A. H. Bell, and one on minute marvels of nature, by Mr. J. G. Ward, illustrated by photo-micrographs, appear in the August number of *Good Words*. The latter article contains several good reproductions of photographs showing internal structures of leaves.

THE Royal Agricultural Society of England has issued a sixpenny pamphlet, written by the Society's zoologist, Mr. Cecil Warburton, with the title "Orchard and Bush-Fruit Pests and how to combat Them." After giving the ingredients and the methods of preparation of a few of the most useful and readily mixed insecticides, the pamphlet describes a number of commonly occurring insects affecting the leaves, blossoms, fruits or wood of orchard trees, with the best methods of preventing their attacks, of checking their depredations, or of destroying them altogether, where possible. The same kind of information is given with regard to various insects infesting currants, gooseberries and raspberries. The pamphlet is illustrated with twelve original wood cuts and is published for the Society by Mr. Murray.

A LECTURE on "The Relation of Science to Art: in reference to Taste and Beauty," delivered before the Hampstead Scientific Society by Sir Samuel Wilks, Bart., F.R.S., on May 12, has been published by the Society. The scientific attitude of mind is so often considered to be opposed to artistic feeling that this analysis of the relationships between the two temperaments is of wide interest. The artist admires the form, and the man of science seeks to discover the cause which produces it. The two-fold characters of an object are closely associated and dependent on one another, but few individuals are able to appreciate them both fully. A large part of Sir Samuel Wilks's address is devoted to the consideration as to "whether beauty depends in any way upon fitness or utility, or whether the feeling is not an inherent faculty of the mind"; and the general conclusion arrived at is

in favour of the former view. As regards people who are able to contemplate with admiration the world around them, the belief is expressed that "much of their appreciation of beauty or aversion to the ugly is obtained from the necessary physical laws governing all objects, although they themselves may be unconscious of the fact."

The additions to the Zoological Society's Gardens during the past week include a Bonnet Monkey (*Macacus sinicus*) from India, presented by Mr. H. G. B. Whitehead; a Lesser White-nosed Monkey (*Cercopithecus petaurista*) from West Africa, presented by Mr. J. Hoatson; two Chinchillas (*Chinchilla lanigera*) from Chili, presented by Captain B. Dixon, R.A.; two Kinkajous (*Cercoptes caudivolutus*), two Cooi Herons (*Ardea cooi*), four American Jabirus (*Mycteria americana*), an Anaconda (*Eunectes murinus*) from Brazil, presented by Dr. E. A. Goeldi; a Common Squirrel (*Sciurus vulgaris*) British, presented by Miss Rice; two Graceful Ground Doves (*Geopelia cuneata*) from Australia, presented by Mrs. C. A. Thompson; a White Stork (*Ciconia alba*) European, presented by Mrs. A. Gregory; a Bennett's Tree Kangaroo (*Dendrolagus bennettianus*) from Queensland, presented by Mr. Winkley Smith; a Cooi Heron (*Ardea cooi*) from Brazil, presented by Mr. W. A. Churchill, H.B.M. Consul, Pará; two Coquerel's Mouse Lemurs (*Chirogaleus coquereli*) from Madagascar, two Red-masked Conures (*Conurus rubrolarvatus*) from Ecuador, a Blue-winged Siva (*Siva cyanouroptera*) from India, deposited; two Graceful Ground Doves (*Geopelia cuneata*) bred in the Gardens.

#### OUR ASTRONOMICAL COLUMN.

ROTATION PERIODS OF THE SUPERIOR PLANETS.—In the *Comptes rendus* of the Paris Academy of Sciences for July 28, M. Deslandres gives the results of his experiments in determining the rotation of superior planets by means of the spectroscopic method based on the Fizeau-Doppler principle.

The method, which was described in detail in *Comptes rendus*, vol. cxx. p. 417, depends upon the differential displacement of the opposite ends of the equatorial diameter, which causes this diameter to appear inclined to its normal direction, and thereby gives, instead of a circular image of the planet in the spectrum, an inclined ellipse, the axis of which is inclined more or less depending upon the speed of the planet's rotation; the relative direction of the major axis of the ellipse depends upon the direction of the planet's rotation.

