THURSDAY, MAY 9, 1901.

EARLY HISTORY OF THE THERMOMETER.

Evolution of the Thermometer, 1592–1743. By Henry Carrington Bolton. Pp. 98. (Easton, Pa., U.S.A.: Chemical Publishing Co., 1900.) Price 1 dollar.

THIS is a most interesting little book, giving the history of the thermometer from the time of Galileo to that of Celsius and Christin.

Galileo's first instrument is thus described in a letter written by Father Castelli and dated 20th September, 1638, in which he says it was used in public lectures 35 years before. "Galileo took a glass vessel about the size of a hen's egg, fitted to a tube the width of a straw and about two spans long; he heated the glass bulb in his hands and turned the glass upside down so that the tube dipped in water held in another vessel; as soon as the ball cooled down the water rose in the tube to the height of a span above the level in the vessel; this instrument he used to investigate degrees of heat and cold."

According to Viviani, author of a "Life of Galileo," published in 1718, this instrument was invented about the time he became professor of mathematics in Padua; this was towards the end of 1592.

Sanctorius, a medical colleague of Galileo, appears to have appreciated the value of fixed points for graduation, and for this purpose he used snow and the heat of a candle; the range thus obtained he divided into degrees. The thermometer was applied by him to take the temperature of the human body; in one instrument the bulb was constructed so as to go into the patient's mouth.

Sanctorius, in his "Commentaries on Galen," speaks of the thermometer "as a most ancient instrument," and it has been suggested by Cleveland Abbe that the instrument was known before the time of Galileo and that his work consisted in the addition of a scale.

The first sealed thermometer was made some time prior to 1654 by Ferdinand II., Grand Duke of Tuscany; he filled the bulb and part of the tube with alcohol, and then sealed the tube by melting the glass tip. Ferdinand and his brother, Leopold de Medici, promoted the establishment in Florence of the Accademia del Cimento, and the accounts of their experiments, published in 1667 and translated into English by Waller in 1684, contain descriptions of various thermometers made and used by the members. One of these old thermometers was given by the Grand Duke of Tuscany to the late Prof. Babbage, and is now in the Cavendish Laboratory at Cambridge.

In England about the same time Boyle made experiments on thermometers. His "Lectures on Cold" were published in 1665 in obedience to the command of the Royal Society, "imposed on me in such a way that I thought it would less misbecome me to obey it unskilfully than not at all. Especially since from so illustrious a company (where I have the happiness not to be hated) I may, in my endeavours to obey and serve them, hope to find my failings both pardoned and made occasions of discovering the truths I aimed at."

The second discourse of these lectures contains some "New Observations about the Deficiencies of Weather Glasses, together with some considerations touching the New or Hermetical Thermometers."

Boyle felt the need of fixed points. Hooke, in his "Micrographia," describes some thermometers with stems above four feet long, in which the range between summer and winter was nearly the length of the stem. To graduate the stems he placed zero at the point where the liquid stood when the bulb was in freezing distilled water; thus to him belongs the credit of taking the temperature of the freezing point of water as the lower fixed point.

There appears to be considerable doubt as to who first employed mercury as the thermometric liquid; the Accademia del Cimento used such an instrument in 1657, and they were known in Paris in 1659. Fahrenheit, however, appears to have been the first to construct, in 1714, mercury thermometers having trustworthy scales.

The use of the boiling point of water as the upper fixed point was suggested by Carlo Renaldini in 1694, who published, at the age of eighty years, a work on natural philosophy.

Sir Isaac Newton, in his "Scala Graduorum," published in the *Phil. Trans.* in 1701, adopts linseed oil as the thermometric liquid. He took as the fixed points the melting point of ice and the temperature of the human body, calling the one 0° and the other 12°. On this scale he gives as the boiling point of water 34°, and as the melting point of lead 96°. Newton did not adopt the boiling point of water as a fixed point.

After an interesting reference to Amontons and others who worked at thermometry in the latter part of the seventeenth century, Mr. Bolton describes the labours of Fahrenheit, who was born in 1686. His work began in 1706. His skill as a glass worker was very great and enabled him to carry out many designs. In his own account of the instrument he says: "The scale of the thermometers used for meteorological observations begins below with 0° and ends with 96°. The division of the scale depends upon three fixed points, which are obtained in the following manner. The first point below at the beginning of the scale was found by a mixture of ice water and sal ammoniac or also sea salt; when a thermometer is put in such a mixture the liquid falls until it reaches a point designated as zero . . . . The second point is obtained when water and ice are mixed without the salts named; when a thermometer is put into this mixture the liquid stands at 32°, and this I call the commencement of freezing . . . . The third point is at 96°. The alcohol"—it is expressly stated earlier that the thermometers were of two kinds, the one containing alcohol, the other mercury—"expands to this height when the thermometer is placed in the mouth or in the armpit of a healthy man and held there until it acquires the temperature of the body."

Above this temperature the scale was merely lengthened by dividing the tube into equal spaces; one of the divisions marked 212° on a certain thermometer was observed to coincide with the boiling point of water, thus the division of the fundamental interval between the freezing point and boiling point into 180 parts was accidental. If we take these two temperatures as our points of departure, marking them as 32° and 212°, the normal temperature of the human body is 98°·4, not 96°

as on Fahrenheit's original scale, so that the scale now known by his name differs slightly from that originally defined by him. Two of his original instruments are in the Physical Laboratory at Leyden; the freezing points as now given by them are at 34°·2 and 34°·1 respectively; both of these are mercury thermometers.

After Fahrenheit's time came various imitators, each with his own special scale; for an account of them we must refer the reader to Mr. Bolton's pages. Among them the scales of Réaumur and of Celsius alone survive, though, as Mr. Bolton points out, Celsius proposed to call the boiling point of water 0° and its freezing point 100°; the change to the present centigrade scale was made independently in 1743 by Christin, of Lyons, and seven years later by Strömer, a colleague of Celsius at Upsala.

Réaumur's choice of 80° for the temperature of steam was made as a result of his experiments on the expansion of alcohol. He found that alcohol, diluted with one-fifth water, expanded in volume from 1000 to 1080 when raised from the freezing point to the boiling point.

Mr. Bolton is to be congratulated on his work. He has made it most interesting, and it deserves many readers; it suggests the hope that some one may take up similarly the history of other physical instruments and write about them in as bright and capable a manner.

THE OXFORD TEXT-BOOK OF ZOOLOGY.

A Treatise on Zoology. Edited by E. Ray Lankester Part II. *The Porifera and Coelentera.* By E. A. Minchin, G. H. Fowler and G. C. Bourne. With an introduction by E. Ray Lankester. Pp. x + 405. (London: Adam and Charles Black, 1900.)

THE second part of the "Treatise on Zoology," now appearing under the editorship of Prof. Ray Lankester, contains six chapters, the work of four different authors, graduates of the University of Oxford. An introductory chapter by the editor, on the Enterocœla and Cœlomocœla, deals with the main divisions of the Metazoa; Prof. E. A. Minchin writes on the Sponges; Dr. G. H. Fowler on Hydromedusæ and Scyphomedusæ; and Mr. G. C. Bourne on the Anthozoa and Ctenophora. The high character of the whole work, of which the volume previously published (Part III. Echinoderma) gave promise, is fully established by that now before us, and it can scarcely be doubted that this treatise will, for some time to come, be regarded as the standard English text-book for advanced students of zoology.

The classification of the Metazoa adopted by Prof. Lankester in the introductory chapter is based upon the work of the most recent writers on animal morphology, and differs in several ways from that previously adopted in the text-books. The whole animal kingdom having first been divided into two grades, the Protozoa and the Metazoa, the grade Metazoa is considered as giving rise to two branches, the Parazoa, or Sponges, and the Enterozoa, the latter name being a term previously introduced by Prof. Lankester as a substitute for Haeckel's term Metazoa, but which he now proposes to restrict to the second great division of the Metazoa. The view thus adopted of the position of Sponges in the animal kingdom is that advocated by Minchin in the present work (see p. 158); but, as that author points out, it is one which is by no means accepted, at the present time, by other leading authorities on the morphology of the Porifera.

After this main division of the Metazoa, Prof. Lankester proceeds to divide the Enterozoa into two branches, the Enterocœla, or those in which the sole cavity is the enteron, and the Cœlomocœla, those in which the cœlom is present as an independent second cavity. It is certainly open to doubt whether any advantage is gained by the introduction, in a work of this character, of these new terms to replace the already so widely used Cœlentera (or Cœlenterata) and Cœlomata. Indeed, Prof. Lankester himself appears to regard his new nomenclature as tentatively put forward for the consideration of his fellow morphologists, for it is not even adopted in the present volume. The title-page bears the name Cœlentera, and this is the term used both by Mr. Bourne and Dr. Fowler in their sections of the work, the latter writer making use also of the form Cœlenterata (p. 60), to which the editor of the treatise takes exception.

The remaining portion of the introductory chapter gives, in a clear and interesting manner, an account of the author's views with regard to the cœlom and its relations to the other cavities of the body in the different phyla of the Cœlomata (Cœlomocœla), together with a detailed history of the progress of our knowledge of that organ. The discussion of this subject is noteworthy on account of the particularly clear statement of the author's theory of the body-cavity relations found in the Mollusca and Arthropoda. According to this theory, now termed the theory of Phlebœdesis, the true cœlom is present in these groups in a reduced form, whilst the blood-holding spaces (hæmocœl) are in reality swollen blood-vessels. In support of this view, Benham's work on *Magelona* (*Quart. Journ. Micr. Sci.*, xxxix. 1896) is brought forward. The concluding part of the chapter is of interest from the great importance attached to the recent work of Meyer and of Goodrich on the nephridia and cœlomoducts of the marine Chætopoda, the views of these authors being entirely adopted, notwithstanding the fact that they revolutionise the prevailing ideas on the subject, ideas which owe their origin very largely to Prof. Lankester himself.

Prof. Minchin's section on the Sponges, we have little hesitation in saying, contains the most successful account of an animal group which has yet appeared in this treatise. It is in many ways a model of what such a general account should be, and is certainly the most satisfactory summary of our knowledge of the Porifera which at present exists in any language. It is by no means merely a compilation and discussion of facts already put on record by other authors. Much new matter is here recorded for the first time—notably the account of the development of *Clathrina blanca*—and a large part of the descriptive portions of the chapter is the direct outcome of the author's own observation and experience. Prof. Minchin's work as a histologist, which has shown him to be an expert in the most recent and delicate methods of technique, is well known, but the present article proves him to be at the same time a painstaking and observant outdoor naturalist. That a sponge is a living organism and that each species is specially adapted

to the particular set of natural conditions under which it grows are facts which are seldom absent from his mind, and as a consequence there is a freshness and reality about much which he has written that are often absent from the writings of the laboratory and museum worker.

Dr. Fowler's accounts of the Hydromedusæ and Scyphomedusæ are, in our opinion, the least satisfactory portions of the volume. The style is too concentrated and concise to make the writing effective, and intellectual interest has been entirely sacrificed in an attempt to introduce every available fact and to deposit it in a properly labelled compartment. The result resembles the syllabus of an advanced course of lectures on the groups dealt with rather than an intelligible account of those groups.

In the chapters on Anthozoa and Ctenophora, Mr. Bourne presents us with an excellent series of detailed descriptions of particular types, together with a clearly stated and well-marshalled body of facts concerning the groups as a whole. His work will undoubtedly prove of great value to both teachers and students. We, however, fail to find in these two sections that originality of treatment and originality of thought which characterise Prof. Minchin's section on the Porifera.

The whole work is well illustrated, being in this respect a great improvement on the volume of the treatise previously published (Part III. Echinoderma). The figures for which Prof. Minchin and Mr. Bourne are responsible, many of which are original, are specially worthy of praise.

THE GRAPHICAL MENSURATION OF VAULTS.

Il Calcolo Grafico applicato alla Misura delle Volte. Prof. Ernesto Breglia. 5th serie, vol. i. (Atti del Reale Istituto d'Incoraggiamento di Napoli, 1899.)

GRAPHICAL methods are used to a certain extent in the solution of engineering problems, although perhaps their employment is not so extended as their neatness and simplicity merit. In some cases, it is true, where the simplification is great and the application easy, they are used practically to the exclusion of other methods. But in other cases where a graphical treatment would effect almost as great a simplification the methods have never been very generally applied. The reason lies, we think, in the fact that it requires greater ingenuity to treat a problem graphically than analytically. Problems such as occur in practice, even though they may be complicated, can generally be hammered out by analytical means. A good mathematician, no doubt, will be able to find a short cut to the solution, but the engineer, whose ready stock of mathematical knowledge on which he can draw with ease amounts to little more than the algebra he learnt at school and an acquaintance with the principles of the calculus, will be able to work out the solution by dint of determined plodding. With graphical methods it is different. To begin with, the geometrical training which an English engineer receives at school is a hindrance rather than a help, so that when he comes to study graphical systems he finds himself in a region unknown to him and is obliged to disembarrass himself of the Euclidean notions acquired in his youth. We are afraid that the Englishman will never be quite happy in using geometrical methods until the groundwork of his knowledge is laid with some more suitable text-book than Euclid's Elements. In addition to this, with these methods each new problem requires somewhat different treatment; it is hard, and often impossible, to lay down very definitely the lines on which to proceed. The ingenuity which is consequently required can only be obtained, by any except the born mathematician, by the habitual use of the system.

Prof. E. Breglia's paper illustrates what we have been saying. The method that he has worked out for measuring the volumes of arches and vaults is extremely neat. In the simpler cases it is, as is natural, very much easier to follow and apply, and the ease of doing so is such that it should commend itself to all who have need to make such measurements. In the cases of vaults of more complicated shape the method becomes also more complex; artifices have to be used in order to "dodge" the more important difficulties. It is just these artifices that are so difficult to find when a new problem is attacked. To apply Prof. Breglia's method to the determination of the volume of a vault similar in shape to one of those he has examined in the paper before us would be fairly simple, even though the shape might be very complicated; to apply it to the case of a vault of quite a different shape would not be nearly so easy. Prof. Breglia has, however, examined a great variety of cases in a thorough manner, and has thus rendered his paper very valuable.

Prof. Breglia's system has other advantages besides a simplicity which enables the volume of a vault of complicated shape to be found without the use of advanced mathematics. The accuracy can be increased practically at will by varying the number of sections into which the vault is divided; with analytical methods high accuracy is often only attainable by undue complication of the mathematics. We are inclined to think, also, with Prof. Breglia that error is less likely to occur in its use, as should any mistake be made it will show itself directly; but this is an advantage that must not be given too great weight, as graphical methods possess possibilities of error, especially in the interpretation of the results, which are not to be met with in other methods. The system is, however, a very useful one, and the paper is worthy the careful attention of all those interested in the subject.

OUR BOOK SHELF.

Experimental Chemistry. By Lyman C. Newell, Ph.D. Pp. xv + 410. (Boston: Heath and Co., 1900.) Price 5*s*.

DR. NEWELL has added one more to the already formidable array of elementary science text-books, each of which, according to their respective authors, has been written to supply a long-felt need. In the present instance, the object is to promote the more efficient teaching of chemistry by modern methods; and in writing his book Dr. Newell has been actuated by "a desire to provide a course of study which shall be a judicious combination of the inductive and deductive methods."

We fail to see in what way Dr. Newell's book superior to a hundred others of a similar kind. The ideal that the author has set before him is a very high one, and we should be the last to deprecate any attempts to improve upon modern methods of teaching experimental science. It is obvious that the time at the disposal of the average student is so limited that it would be

quite impossible to carry out the logical method consistently, and at the same time cover any but the most elementary parts of the subject; the only question is as to the nature of the compromise.