M. Deslandres uses a spectroscope of moderate dispersion and a wide slit, and emphasises the fact that the entire light of the planet may thus be used, and still very useful, though less accurate, results may be obtained. He points out that one advantage of this method is that the apparent displacement is double the real displacement due to the rotary motion, for, of course, both ends of the diameter are equally displaced, therefore a high degree of accuracy may be obtained. Experimenting on the rotation of Jupiter, two forms of instrument were used, first a small spectroscope with a wide slit and then a 30° prism mounted in front of the object-glass of a telescope of om. 55 aperture. In each case three exposures were made, the first with the slit, or the edge of the prism, parallel to the equator of Jupiter, and the second and third after having turned the complete apparatus through 90° and 180° respectively; thus the displacement of the equatorial extremities was made evident on both sides of their normal position, thereby giving greater accuracy to the measurements, and in the case of Jupiter indicating for the linear equatorial velocity of 12 km. an equatorial velocity, according to the displacement, of 48 km. The results obtained show very good accordance, and M. Deslandres claims a greater degree of accuracy for this method than is obtainable by the ordinary method. During this year the method has been applied to the determination of the rotation of Uranus, and it has already been shown that the planet rotates in a retrograde direction, but the detailed results will be given in a later communication.

THE DUTCH ECLIPSE EXPEDITION OF 1901.—In a preliminary report published by the Eclipse Committee of the Royal Academy of Sciences, Amsterdam, Profs. Julius, Wilter-

dink and Nijland give an account of the proceedings of the expedition which was sent out to Sumatra, by the Dutch Academy, to observe the total solar eclipse of May, 1901.

Elaborate preparations were made. Government help in the matters of transport and manual labour was obtained, and a number of officers and men belonging to the Dutch ironclad *Sumatra* was told off to assist in making the observations.

The programme of the expedition was divided into four parts: (1) the coronagraphs, (2) the spectrographs, (3) the physical observations, and (4) the collection of amateur observations, and the results of the observations made in each section are treated separately in the report.

The coronagraph negatives were mostly spoiled by cloud-fog, only those obtained by short exposures and on slow plates giving good results. Using the 40-foot coronagraph, kindly lent by the U.S. Naval Observatory, and a "Lumière jaune" plate measuring 24 × 30 inches, some very fine prominences and details of the inner corona were obtained on the negative.

Of the five spectrographs used, only one gave results which are of any use, and in the negatives obtained Prof. Julius makes a special point of the doubling of all the chromospheric crescents, which he assigns to the phenomenon of anomalous dispersion of the chromospheric light, afterwards pointing out the improbability of the doubling being of instrumental origin.

In the physical observations the clouds interfered seriously, so that little weight may be attached to the heat-radiation observations, but in the observations of the polarisation of the coronal light it is shown that the light at some distance from the sun's limb is more strongly polarised than that which is near to that limb, whilst the polarisation decreases again as the distance from the limb is increased.

The results of the amateur observations are various; 39 drawings and 69 photographs of the corona have been secured, and 37 of the latter are described as "good," "very good," or "excellent." Reports on the observations of the shadow-bands were received from seventeen stations.

THE SATELLITES OF SATURN AND URANUS.—Dr. J. J. See gives the results of his observations of the satellites of Saturn and Uranus, made with the 26-inch refractor of the U.S. Naval Observatory, Washington, in No. 3806 of the *Astronomische Nachrichten*.

The "Clark Micrometer II.," with magnifying powers of 388 for the satellites of Saturn and 606 for those of Uranus, was used, and the observations are based on the method of relative measures adopted by Prof. H. Struve at Pulkowa. The micrometer is so constructed that in measuring the position of *Japetus* it can be directly referred to *Titan* by means of a sliding eyepiece, thus probably giving more correct results than by the usual method.

Dr. See points out that the statement in his paper on the satellites of Uranus, *A.N.* 3676, that the places given in the American ephemeris are 37° in advance of the observed places, is an error due to the ambiguous wording of the ephemeris.

#### AUSTRALIAN CHILDREN'S GAMES.<sup>1</sup>

A certain amount of attention has been paid of late years to the subject of the games of primitive peoples, but so far we are only in the preliminary stage of the inquiry; indeed, a vast deal more evidence must be collected before sound generalisations can be made. A few suggestions have been thrown out by various students which must be regarded more as trial hypotheses than as definite conclusions, indeed they should be looked upon rather as "kites."

So few travellers think it worth their while to mention games and toys, especially those played by children, that the record for any country is imperfect, and for most peoples there is no information to hand. When there is any information it is nearly always simply a bare enumeration of the games played or of the toys employed; very rarely is a description given of the method of playing.

We are slowly learning the lesson that many of those activities which appear to be merely trivial have, or have had, an important significance in the evolution of human culture. The physiological, psychological and sociological aspects of playing have been dealt with by Karl Groos in his book "The Play of

<sup>1</sup> *North Queensland Ethnography: Bulletin* No. 4, March, 1902, "Games, Sports and Amusements." By Walter E. Roth, Home Secretary's Department, Brisbane, C.A. 8—1902.