Dr. Newell has attempted to cover a very wide field, with the result that a large amount of matter has been inserted which is beyond the range of an elementary student and of little use to the more advanced. His method is one that is excellent in theory, but in practice easy to carry to excess. To the title of a treatise on elementary chemistry the book lays no claim; it is nothing more than a guide-book for use in the laboratory, and must be supplemented by others for detailed information; while as a work of educational value it is by no means the most efficient that could be devised. Elementary students, however, will doubtless find portions of it of considerable assistance, for the experiments are carefully described, and the illustrations clear.

The Elements of Darwinism, a Primer. By A. J. Ogilvy. Pp. 160. (London: Jarrold and Sons, 1901.) Price 2*s.* 6*d.*

THE object of this little book is, as the author states in the preface, to give the ordinary non-expert reader an intelligent notion of the theory of natural selection. There is no doubt that there is scope for such a work, for even at the present time it is remarkable how widespread are the ignorance and misapprehension of Darwin's teaching among the general public. Mr. Ogilvy divides the subject into three parts: general statement, consisting of eleven chapters; illustrations, consisting of seven chapters; and a third part consisting of nine chapters. Although keeping fairly well within the limits of Darwin's teaching, the author shows some originality of treatment, and has not slavishly followed the custom so prevalent at one time of simply rearranging the facts collected by our great master and dishing them up as an original contribution to science. Several new illustrations of Darwinian principles are introduced, some of them appropriate and forcible, others less appropriate and in some cases altogether questionable. In the chapter on flight, for example, the author attempts to define two kinds: "Now some birds fly chiefly by muscular, some by nervous power." The condor and the albatross are quoted as examples of the former, and the partridge as an example of the latter. The principles which have governed the author in classifying the contents of the various chapters are not in all cases clear, and a rearrangement might have been made in some instances with advantage. One other very obvious defect is the too facile exposition of evolutionary steps which are at present difficult to understand, and of which the course is confessedly obscure. The kind of reader for whom Mr. Ogilvy has written his book is just the person upon whom such treatment would produce an impression of dogmatic security. In spite of these defects, however, any one previously ignorant of the subject who carefully reads the volume cannot fail to acquire a fairly sound idea of Darwinism, and this is all that the author claims to have had in view. It should be added that the manuscript has been read by Dr. Alfred Russel Wallace, who does not, however, hold himself responsible for all the statements. R. M.

La Betterave à Sucre. Par L. Malpeaux. Pp. 206. (Paris: Mayson and Gauthier-Villars. No date.) Price fr. 2.50.

THIS small volume, one of the series known as "l'Encyclopédie scientifique des Aide-Mémoire," is prefaced by a few general considerations upon the importance of the sugar beet. In the opening chapter the history and the present state of cultivation, as well as the future of the sugar beet, are dealt with. As regards the future it is interesting to note that as the supply already meets or even exceeds the demand, the only hope held out to the cultivator is an increase in the consumption of sugar. The second chapter treats shortly of the production of sugar in the plant. A brief description of the different varieties of beet is followed by a chapter on the production of seed. This is perhaps the most interesting portion of the volume before us. In it the methods of selection, physical, chemical and genealogical, the culture of seed plants and the analysis of the roots are given at some length. Then follow chapters on the influence of climate and soil and manures. The important fact that the beet removes from the soil very little else than carbon, hydrogen and oxygen, and therefore the manures supplied to it benefit the crops which follow, is duly insisted on. Two short chapters on sowing, hoeing and thinning are followed by one on diseases, insect and other pests. Although a number of remedies, such as sprinkling with copper arsenite, &c., are mentioned, proper cultivation is upheld as the most important factor in preventing and overcoming such diseases and insect ravages. The remaining pages are devoted to the harvesting and storage, the marketing, and, in connection therewith, the analysis of the juice and the cost of cultivation.

The illustrations are clearly drawn and the curves showing annual production of roots, &c., are a valuable feature of the book. A bibliography of the subject, in which French authors only are mentioned, is attached. The addition of an index would add to the value of this useful monograph. J. E. M.

Assimiliation chlorophylienne et la Structure des Plantes. By Dr. Ed. Griffon. Pp. 106. (Paris: Georges Carré et C. Naud.) Price 2 francs.

L'Evolution du Pigment. By Dr. G. Bohn. Pp. 96. (Same publishers.) Price 2 francs.

THESE two manuals belong to the biological section of the valuable "Scientia" series, each volume of which contains authoritative descriptions of subjects in which progress is being made.

Dr. Griffon's brochure deals with a subject which has engaged the attention of many physiological botanists. Numerous determinations have been made of the physico-chemical properties of chlorophyll; and the experimental methods employed to measure the changes resulting from the action of its functions have been so much improved in recent years that valuable results are frequently obtained. But there is a matter which has almost been left in the background, namely, the influence of the structure of plants on the decomposition of carbon dioxide. It is true that important data have been obtained upon this subject, but they are chiefly from special points of view, and no general conclusions have been reached. Dr. Griffon reviews the work which has been done upon this subject, both as regards plants which naturally differ among themselves in anatomical characters and plants of the same species of which the structural differences are due to varying conditions as regards light, heat, hygrometric state, presence of various mineral salts, &c. A chapter upon the nature and measurement of assimilation in plants precedes this treatment, and one on the principal factors determining the rate at which carbon dioxide is decomposed concludes the book. Dr. Griffon succeeds in presenting a connected account of researches and results of interest to all students of botany.

Dr. Bohn's book opens with a general statement of cell structure, bacteria and pigmentary bodies. He then deals in succession with the constitution and biology of pigments, modifications of pigment in organisms, evolution of pigment in various groups of animals, and utilisation of colour in nature for protective and other purposes.

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.]*

Scope of the Royal Society.

As a general principle it is not desirable to make the affairs of the Royal Society a subject of public discussion. The question to be submitted to the consideration of the fellows on May 9 is, however, of sufficient general interest to justify an exception.

The notice given has been short, and I am unable to be present. No vote is to be taken. It will, therefore, not be too late to draw attention to some facts which appear to me to have been overlooked.

The starting point of the matter as it is presented to the Society is contained in the following statement :—

"The Society exists for the promotion of Natural Knowledge. The interpretation of the term 'Natural Knowledge,' according to the present practice of the Royal Society, assigns to it a range from Mathematics to the various Biological sciences, and this secures the inclusion of the scientific study of man in his biological relations. It has been argued that this range might be properly increased by the inclusion of the scientific study of man in his reasoning, social and historical relations. It may, indeed, be further contended that the Society should include in its scope all branches of Natural Knowledge which are capable of consecutive and ordered development. Such a test would permit the inclusion of subjects such as Psychology, Economics, Historical Science and Philology in the widest sense of the term, which, under the present practice of the Society, may be deemed excluded, but which, when pursued as they now are by the most capable students, in a scientific spirit and by scientific methods, do fall within the domain of Natural Knowledge. The investigation, for instance, of the phenomena of the origin and variations of human speech, of the beliefs and customs of primitive man, of the production and distribution of wealth, of the laws which govern the development of political societies, is an investigation into natural phenomena in a sense which the progress made in our conceptions of nature during the last two centuries seems to justify."

Now I have always understood—and my impression is confirmed by the highest authority—that admission to the Society is actually open to any one who has promoted Natural Knowledge, in whatever field, by scientific methods. The open door may not have been taken advantage of, but I am not aware that there is the smallest ground for believing that it has ever been closed. What I wish to draw attention to is that though the actual representation of the subjects enumerated above may not have been as full as it might have been, I am unable to agree that they, "under the present practice of the Society, may be deemed excluded." A rather cursory inspection of the names of those who have been fellows, or have been elected during the last twenty years, confirms my opinion. Under Economics I find Heywood, Newmarch, Sir James Caird, Jevons, Palgrave, Sir Robert Giffen, Charles Booth and Shaw-Lefevre. I am under the impression that for the period this is a very fair, if not actually adequate, representation of economic science. Historical Science, I presume, must be taken to include archæology and ethnography, otherwise these will have again to be "deemed excluded." Assuming that this is not so, I find the names of General Pitt-Rivers, Sir Augustus Franks, Canon Greenwell, Tylor, Penrose and, in the list now recommended by the Council, of Arthur Evans. Of Historians, in a restricted sense, I find Dean Stanley and Sir Henry Howorth, and, if Privy Councillors are included, of Bryce and John Morley. And with regard to the class of Privy Councillors, it is to be remarked that although any one is eligible it is apparently rare for any to be elected without something more than mere political qualifications. Philology has been more weakly represented; still, I find the names of the Dean of Canterbury, Alexander Ellis, Sir Henry Rawlinson and Bryan Hodgson. And if Psychology finds its only representative at the moment in Lloyd Morgan, it is, I believe, an open secret that Herbert Spencer might, had he thought fit, have been a fellow of the Society.

Besides the names I have enumerated, I am very much disposed to doubt if a score can be enumerated, or perhaps even half that number, of others in the same fields who during the last twenty years possessed conspicuous claims to admission to the Society. Nor can I believe that if men like the late Bishops of Oxford and London or Freeman had been willing to become candidates there would have been any likelihood of their being unsuccessful. Like Thorold Rogers, whom I often urged to allow himself to be proposed, they may not have desired admission.

W. T. THISELTON-DYER.

Kew, May 6.

The Spectra of Carbon Monoxide and Silicon Compounds.

A PAPER published by Prof. Hartley (*Proc.* Roy. Soc. vol. lxviii. pp. 109-112, March, 1901) reminds me of some observations on the spectra of the compounds of silicon with fluorine and hydrogen ($SiFl_4$ and SiH_4), made by me several years ago and published in *Wiedemann's Annalen* (vol. xxi. pp. 427-437, 1884). As they seem to be not without some interest, and a definite explanation of them has, so far as I know, not been given till now, I may be permitted to give here a short account of the principal contents of my little paper.

A vacuum tube filled with $SiFl_4$ and procured from Geissler Nachfolger, in Bonn, showed a spectrum of which the greatest part consisted in the well-developed band spectrum due to carbonic oxide, besides which there appeared the eight beautiful blue lines, or rather stripes, that seemed (at least then) to be characteristic of $SiFl_4$. Now there is nothing wonderful about the presence of traces of the carbonic oxide spectrum in a vacuum tube, as is well known, but in our case it was so predominant, as if one had not simply to deal with impurities, but on the contrary, as if it was the principal part of the phenomenon. Intending to clear up the circumstances, I tried to prepare vacuum tubes from which the presence of carbonaceous matter, as well as of air and moisture, were as much as possible excluded, and finally the $SiFl_4$ gas was developed from a mixture of pure glass and flourspar powder and also purest sulphuric acid in an apparatus composed entirely of glass and sealed directly to a Toepler mercurial pump. All stop cocks and sliding pieces that want greasing were totally avoided. Nevertheless, the carbonic oxide spectrum remained in its very predominant position; at low pressures it was even present almost alone, as if one were working on a carbonic oxide tube containing some impurities due to silicon combinations. Sometimes, it is true, the carbonic oxide bands were less brilliant, and the blue stripes (belonging to $SiFl_4$?) more prevailing, from what cause I do not know, but still the carbonic oxide spectrum always remained well visible. Perhaps it is worth mentioning that sometimes there were seen four additional lines situated more towards the violet end of the spectrum, and occasionally, also, some green ones. Also the well-known swan spectrum could be obtained, especially when the discharges of a Leyden jar were sent through the vacuum tube. Even tubes illuminated in the well-known manner without the use of electrodes still showed the carbonic oxide spectrum in its predominant position. If some traces of oxygen had been developed from moisture, which, as is well known, it is almost impossible to totally remove from the glass apparatus used, and this had, by combining with some carbonaceous compound present in the tube given rise to some traces of carbonic oxide, then one could, so far as I know, only have expected a rather faint spectrum due to it. I do not know if the suggestion of carbon being contained in the element silicon is at all acceptable, according to present knowledge, but at all events the brilliant appearance of the CO bands awaits, as I believe, a sufficient explanation.

In a rather high vacuum this CO spectrum is not seen, but there are visible (except lines due to mercury, hydrogen, &c.) some lines also observable in highly exhausted tubes filled with carbonaceous compounds, but which, as I found in the latter case, only appear when luminous points are seen at the electrodes and the glass covers that partially surround them. As I found those lines to coincide with lines observed in the spark spectrum of $SiFl_4$ at high pressures, this so-called vacuum spectrum probably belongs to some silicious matter evolved out of the above-mentioned glass covers by the action of the said bright points.

Under suitable conditions SiH_4 also showed the carbonic oxide and swan spectrum, and as well the one ascribed to hydrogen, this latter especially being seen at lower pressures, whilst of a silicon spectrum nothing was observable. Only at higher pressures, by the aid of spark discharges, some of the lines were obtained that had been seen formerly in the spark spectrum of $SiFl_4$.

As my principal object in these researches had only been to get rid of the carbon spectrum (though in vain), I did not make any measurements of wave-length. Later on, as many laboratories were provided with powerful spectroscopic apparatus, I did not believe it to be any longer worth while to work on the subject with small instruments, hoping some other investigator would take care of it. I should be very glad if the present note would induce some spectroscopist to control and further pursue my observations. In addition, some researches with very strong sparks seem to me to be very desirable.

Berlin. KARL V. WESENDONK.

The Dust of "Blood-Rain."

I HAVE handed to Prof. Judd the specimens of "blood-rain" dust collected by me in Sicily, as mentioned in your issue of March 28. It may be remembered that the dust was collected from three tables on the terrace of the hotel, and that I brought home that from the most favourably situated table in the wet state in which it was obtained. This has since been dried and weighed, with the result that, as I expected, the density of the fall was greatest on this table, being equivalent to 9½ tons per square mile. The average given by the other two tables was 5½ tons per square mile.

The largest value is probably the best, but if we take the mean we shall be within the mark in saying that the density of the fall near the theatre at Taormina was about 7 tons to the square mile. ARTHUR W. RÜCKER.

A Convenient Primary Cell.

IN your "Notes" of April 18 (p. 594) you give an account of the new cell—the Cupron-element—brought out by the Accumulator Industries Company. Without intending any disparagement, will you allow me to point out that the cell, with the exception of the special form of copper oxide for which the company justly claim credit, was invented long ago by Lalande, but does not appear to be known so widely as its merits deserve. I have used the cell for a considerable time, the positive plate taking the form of a plate of copper faced on one side with granular copper oxide held in its place by a piece of copper gauze, and can corroborate the statements as to its very low resistance and great constancy. For elementary work, where resistances of a few hundredths of an ohm are to be compared and a galvanometer of negligible resistance used, I have found it most valuable. Another form of the cell, in which the copper plate is merely painted with a mixture of copper oxide powder and gum and then heated until the latter chars, is very readily set up, but has a rather greater internal resistance. Where this is desirable it may be regulated within considerable limits by making the cell a "sawdust Lalande," which has obvious advantages on other grounds. A. E. MUNBY.

Felsted.

THROUGH the kindness of the Editor I am able to reply to Mr. Munby's interesting letter. I did not intend by my note to imply that the "Cupron-element" was an entirely new combination, and indeed suggested that its chief claim to novelty lay in the construction of the copper oxide plate. The Accumulator Industries, Ltd., it is only fair to say, fully acknowledge in their circular that the cell is developed from the copper oxide element of Lalande and Chaperon. It is interesting to have Mr. Munby's testimony to the convenience of the cell, which is, I believe, used to a considerable extent on the Continent, but, as your correspondent says, is not very widely known in England.

THE WRITER OF THE NOTE.

AGRICULTURAL SEEDS.

UNDER the auspices of the Board of Agriculture a committee was appointed last summer to take into consideration the conditions under which agricultural seeds are at present sold, and to report whether any further measures can, with advantage, be taken to secure the maintenance of adequate standards of purity and germinating power.