Man," but it is not yet possible to map the distribution of most of the toys and games, to trace their origin, or to indicate the meaning that in many cases was primitively attached to their exercise.

Thanks to the investigations of Messrs. A. MacFarland Davis, F. Cushing, Stewart Culin, G. A. Dorsey and others, we have some indication concerning the variations, distribution and significance of the principal games of the North American Indians. Some hundred or so of these games are known, which can, however, be reduced to six main groups. These are derived from the employment of the shield and spear, marked arrows, shields on which were painted the four world quarters, and balls. Some of these games may have been originally merely games of skill, others were divinatory, while others, again, were doubtless magical.

In that vague region known as the Far East, the fragmentary evidence points to similar conclusions as the researches, amongst others, of Messrs. Stewart Culin, G. von Schlegel, R. Andree and E. B. Tylor. The same, too, appears to hold good for Oceania.

These general remarks will show how important it is that further evidence should be collected, and will indicate the welcome that will be given to the last of Dr. Walter E. Roth's studies in the ethnography of North Queensland. The following is Dr. Roth's classification of games, sports and amusements:—(1) Imaginative games, such as tales, of which nine are given. (2) Realistic games, playing with pets, playing with plants, making smoke spirals, bathing, &c. (3) Imitative games, objects and phenomena of nature imitated by attitudes, movements and paintings; the author figures seventy-four

a duck flying (Fig. 1), is similar to a string figure in Torres Straits which is called "throwing the fish spear," but this is a very simple figure to make. In this category are placed all those games in which children imitate their elders. Several round games are described in which "collecting honey,"



FIG. 2.

"catching cockatoos" and similar operations are represented; one of them, "playing bean tree" (Fig. 2), resembles a game I have described as played by Papuan children ("Head-Hunters, Black, White and Brown," 1901, chap. xv.). There are other analogies between the games of the aborigines of North Queensland and those of the Papuans. (4) Discriminative games, hide and seek and a guessing game. (5) Disputative games, wrestling, tug-of-war. (6) Propulsive games, ball games, tops, stick-throwing games, &c.; amongst the latter are certain methods of casting petioles of grass blades similar in principle to what is done by certain Papuan children. Of special interest is the hurling of a toy spear by means of a knotted string; a similar device was used by the men of the Southern New Hebrides, New Caledonia and the Loyalty Islands, and the present writer has recorded it as a child's plaything at Delena, Hall Sound, British New Guinea, and now it has turned up amongst the coastal blacks of North Queensland. (7) Exultative games, songs, dances, music. This little memoir, which is illustrated by thirty-nine plates, is full of valuable information, as it opens up a new field to the student.

A. C. H.

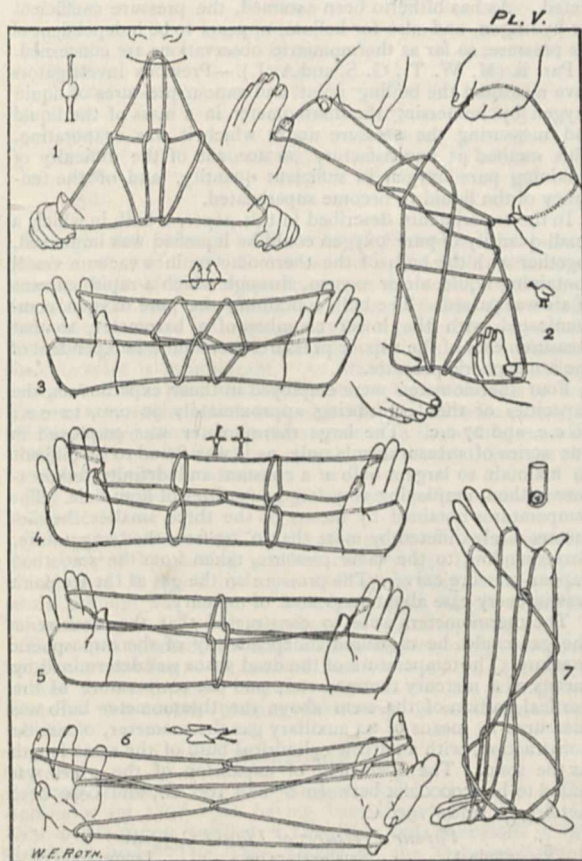


FIG. 1.

examples of those ingenious string figures in which so many primitive peoples excel. Very few illustrations of "cat's cradles" have ever been published, so that we cannot at present say how far particular devices are common to different peoples. One at all events (Plate v., Fig. 6), which represents

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

SIR GEORGE G. STOKES, Bart., F.R.S., senior fellow and president of Pembroke College, Cambridge, has been elected master of the College, in succession to the late Dr. Searle.