The committee met on ten occasions and examined upwards of thirty witnesses, seed-merchants, farmers and scientific witnesses, including Mr. Carruthers, Mr. Gilchrist, Mr. Hall, Profs. T. Johnson, McAlpine and Somerville. The evidence of these witnesses is now published as a Blue-book, whilst the report of the committee is issued separately.

Taking the report first, the committee find that there is [now] no wide-spread complaint of the quality of seeds sold throughout the country. The committee, further, think that every encouragement should be given to seed-merchants to give a guarantee with the seeds they sell, and that farmers should be advised to buy only subject to such guarantee and to test the seeds they have purchased. To facilitate this the committee recommend the establishment of one central seed-testing station under Government auspices, with the aid and counsel of a small committee of experts. The report is signed by all the members of the committee. Two of their number, Sir W. T. Thiselton-Dyer and Mr. Leonard G. Sutton, while agreeing generally with the findings of the committee, raise objections to the proposal to establish a Government seed-testing station.

It is satisfactory to hear that the general quality of the seeds sold has greatly improved of late years. This improvement is, no doubt, in great measure due to the passing of the Adulteration of Seeds Act, an Act, it may be pointed out, which was promoted by the seedsmen themselves, who desired to purify their business from seed-killing, seed-dyeing and other questionable practices which had been allowed to grow up to such an extent that it was difficult for a merchant to avoid conniving at, if not practising them.

At present, so far as the large firms are concerned, there is in general no question as to the excellence of the seeds they sell, and those who, like the writer of the present notice, have had the opportunity of witnessing the care taken in selecting the seed and in afterwards cleaning it and preparing it for market will corroborate this statement. With the smaller dealers, especially in some parts of Wales and Ireland, the case seems different. There the farmers often buy relatively small quantities of seeds of low quality and equally low price from local tradesmen, ironmongers, cornfactors and the like, who have no other knowledge of seeds than such as is necessary for securing the best means of disposing of them. It is especially for the protection of small, and often ignorant, farmers that the seed-testing station is intended.

All the large firms test their own seeds and the seeds they buy from the Continent or elsewhere. Moreover, they grow them in their own trial grounds. They do this on a very much larger scale than would be possible in a seed-testing station.

Some of the smaller firms, and perhaps some of the large houses also, occasionally make use of the seed-control stations at Zurich or Halle, and they find it a grievance that they have to send to Switzerland or Germany for information which obviously could as well be obtained here. Indeed, the botanists of the Royal Agricultural Society (Mr. Carruthers) and of the Highland and Agricultural Society of Scotland (Mr. McAlpine), and perhaps others, do undertake to test seeds for the members of their several societies, or, under certain conditions, for outsiders.

These tests, wherever they be made, have reference to the "purity" of the seed, its germinating power and its "genuineness." By purity is meant freedom from seeds of weeds or other admixtures. The germinating power is tested by the percentage of seeds in any given sample which, under favourable conditions, is found to produce healthy seedlings. Theoretically a hundred per cent. should grow. In practice the percentage may, without fault of the seedsman, be, in certain cases, much below this, but it is satisfactory indeed when one thinks of the many contingencies to which the clover plant is subjected to find it to be quite common for 98 per cent. of the seed to grow. When one thinks of the humble bees, and the

mice and the cats and the vicissitudes of the climate, it seems remarkable that such a percentage of good seed should ever be obtained.

What seedsmen mean by the "genuineness" is another matter, but one of extreme importance. It would be quite impossible even for an expert to recognise seed of a particular stock or breed, say of broccoli or turnip. There are good stocks and bad "stocks" of these, but they cannot be distinguished by their seeds. A mere seed-testing station, private or official, could render no assistance in such cases. The only way to test the genuineness of a stock is to grow it and watch it throughout the season. Obviously the purchaser could not wait for that, he must trust to the good faith and reputation of the seedsman.

Considering, then, the vast scale on which seed-testing and seed-trials are now made by the leading firms and the limited scale on which seeds can be tested at a seed-testing station, and, further, bearing in mind that the ordinary seed-trials give no indication of "genuineness," we do not see that the farmer for his immediate practical purposes would be materially benefited by a seed-testing station. It would answer his purpose very much better to devote a little care to testing the seeds for himself from a sample procured some weeks before he required to sow for a crop. The seedsman, in his turn, should give a guarantee that the bulk should be equal, or closely approximate, to the sample. We say closely approximate because so numerous and so varied are the vicissitudes to which the seed is, or may be, exposed that some latitude, say to 5 or even 10 per cent., would only be reasonable.

Farmers in general sow much too thickly, so that a lower percentage than is theoretically desirable might well be condoned in practice if the seed were good of its kind.

While saying so much we are far from wishing to undervalue the importance of research-stations wherein the phenomena of germination as well as other physiological and pathological processes might be studied from the point of view of research. Associated with a small trial-ground, such stations would be very valuable for the investigation of the properties and mode of life, not only of old well-known crops, but also of new introductions. It is just here that the value of the "crank of a scientific man" would show itself. One of the witnesses objected to placing such a man at the head of a Government seed-testing station because "they get so infallible and then they take notions in their heads."

It is as well to see ourselves as others see us. We should have thought infallibility in this connection was a sign of nescience rather than of science.

MAXWELL T. MASTERS.

THE MARINE RESOURCES OF THE BRITISH WEST INDIES.

THE above is the title of a paper by Dr. J. E. Duerden, which, with a series of appendices, has lately been issued as an extra number of the *West Indian Bulletin*—the official journal of the Imperial Agricultural Department of the West Indies. As read, it formed the leading feature of a recent Congress at Barbados, held under the auspices of the aforenamed Department, at which representatives of all the West Indian Islands were present, and it sets forth in a concise and connected form the essence of all that has transpired in the utilisation for economic purposes of the rich resources of the West Indian seas. In the first part of the paper the fisheries of Jamaica, the Barbados, Bahamas, Leeward Islands, Trinidad, St. Vincent, British Guiana and Honduras are each dealt with in turn, mainly from the statistical standpoint; and then, in descending zoological order, there are treated the principal marine resources from the Mammals to the Sponges. The history of a movement of recent years to establish in the West Indies a marine biological station is next fully sketched, and its defence strengthened by a plea based on a comparison of the work achieved by institutions of the desired order existing elsewhere.

The paper shows that, in their utilisation, the marine resources of the West Indian Islands have long played a too limited part in the maintenance of the Colony itself, and that they fall short through being nowhere under the control of an organised plan. The yearly value of the fish caught is estimated at 30,000*l.*, against that of fish imported at 147,000*l.*, which is thus nearly five times the greater, while attention is directed to a diminution in the supply of the West Indian turtle and a decadence in more especially the "sea egg" industry, due to the effects of over-fishing and lack of scientific treatment, and, in the case of the turtle, due also to the "ceaseless capture of adults." Dr. Duerden, in discussing the remedies for these shortcomings, shows conclusively that they lie in a restocking process to be based on a practical knowledge of the life-history of the species rather than the establishment of closed seasons. Perusal of his paper shows that the importance of these two industries to the traders and inhabitants of the islands is so great that, under the present circumstances, immediate action should be instituted on their behalf.

Concerning the question of fish-capture, Dr. Duerden refers at some length to an unsuccessful attempt made in 1898 to gauge the trawling capacity of certain of the West Indian seas. He gives in full a copy of the log of the vessel employed, and in discussing the alleged failure he expresses the conviction that the venture (which was a private one) was too early suspended, and shows reason to conclude that the further introduction of northern methods without reference to tropical conditions is not likely to be successful. Claiming satisfaction for line-fishing at 200 fathoms, he is led to advocate the stake-net method lately introduced from America as specially fitted for use in bays and lagoons, if not among the coral reefs themselves. His paper shows that he has thoroughly mastered all branches of his subject, and proves beyond previous experience that the West Indian seas contain a rich fauna, which, systematically handled on scientific lines, ought materially to increase the resources of the islands, and thereby to aid in raising them from their present unsatisfactory condition.

Dr. Duerden institutes comparisons between the results obtained at the West Indies and those begotten of trained supervision and the establishment of a fisheries bureau, with its necessary plant and equipment, at the Cape and elsewhere, and he with much naïvety dwells upon the facts as calculated to affect, by competition, the Sponge industry of the Bahamas, financially the most important industry the Colony can boast. He points with justifiable emphasis to the need in the West Indies of a fisheries establishment, regarding it as a pressing necessity to enable the colonists to keep pace with the times and fully to maintain their position in competition and advancement beside the rest of the world.

Conspicuous among the marine biological establishments to which he points as exemplary, are those which have arisen in relation to the agricultural departments of localities at which they are placed; and the suggestion arises that a similar extension should be granted the Agricultural Department of the West Indies, now wholly botanical. Of the success which has attended the work in economic botany which Dr. D. Morris, the indefatigable director of this Department, has achieved in the short period which has elapsed since its foundation, our readers are aware; and we are informed by a local authority that he is eminently desirous of the extension of his sphere of influence in the direction of economic zoology. In Dr. Duerden he has at hand the one man

who, by training and experience, is most familiar with the neighbouring West Indian seas and all that pertains to fisheries work upon them. Perusal of Dr. Duerden's paper is convincing as to the urgency of this matter, and we consider that the Government and those in charge of the Agricultural Department of the West Indies would be well advised did they provide, properly equipped, a laboratory of which he should be put in charge. To do so would be but to give the Department equal chances with others under Imperial control, to which it is closely akin.

Concerning the economic zoology of the West Indian seas then, everything tends to show that at the present time circumstances so combine that it may be said all is ripe for the initiation of a new departure, under which systematic work and organisation, guided by the light of science, may be profitably brought to bear. The local Press are advocating this course, and the special publication of Dr. Duerden's paper is the expression on the part of those best competent to judge of its desirability. Given this, and the scientific knowledge of the movements and life-histories of the denizens of the seas which would thus be obtainable, the hatcheries, curing-houses, wharves and trading-fleet would follow in due course; and it is certain that a moderate amount of assistance bestowed in the direction we have indicated might be the means of placing the depressed colonies in an improved position, and of thereby lessening their constantly-recurring charge upon the mother country.

THE LATE MR. SEEBOHM'S TRAVELS IN ARCTIC EUROPE AND ASIA.[1]

THE two well-known volumes, respectively entitled "Siberia in Europe" and "Siberia in Asia," in which Mr. Seebohm described his bird-nesting expeditions to the Petchora (1875) and Yenesei (1877) valleys, having long been out of print, the author determined to combine (and to some extent condense) the two narratives, and to issue them in single volume form. The greater portion of this task had been accomplished when it was unhappily brought to an abrupt close by the untimely death of the talented author. Its completion was thus of necessity left to another hand. Although the editor has not thought fit to make his identity known to the public, he may be congratulated on the tact and skill with which he has carried out his share of the work.

In one respect, and one respect only, are we disposed to find fault with the editor; and this in regard to the title chosen for the volume. In this respect, indeed, both author and editor are singularly unfortunate. "Siberia in Europe," the title of the first volume of the original work, is a geographical absurdity, and "Birds of Siberia" is but little, if at all, better. For, in the first place, at least half of the tract of country through which the author travelled has not the faintest shadow of a claim to be termed "Siberia," and, secondly, birds form by no means the sole topic on which the author discourses. "Egg-hunting in high latitudes," or some such title, would, we think, have been a far preferable designation.

Since Mr. Seebohm's account of his journey along the Yenesei was reviewed at considerable length in these columns when the original work was published, a very brief notice will suffice on the present occasion. The author's main object was to obtain nests, eggs and young of birds whose breeding habits were previously almost or entirely unknown; and his success in discovering the breeding places of the grey plover, little stint and other kinds of his favourite "Charadriidæ" are now matters of history. Migration was also a favourite subject of study and speculation on the part of Mr. Seebohm; and although we may be unable to assent to all his views and opinions with regard to this phenomenon, his account (p. 203) of the rush of migrating birds on Heligoland must remain fresh and interesting for all time.

"From the darkness in the east," he writes, "clouds of birds were continually emerging in an uninterrupted stream; a few swerved from their course, fluttered for a moment as if dazzled by the light, and then gradually vanished with the rest in the western gloom. . . I should be afraid to hazard a guess as to the hundreds of thousands that must have passed in a couple of hours . . . . . The scene from the balcony of the lighthouse was equally interesting; in every direction birds were flying like a swarm of bees, and every few seconds one flew against the glass."

And Mr. Seebohm is equally happy when describing the habits of the birds and their young on the tundra, which formed the main object of his expeditions. The most striking illustrations in the book are undoubtedly those of the nest and young of the grey plover and little stint, but as these appeared in NATURE on a former occasion they are not repeated here, and we prefer to

FIG. 1.—A group of willow-grouse. (From "The Birds of Siberia.")

give, as an example of Mr. Whymper's illustrations, the exquisite cut of willow-grouse which stands at the head of chapter xii.

But, as we have already indicated, Mr. Seebohm by no means confined his attention to birds, and his notes on the Samoyedes of the Petchora should form interesting reading to all students of anthropology, while his observations on reindeer can scarcely fail to attract all those who make a special study of the deer tribe. The sportsman, too, will find much interesting matter in many of Mr. Seebohm's pages.

Our opinion of the manner in which the editor has carried out his task has been already expressed; but we think he would have been wiser had he cut out the penultimate paragraph of the last chapter, which contains certain very unnecessary reflections on the mode of zoological work in vogue in this country.

As an interesting and well-written account of two adventurous journeys through little-known mosquito-haunted regions, the work should attract a large circle of readers. R. L.

[1] "The Birds of Siberia; a Record of a Naturalist's Visit to the Valleys of the Petchora and Yenesei." By Henry Seebohm. Pp. xix + 512. Illustrated. (London: Murray, 1901). Price 12s. net.

SCOTCH SCENERY AND GEOLOGY.[1]

THE five-and-thirty years which have elapsed since the first edition of this work appeared have witnessed great advances in certain departments of geology, especially those which are all-important in that of Scotland. In 1865 the northern and central Highlands were confidently asserted to be metamorphosed Silurian sediments, and the complexities of the southern uplands were unsuspected. Now the secret of the Highlands and the mystery of the Lowlands have been discovered, thanks mainly to Prof. Lapworth, and although riddles yet remain unsolved in the former, particularly near the southern border, the members of the Survey can work

FIG. 1.—Brig o' Trams Wick. (Cliffs of Old Red Flagstone, illustrating bedding, joints and weathering.)

with confidence on their leading principles of interpretation. Even since 1887, the date of the second edition, no small advances have been made, so that we are not surprised to read that the present edition has been thoroughly revised and considerably enlarged. Since the first one, in fact, the greater part of the book has been rewritten, and so much new matter incorporated that we soon lose our way in trying to compare the two volumes page by page. In some respects there are omissions, for several points, open to debate in 1865, may now be taken for granted; while on others, opinions then commonly entertained are now repudiated. For instance, we are no longer told that the greywacke and shale of the southern uplands have been in some places changed into serpentine, felstone or granite.

But, though many disputed points are now settled, others still remain. Personally, we should not assume that an ice-sheet had crossed from Scandinavia to the eastern coast of England, or had deposited the boulder clay on the northern heights of London; we should not have left, without fuller discussion, the possibility of the larger lake basins being mainly formed by earth flexures after the valleys had been excavated; nor should we have so readily accepted the parallel roads of Lochaber as produced on the shores of lakes the waters of which were retained by dams of ice. But time will settle these disputes, as it has settled, during the last quarter of a century, differences yet more fundamental. Enough to say that the new edition of "The Scenery of

FIG. 2.—Erect Coniferous tree in basalt, Grilon, Isle of Mull.

Scotland" ought to be the companion of every one who does not visit the country merely to kill animals or to say he has been there. The itineraries at the end, with their references to the volume, and the four maps, bringing out so clearly the geology and physical features, will teach the traveller, pleasantly and as easily as may be, to interpret the works of nature in that wonderful land.