DR. W. PALMER WYNNE, F.R.S., assistant professor of chemistry in the Royal College of Science, South Kensington, has been appointed to the chair of chemistry in the School of Pharmacy of the Pharmaceutical Society of Great Britain in succession to Dr. J. Norman Collie, F.R.S., who was recently appointed to the chair of organic chemistry in University College, London.

THE council of University College, Liverpool, has unanimously agreed to invite Dr. Benjamin Moore to accept the chair of biochemistry recently founded in University College by Mr. William Johnston. Dr. Moore is now lecturer on physiology in the Charing Cross Medical School, and has made himself widely known among men of science as a successful teacher and an original investigator.

MR. J. QUICK has been appointed principal of the Technical Institute, Limerick.

AFTER a discussion extending over several sittings, the seventh clause of the Education Bill has passed Committee of the House of Commons in an amended form. The clause refers to the management of elementary schools, and it raised the

question as to the proportion of popularly elected managers which should act as bodies controlling the work of voluntary and denominational schools. The clause as amended provides that the management board of every public elementary school not provided by the local educational authority shall consist of four foundation or trust managers and two managers appointed by elected bodies. This principle has been accepted as part of the Bill. The discussion of the whole question of the machinery by which the managers of voluntary schools are to be elected has been postponed until the autumn session.

THE Ministerial changes consequent upon the resignation of Lord Salisbury, and the appointment of Mr. Balfour as Premier, involve a reconstitution of the representatives of the Board of Education in Parliament. Sir John Gorst, who has been Vice-President of the Committee of Council for Education since 1895, has resigned, and his office becomes extinct. The Duke of Devonshire remains Lord President of the Council, but ceases to preside over the Education Department. The newly constituted Board of Education has for its President the Marquis of Londonderry, who was chairman of the London School Board some years ago, and as Parliamentary Secretary Sir William Anson, member for the University of Oxford and a leading authority upon educational matters. The Duke of Devonshire will therefore no longer be directly concerned with departmental work in education, though he will have charge of the Education Bill when it reaches the House of Lords.

THERE is a feminine and a masculine type of mind. The former depends chiefly on memory and being reproductive; the other relies upon reasoning and being creative. The mind of the man of science is masculine, that of the clergyman is feminine. Not every woman possesses a feminine mind, though many men have little else. The whole of our education from top to bottom is essentially feminine, chiefly because in its origin and continuance it is clerical. Such are but a few of the opinions expressed by Mr. James Swinburne in an article on "Feminine Mind Worship" in the current number of the *Westminster Review*. The whole article is a powerful appeal for a fuller recognition of the value in education of a rational training in the methods of science, so that boys may obtain at school such a practical acquaintance with experimental physics and chemistry as will lead them to develop their reasoning faculties and endow them with those powers of initiative which are essential, since the whole welfare and existence of a commercial country like ours depends on the application of science and the work of the despised masculine mind. Mr. Swinburne's essay deserves to be widely read.

### SCIENTIFIC SERIALS.

*Bulletin of the American Mathematical Society* (2) viii. No. 9, June.—T. J. I. A. Bromwich, on the infinitesimal generators of parameter groups. The author gives a simplified method of calculating the generators of a group of known structure, and compares his results with those of Slocum (*Bulletin* for January).—E. V. Huntington, a second definition of a group. The definition is reduced to four independent postulates, to which a fifth must be added if a distinction is to be made between finite and infinite groups.—G. A. Miller, determination of all the groups of order  $p^m$ ,  $p$  being any prime, which contain the Abelian group of order  $p^{m-1}$  and of type  $(1, 1, \dots)$ .—L. E. Dickson, a class of simply transitive linear groups.—D. N. Lehmer, errors in Legendre's tables of linear divisors.—Reviews of Gray's "Treatise on Physics," vol. i., Cellérier's "Cours de Mécanique" (E. B. Wilson), and Kiepert's "Grundriss der Differential- und Integral-Rechnung" (E. W. Davis).