The excellent illustrations—much more numerous and far better executed than those in the first edition—of which we give specimens, will greatly help the learner. Besides this, the book, though so much enlarged, has not lost its original literary charm. We have always considered the first edition to rise even beyond the high level which the author is wont to maintain, and so took up this with some apprehension that, as often happens in real life, the child had lost its beauty in growing up. A change there has been; the book has reached its full stature but retains its attractiveness, while it has increased in power. Hence, in congratulating Sir Archibald Geikie

[1] "The Scenery of Scotland viewed in Connection with its Physical Geology." By Sir Archibald Geikie. Third edition. With four maps and numerous illustrations. Pp. xxii + 540. (London: Macmillan and Co. Ltd., 1901.) Price 10s. net.

on this appropriate close to his more professional work, we express an earnest hope that it will be not a few years before the inevitable *finis* is written on his scientific and literary career. T. G. B.

DINNER TO SIR ARCHIBALD GEIKIE.

THE complimentary dinner to Sir Archibald Geikie on May 1, provided a means of giving public expression to the regard in which he is held, not only in the scientific world, but also by leaders in other branches of intellectual activity. The representative character of the dinner was very noteworthy, as will be seen from the following list of those present :—

Rt. Hon. Lord Avebury, Sir Archibald Geikie, Sir G. G. Stokes, Bart., Sir F. Abel, Bart, Major-General Sir J. Donnelly, Admiral Sir. W. Wharton, Sir John Evans, Sir Norman Lockyer, Sir Henry Craik, Sir John Murray, Sir Michael Foster, Sir William Turner, Sir Henry Howorth, Sir Henry Roscoe, Sir Lauder Brunton, Major-General Festing, C.B., S. Spring-Rice, C.B., Digby Pigott, C.B., Major-General McMahon, Colonel Johnston, Colonel Bushe, Major Craigie, Rev. Prof. Bonney, Rev. Prof. Wiltshire, Prof. T. McK. Hughes, Prof. Sollas, Prof. Ray Lankester, Prof. C. le Neve Foster, Prof. J. Geikie, Prof. E. Hull, Prof. Joly, Prof. Jack, Prof. Corfield, Prof. Lapworth, Prof. Watts, Prof. Seeley, Prof. Garwood, Prof. T. Groom, Prof. G. A. J. Cole, Prof. W. Galloway, Prof. H. Bauerman, Prof. R. A. Gregory, Prof. Evan Small, Dr. F. Moreno, Dr. W. Blanford, Dr. P. L. Sclater, Dr. Scharff, Dr. F. Parsons, Dr. George Ogilvie, Dr. Tempest Anderson, Dr. Horace Brown, Dr. Scott Keltie, Dr. Hugh R. Mill, Dr. J. W. Evans, Phipson Beale, K.C., H. Arnold Bemrose, J. E. Bartholomew, E. Best, F. Best, C. Borchgrevink, B. H. Brough, G. L. Craik, C. Fox-Strangways, Roderick Geikie, E. Greenly, George Griffith, A. Harker, R. S. Herries, T. V. Holmes, W. H. Hudleston, R. L. Jack, D. A. Louis, J. E. Marr, F. Macmillan, G. A. Macmillan, H. W. Monckton, George Murray, E. T. Newton, Grant Ogilvie, J. Parkinson, F. W. Rudler, A. Strahan, H. J. Seymour, J. J. H. Teall, C. Tookey, W. Whitaker, H. B. Woodward, Martin Woodward.

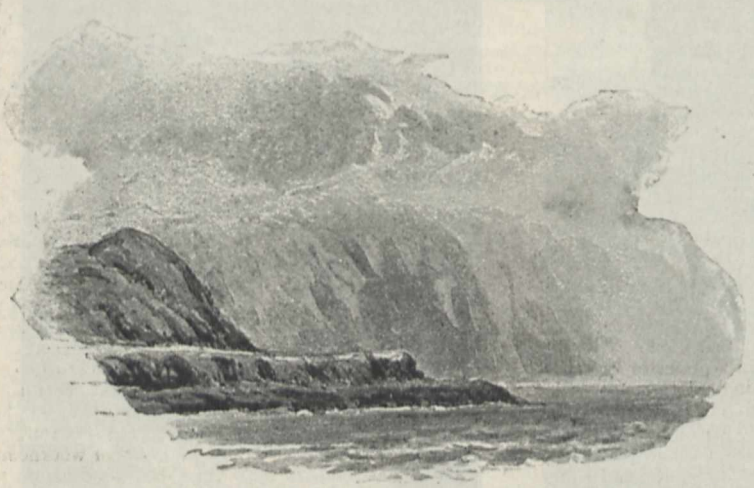


FIG. 3.—Rock terraces of old sea margins, Isle of Jura.

The list shows that the different public departments with which the Geological Survey is most closely connected were well represented, including the Treasury, Admiralty, Board of Education, Local Government Board, Board of Agriculture, Ordnance Survey, Scottish Education Office, Stationery Office and British Museum. There were likewise present the professors of geology in London, Oxford, Cambridge, Edinburgh, Dublin and Birmingham, together with numerous other Fellows of the various learned societies. Letters, telegrams and addresses of felicitation were received from all parts of Europe and America. The following telegram from Christiania was read by the chairman : "Also from Norway's mountains an echo of the cheers for the master of English geology—Brögger, Helland, Nansen, Reusch, Vogt."

Lord Avebury, in proposing the health of the guest of the evening, said :—

Sir Archibald was educated at the Royal High School and University of Edinburgh, which must indeed be very proud of him. He commenced his official career in 1855, when, at the early age of nineteen, he was appointed to a post on the Geological Survey, and in 1867 was made director for Scotland. In 1871 he became professor of geology at Edinburgh, and held the post till 1881, when he resigned it on his appointment as director-general of the Geological Survey and director of the Museum of Practical Geology in Jermyn Street, which he has since held with credit to himself and great advantage to geological science. Every one would admit (1) that the Geological Museum was a model museum, (2) that the Geological Survey has been admirably managed and that Sir Archibald has organised a splendid staff, (3) that the maps and memoirs of the Geological Survey are admirable contributions to science and an honour to all concerned.

Sir Archibald was one of the first field geologists to realise the value of microscopic sections of rocks, and under his superintendance some thousands of slides were made and added to the Jermyn Street Museum. Under his able successor, whom we all congratulate on his appointment, we may be sure that this branch of the science will not be negelcted.

Besides his official duties Sir Archibald has contributed to the progress of science by much original work, comprising nearly 100 separate memoirs; to scientific education by his primers and text-books, which are models of clearness; to scientific literature by his admirable "Text-book of Geology," his "Geological Sketches at Home and Abroad," "Founders of Geology," "Memoir of Ramsay," "Life of E. Forbes," "Life of Murchison," &c.

Others also of his books are important as contributions to science, and also in rendering it more accessible and more interesting to the general reader, such as his charming "Scenery of Scotland" and "The Ancient Volcanoes of Britain." These seem to me models of what such books should be, combining, as they do, scientific accuracy with a love of scenery, and the power of description in happy and expressive words, for Sir Archibald combines with the striking qualities of a geologist those of an enthusiastic lover of nature. He is an artist in two senses, both with pen and pencil, for his sketches add much to the vividness and clearness of his writings.

Our countrymen have not always received fair play from foreigners, but I am happy to say that, among men of science at any rate, the most friendly and harmonious relations exist; we cordially acknowledge the splendid services they have rendered to science, and recognise that, in this respect at any rate, our international relations are pleasant and harmonious. For this also we are greatly indebted to Sir Archibald Geikie.

Sir Archibald is now retiring from his official duties, and the additional leisure which he will enjoy will in great measure, we may be sure, be devoted to the prosecution of geological research.

He has received many well-deserved honours. He was made F.R.S. before thirty; has been vice-president and foreign secretary of the Royal Society and received a Royal Medal; also the Macdougal-Brisbane Medal of the Royal Society of Edinburgh, and the Wollaston and Murchison Medals of the Geological Society. He is an associate of most of the chief academies of Europe and America, D.C.L. of Oxford, D.Sc. of Cambridge and Dublin, and LL.D. of Edinburgh and St. Andrews. He received the honour of knighthood in 1891.