*Annals of Mathematics* (2) iii. No. 4, July.—H. S. White, note on a twisted curve connected with an involution of pairs of points in a plane.—R. E. Allardice, on some curves connected with a system of similar conics.—J. Westlund, note on multiply perfect numbers.—W. R. Ransom, a mechanical construction of confocal conics.—P. F. Smith, on Sophus Lie's representation of imaginaries in plane geometry. This is an interesting commentary on Lie's first paper, published in the *Transactions of the Academy of Christiania* in 1869.—G. A. Miller, note on the group of isomorphisms of a group of order  $p^m$ .—L. D. Ames, evaluation of slowly convergent series.

### SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, June 19.—"On the Measurement of Temperature." Part i.—On the Pressure Coefficients of Hydrogen and Helium at Constant Volume and at different Initial Pressures. Part ii.—On the Vapour Pressures of Liquid Oxygen at Temperatures below its Boiling Point on the Constant Volume Hydrogen and Helium Scales. Part iii.—On the Vapour Pressures of Liquid Hydrogen at Temperatures below its Boiling Point on the Constant Volume Hydrogen and Helium Scales. By Morris W. Travers, D.Sc., Fellow of University College, London, George Senter, B.Sc., and Adrien Jaquerod, D.Sc. Communicated by Prof. William Ramsay, F.R.S.

Part i. (M. W. T. and A. J.).—The pressure coefficients were determined by measuring the pressure which the gases exerted when the bulb of the constant-volume thermometer was surrounded with melting ice, or with steam at the boiling point. The apparatus employed cannot be described in this abstract; it was completely constructed of soda-glass, and as all junctions were sealed in the blowpipe flame, leakage of the gas was impossible. By enclosing the manometer column and *dead space* between parallel glass plates in a water jacket, it was possible to measure the temperature of these parts of the apparatus to  $0^{\circ}02$  C. and thus eliminate errors which might seriously affect the results.

The pressure coefficient at an initial pressure of 700 millimetres in the case of either gas appears to have the value  $0\cdot00366255$ , which does not differ appreciably from that obtained by Chappuis for hydrogen at an initial pressure of 1000 millimetres of mercury. At a pressure of 520 millimetres no appreciable decrease in the value of the coefficient could be detected. As has hitherto been assumed, the pressure coefficient for hydrogen, and also for helium, appears to be independent of the pressure, so far as thermometric observations are concerned.

Part ii. (M. W. T., G. S. and A. J.).—Previous investigators have measured the boiling point and vapour pressures of liquid oxygen by immersing the thermometer in a mass of the liquid and measuring the pressure under which it was evaporating. This method is unsatisfactory on account of the difficulty of obtaining pure oxygen in sufficient quantity, and of the tendency of the liquid to become superheated.

In the experiments described in this paper, a bulb in which a small quantity of pure oxygen could be liquefied was immersed, together with the bulb of the thermometer, in a vacuum vessel containing liquid air or oxygen, through which a rapid current of air was passed. The bulb containing the pure oxygen communicated with the lower chamber of a barometer, so that measurements of the vapour pressures were quite independent of the atmospheric pressure.

Four thermometers were employed in these experiments, the capacities of the bulbs being approximately 90 c.c., 12 c.c., 26 c.c. and 27 c.c. The large thermometer was employed in one series of measurements only, as it was found to be difficult to maintain so large a bulb at a constant and definite temperature without employing very large quantities of liquid air. The temperatures obtained by means of the three smaller thermometers rarely differed by more than  $0^{\circ}03$  from the temperature, corresponding to the same pressure, taken from the smoothed vapour-pressure curve. The pressure on the gas at the ice point was in every case about 1000 mm. of mercury.

The thermometers were so constructed that the pressure on the gas could be measured independently of the atmospheric pressure. The temperature of the dead space was determined by means of a mercury thermometer, and the temperature of the vertical portion of the stem above the thermometer bulb was measured by means of an auxiliary gas thermometer, of similar construction, with a narrow cylindrical bulb of the same length as the stem. The coefficient of expansion of the glass was found to be  $0\cdot0000284$  between  $0^{\circ}$  and  $100^{\circ}$  C., and  $0\cdot0000218$  between  $0^{\circ}$  and  $-190^{\circ}$  C.

Pressure in millimetres.	Vapour Pressures of Liquid Oxygen.	
	Temperature on hydrogen scale.	Temperature on helium scale.
800	90 <sup>o</sup> 60	90 <sup>o</sup> 70
760	90 <sup>o</sup> 10	90 <sup>o</sup> 20
700	89 <sup>o</sup> 33	89 <sup>o</sup> 43
600	87 <sup>o</sup> 91	88 <sup>o</sup> 01
500	86 <sup>o</sup> 29	86 <sup>o</sup> 39
400	84 <sup>o</sup> 39	84 <sup>o</sup> 49
300	82 <sup>o</sup> 09	82 <sup>o</sup> 19
200	79 <sup>o</sup> 07	79 <sup>o</sup> 17

Part iii. (M. W. T. and A. J.).—The three small thermometers used to measure the vapour pressures of liquid oxygen were also employed in the case of liquid hydrogen. The small bulb, which in the previous experiments had contained pure oxygen, now contained pure hydrogen. The agreement between the results obtained with different thermometers is indicated in the following table:—

## I.—Hydrogen Scale.

Thermometer.	Vapour pressure of liquid hydrogen. mm.	Temperature.	
		Found.	From curve.
A (12 c.c.)	757.2	20.17	20.21
B (26 c.c.)	766.6	20.28	20.25

## II.—Helium Scale.

Thermometer.	Vapour pressure of liquid hydrogen. mm.	Temperature.	
		Found.	From curve.
A (12 c.c.)	765.0	20.42	20.44
B (26 c.c.)	759.2	20.41	20.41
C (27 c.c.)	770.0	20.43	20.46
	749.0	20.36	20.36

The vapour pressures were measured between the boiling and melting points. The results are as follows:—

## Vapour Pressures of Liquid Hydrogen.

Pressure in millimetres.	Temperature on the hydrogen scale.	Temperature on the helium scale.
800	20.41	20.60
760	20.22	20.41
700	19.93	20.12
600	19.41	19.61
500	18.82	19.03
400	18.15	18.35
300	17.36	17.57
200	16.37	16.57
100	14.93	15.13
50	—	14.11

Though the pressure coefficients of hydrogen and helium between 0° and 100° C. show no appreciable difference, measurements of low temperatures on the scales of the two thermometers are not identical. It is probable that at the normal temperature both gases may be considered as so nearly perfect that the difference between the gas scale and the absolute scale is insignificant. As the critical point of helium lies much lower than that of hydrogen, measurements of low temperatures on the helium scale should approach more closely to absolute temperatures than measurements on the hydrogen scale. It is pointed out that helium should replace hydrogen as the normal thermometric substance.

The melting point of hydrogen was found to be 14.10 on the helium scale.

The pure helium used in the thermometric measurements was obtained by passing purified cleveite gas through a coil cooled to 15° in liquid hydrogen boiling *in vacuo*. An unsuccessful attempt was made to liquefy this gas, which could not be condensed at 13° under a pressure of 60 atmospheres.

The vapour pressures of solid neon were measured at temperatures corresponding to 20.4 (12.8 mm.) and 15.65 (2.4 mm.). It was shown that the vapour pressure did not change as the solid evaporated, proving that neon is a homogeneous substance.

## EDINBURGH.

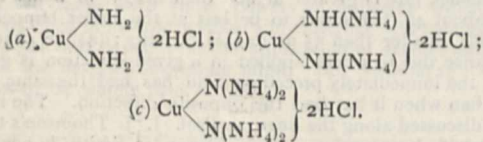
Royal Society, July 21.—Prof. Geikie in the chair.—The Neill prize for 1898-1901 having been awarded to Dr. J. S. Flett for his papers entitled "The Old Red Sandstone of the Orkneys" and "The Trap Dykes of the Orkneys," Prof. Geikie, in making the award, recalled the important work which Dr. Flett had done in searching for and finding organic remains in rocks hitherto supposed to be unfossiliferous, and then in proving that these strata were divisible into definite zones, each characterised by its own particular fish fauna. The paper on the trap dykes could have been written only by one who was at once a skilled field geologist, a thoroughly equipped petrologist, an expert microscopist and a facile chemist.—In a further communication on magnetic shielding in hollow iron

cylinders and superposed magnetic inductions in iron, Mr. James Russell discussed in particular the superposition of two magnetising forces at right angles to one another, and the magnetic æolotropy of demagnetised iron. Thus, if  $H_1$  represent the field first acting and  $H_2$  the field superposed at right angles to the first, and if  $B_1$  and  $B_2$  represent the resultant inductions in the directions of  $H_1$  and  $H_2$  respectively, then the general result was that with  $H_2$  superposed on  $H_1$  the  $B_1$  component always lay above the  $B_2$  component. For low fields the  $B_1$  component is greater than in the normal case when no  $H_2$  acts, but as the field is taken stronger the  $B_1$  component approaches the normal value, and finally in high enough fields falls below it. The  $B_2$  component lies below the normal value with this exception, that with low values of  $H_1$  there is a slight excess of the  $B_2$  component over the normal value. Then again, as regards æolotropy the following result was established. During the early stages of induction, iron is more permeable to a force in the same direction as that used in the immediately preceding process of demagnetising by reversals than it is to one at right angles to it. The results were discussed in terms of the recognised theories of molecular magnetism.—Dr. W. Peddie, in an additional note on the use of quaternions in the theory of screws, applied his method of interpretation to the case of a rigid body moving with two degrees of freedom, and was led to the investigation of the elliptic cylindroid, which differs from the ordinary cylindroid by being referred to an elliptic cylinder instead of to a right cylinder. Further developments were also given.—Prof. C. G. Knott read the second part of a paper on change of resistance of nickel due to magnetisation at different temperatures. The apparatus was the same as that already described, but by a modification in the method of experimenting more precise results had been obtained. The rate of change of resistance per unit increase of field at constant temperature and the rate of change per unit increase of temperature of this magnetic rate of change in a given field being distinguished as the magnetic change rate and the thermal variation respectively, the general conclusions were: (1) the magnetic change rate of resistance of a given nickel wire increases steadily with increase of field, but at a somewhat slower rate as the field increases; (2) the magnetic change rate increases slightly but unmistakably with rise of temperature up to 100° C. and probably higher; (3) the thermal variation of this change rate is greater at 40° than at 75° in fields higher than about 40, but tends to be less at the lower temperature in fields smaller than 35 or 40 C.G.S. units; (4) the change of resistance due to a field applied in a given direction is greater when the immediately preceding field has had the same direction than when it has had the opposite direction. The results were discussed along the lines of Prof. J. J. Thomson's theory of electrified corpuscles.—Prof. Alexander Smith, in continuation of a previous paper on the freezing point of sulphur, communicated a note on causes which determine the formation of amorphous sulphur. The proportion of amorphous sulphur formed in a mass of sulphur purified by crystallisation and kept heated at 448° C. was found to increase with the time which elapsed between the purification and the heating, and to decrease as the heating was greatly prolonged. Passing certain gases such as air, dry sulphur dioxide and dry hydrogen chloride through the sulphur during the heating increased the yield of amorphous sulphur; and under these conditions long continuation of the treatment did not cause any reduction in the yield. On the other hand, nitrogen, carbon dioxide, hydrogen sulphide and ammonia, used similarly from the beginning of the heating, seemed to prevent the formation of the amorphous form. It was not advisable to offer any theory until further work had been done.

## PARIS.

Academy of Sciences, August 4.—M. Bouquet de la Grye in the chair.—Reflection and refraction as regards transparent bodies in rapid motion: reflected and refracted waves: amplitude of vibrations, by M. J. Boussinesq.—Experimental demonstration of the decomposition of carbon dioxide by leaves exposed to light, by MM. P. P. Dehérain and E. Demoussy. The authors point out that when the ordinary method of immersing leaves in a saturated solution of carbon dioxide is followed, the results are invariably successful with normally submerged aquatic plants like *Ceratophyllum submersum*, but vary greatly with plants the leaves of which normally decompose carbon dioxide in air. The results are satisfactory if the leaves

are placed in air above a saturated solution of carbon dioxide. The volume of oxygen liberated was invariably found to be exactly equal to that of the carbon dioxide decomposed, and no appreciable quantities of carbon monoxide, hydrogen, or gaseous hydrocarbons were formed.—The fruits of *Rosellinia necatrix*, by M. Ed. Prillieux. One of the common parasites which destroy the roots of fruit trees and vines was named *Dematophora necatrix* by Hartig, although he pointed out that it seemed to be closely allied to the group *Rosellinia*. The author has for the first time been able to study thoroughly the fruits, and as the parasite without doubt belongs to that group suggests a change of name.—Direct reduction of oxides of nitrogen by the contact method, by MM. Paul Sabatier and J. B. Senderens. A study has been made of the action of reduced nickel and reduced copper on the oxides of nitrogen. The results obtained are shown to be similar to those produced by spongy platinum, and it is pointed out that nickel or copper might with advantage replace platinum for such reactions.—Measurement of the limit of elasticity of metals, by M. Ch. Fremont.—On a new method of optically measuring the thickness of plates, by MM. J. Macé de Lepinay and H. Buisson (*cf. C. R.*, April 21). Results are given for a plate of quartz showing the great accuracy of the method.—Reflection of light from an iron mirror magnetised perpendicularly to the plane of incidence, by M. P. Camman. The author confirms experimentally the theory of M. C. H. Wind (*Archives néerlandaises*, 2<sup>e</sup> série, t. i. 1897) regarding the reflection of light from magnetised mirrors, viz., if the incident light is polarised in the plane of incidence, the magnetisation has no effect upon the reflection, but if the incident ray is polarised perpendicularly to the plane of incidence, the time, the phase and the amplitude of reflected rays are changed.—Method of regulating resonators for high-frequency discharges with a view to their use in medicine, by M. H. Guilleminot.—On gentiobiose: preparation and properties of crystallised gentiobiose, by MM. Em. Bourquelot and H. Hérissey (*cf. C. R.*, cxxxii., March 4, 1901, p. 571).—Ammoniacal anhydrous copper chlorides: cupro-ammoniacal radicles, by M. Bouzat. The author finds that besides the compounds (a)  $\text{CuCl}_2 \cdot 6\text{NH}_3$  and (c)  $\text{CuCl}_2 \cdot 2\text{NH}_3$  described by Rose and Graham respectively, there is a third intermediate compound (b)  $\text{CuCl}_2 \cdot 4\text{NH}_3$ . He assigns to them the constitutional formulæ



—Action of nitrous acid in alkaline solution on  $\alpha$ -substituted  $\beta$ -ketonic esters, by MM. Bouveault and René Locquin. The conclusion arrived at is that if the reaction is carried out under such conditions that the ester group is not saponified, or if it be saponified in acid solution, there results an acid and an oxime of a substituted glyoxylic ester; but if, during the reaction, the ester group is saponified in such a manner as to give the salt  $\text{R}-\text{CO}-\text{CH} \begin{Bmatrix} \text{COOMe} \\ \text{R}' \end{Bmatrix}$ , one obtains a monoxime of an  $\alpha$ -diketone and carbonic anhydride.—Antiparamœcious serum, by M. Ledoux-Lebard. The author finds that the serum of rabbits and guinea-pigs which have been several times injected with cultures of *Paramœcium caudatum* is much more toxic towards this species of *Paramœcium* than normal serum. The toxic effect is less towards other species of *Paramœcium* (*e.g. P. aurelia*).—Action of alcoholic fermentation on the *Bacillus typhosus* and the *Bacillus Coli*, by MM. E. Bodin and F. Pailheret. Alcoholic fermentation does not seem of itself to destroy these bacilli.—Variation of the phosphoric acid in cow's milk with time after calving, by MM. F. Bordas and Sig. de Raczkowski. The phosphoric acid diminishes steadily from the time of calving.—Researches on the assimilation of leaves, influenced by chlorophyll, of which the upper or lower surfaces may be exposed to light, by M. Ed. Griffon.—On the cavern of Höll-Loch (Hell's Cavern) and the Schleichende Brunnen (Creeping Springs), Switzerland, by M. E. A. Martel. This cavern, discovered in 1880, is one of the most remarkable in Europe. It lies near Stalden. A description is given.

NEW SOUTH WALES.

Linnean Society, June 25.—Mr. J. H. Maiden, president, in the chair.—By the wish of the council, the president explained to the meeting that, in consequence of the retrenchment policy which untoward circumstances had forced upon the neighbouring State of Queensland, it was to be feared that Mr. F. M. Bailey's "Queensland Flora," now in course of publication, would be brought to an abrupt termination in the middle of the sixth or concluding part. An expression of the views of scientific men in other States would perhaps help to justify the Queensland Government in making some special effort to utilise to the full Mr. Bailey's experience and unrivalled knowledge of the flora of Queensland in completing the important publication in question. On the motion of the president it was unanimously resolved, "That this meeting desires respectfully to give expression to the hope that, in the interests of science, the Queensland Government may see its way to allow Mr. F. M. Bailey to take the steps necessary to complete the 'Queensland Flora.'"—Notes on *Juncus holoschaenus*, R. Br., and *J. prismatocarpus*, R. Br., and on certain other New South Wales plants, by Mr. E. Cheel.—(1) On *Eucalyptus Baueriana*, Schau; (2) on *Eucalyptus calycogona*, Turcz., by Mr. J. H. Maiden.—A new gum (Levan) bacterium from a saccharose exudate of *Eucalyptus Stuartiana*, by Mr. R. Greig Smith.—*Eucalyptus melanophloia*, F.v.M., and its cognate species, by Mr. R. T. Baker. The object of the paper is to show that previous descriptions of this species must now be modified, as the foliage has not that constancy of form that has up to the present time been attributed to it.

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