But it is not merely to do honour to a great geologist that we

are here to-night, but to express our warm feelings towards an old and valued friend and to congratulate him on his well-earned honours. Sir Archibald, we drink your health, and for our own sakes, as well as for yours, we hope that you have before you many years of health and happiness.

The chairman then presented Sir Archibald with an illuminated address from his colleagues of the Geological Survey and Museum in the following terms:—"We desire, upon the close of your tenure of office, to express our sense of the high value of the services which you have rendered to these Institutions; we proudly recognise the high position attained by you in the scientific world and gratefully acknowledge the beneficial influence of your example. That you may long live, after more than forty-five years in the public service, to enjoy your freedom from official cares and to enrich geological literature with your luminous writings is our earnest desire."

Sir Archibald Geikie replied as follows:—

You may well believe that on such an occasion as this it is hardly possible for a man adequately to express the feelings that overpower him. If "silence is the perfectest herald of joy," this is no less true of gratitude. Hence, were that permissible, I would fain simply thank you in the fewest words for this manifestation of your friendly regard. To you, my lord, I am deeply indebted for all the kind words you have been pleased to say of me and my work, and to you, my friends, my debt is not less for the way in which these kind words have been received and re-echoed by you. The feeling, next to overpowering gratitude, which rises uppermost in my mind is a bewildering wonder why so much kindly appreciation and good-will should have been in this way showered upon me. And yet on reflection I recognise that it is only the culmination of what has been so liberally extended to me all my life. When I look back into the past, the vista of fifty years seems to me crowded with friendly faces and helpful hands, ready at every turn with wise counsel or stimulating sympathy and encouragement. Most of these voices have long been silent for ever, but their sound still lingers in my ears. It is to their aid and guidance that I stand mainly indebted for anything that I have been able to do in the cause of science, and I should be ungrateful and unworthy if on this memorable occasion I failed to acknowledge my indebtedness.

At the outset of my career there were four men who specially befriended me and set me in the path which I have followed ever since. The first of these was James Pillans, professor of Latin (or Humanity as it is called in the north) in the University of Edinburgh. As he was teaching for more than half a century, a large part of the population had passed through his hands. Robert Chambers used humorously to divide mankind into two sections—those who had been under Pillans and those who had not. I am glad to have belonged to the former section. Pillans's name is perhaps most widely known from the savage and wholly undeserved slander of him inserted by Byron in his "English Bards and Scotch Reviewers." As I knew him he was a genial old man, with much of the gravity and stiffness of an eighteenth century pedagogue, but with a kindly nature, a vein of chivalrous sentiment and an enthusiasm for classical literature to which his best students owed much. He was an educational reformer well in advance of his time. In particular, he used to insist on the study of physical geography as a necessary accessory in all historical inquiry. When the story of the progress of education in this country is fully written, an honoured place will be given to Pillans. Horace was his favourite author, and as I was fond of turning the odes into English verse and illustrating them with parallel passages from other authors, my exercises procured me first his notice and then his friendship, which he continued to the end of his life. Knowing my taste for geology, he asked me to meet Leonard Horner at breakfast, and in this way indirectly led to my introduction to Lyell and to the Geological Society of London.

Another teacher whose influence and help were great was George Wilson, well known to chemists for his able researches on fluorine, and to a much wider public for his delightful literary essays. In his laboratory I studied chemistry. It was he who first opened out to me the prospect of employment in the Geological Survey and eventually introduced me to Andrew Crombie Ramsay.

Hugh Miller, by his writings, and still more by the personal charm of his conversation, as he discoursed over the fossil treasures in his museum, finally confirmed my determination to give my life up to geology, if that were found to be practicable. It was he who first brought my name before Murchison, then newly appointed Director-General of the Geological Survey.

To William Edmond Logan, Director of the Geological Survey of Canada, it is a pleasure to acknowledge my deep indebtedness. From time to time he used to return to this country, and on each of his visits to his brother, who was a lawyer in Edinburgh, I was privileged to spend long hours with him, while he spread his Canadian maps on the floor and gave me graphic pictures of his life and work, with the help of his well-filled sketch-books and note-books. After such interviews, as you may well believe, the determination to become a geologist took deep root.

At that time, however, now half a century ago, the outlook for employment in a geological capacity was neither very wide nor very clear. Robert Chambers, probably most widely known now as the author of the once famous "Vestiges of Creation," but, I venture to think, best deserving to be remembered for his pioneer work in glacial geology, rather sought to dissuade me from the Survey. I remember that one of the reasons he gave was that he hardly thought I possessed strength and appetite enough for the life of a professional geologist. He had lately been in Wales with a Survey party, consisting, if I remember, of Ramsay, Selwyn and Jukes, and being the oldest member of the company was unanimously voted into the chair, where he had the duty assigned to him of carving a leg of Welsh mutton. He described the prodigious capacity of the geologists for food, and the incredibly short time that passed before he had nothing but a bare bone in front of him.

In the early autumn of 1855 I had an interview with Murchison at his hotel in Edinburgh. He looked a little doubtfully at my youthful and slight figure, but was reassured by Ramsay, whom I had shortly before taken on a geological excursion in the neighbourhood. The chief remarked to me that a pair of good legs were of about as much use as a head to a geologist. I joined the staff in the following October. Six years later I accompanied Murchison in a long geological tour through the Highlands, and as the climbing all fell to me, he was quite satisfied as to the capacity of my legs. That expedition secured for me his lasting friendship. He never lost an opportunity of aiding me. Underneath a somewhat stiff military manner he carried a warm heart. Among all my benefactors there is none to whom I owe so much and for whose memory I cherish a warmer regard.

The Geological Survey was then a much smaller establishment than it has since become. Originally placed under the Board of Ordnance, its members wore a military uniform; but on the transference of the organisation to the Civil Service this uniform was discarded, though, as in the case of the "poor workhouse boy," the gilt buttons survived, and with their crossed hammers and crown continued for many years afterwards to be sported on the vests of the Survey men at their annual festivities. Who shall describe the delights of the Survey life in the field, when what had been the employment only of an occasional precious holiday, became the absorbing occupation of one's life? We had pessimists on the staff then as now. One of these continually reminded us that as ours was a service depending for its maintenance upon an annual vote of Parliament, which might some fine day be refused, we should all hold ourselves prepared to find something else to do.

When I joined the staff the system of Civil Service examinations had lately been authorised by Act of Parliament, but had not yet been brought into working order. I used to be warned from time to time by one lugubrious member of the Department that I had better get myself examined in time, otherwise I would probably endanger my pension, if I lived long enough to claim it. But I knew that, as the examinations were then framed, I should infallibly be plucked. I could not, for example, have given the precise ages of each of Henry the Eighth's wives, nor could I have done a sum in compound addition three feet long in ninety seconds. So I thought it best to let a sleeping dog lie. I never passed any examination, and I am happy to assure you that the Treasury has not refused me my pension.

No member of the Survey who served under Ramsay will ever forget the charm of his presence, his radiant good humour, his unvarying helpfulness, his acuteness in criticism, his sagacity

in geological discussion and the little petulances and whims that made his society so irresistibly amusing. His beneficent influence was long one of the great features of the service, and we owe to him, not only the recollection of his delightful personality, but the guidance and encouragement which have carried us through our work.

To my colleagues in the Survey who have prepared and signed this beautiful address my heartiest acknowledgments are due. It will remain with me as a precious memorial of many close and enduring friendships. Each signature will remind me, now of some delightful ramble in the country when geological problems were eagerly discussed on the ground, now of some momentous conference in the office when the plan of campaign or the details of maps and memoirs were fully considered and settled.

During my tenure of office as Director-General I have been ever supported by the loyal and unstinted devotion of the staff. It has been an honour and a pleasure to be placed at the head of such a body of men—so enthusiastic in their whole-hearted consecration to science and so unwearied and loyal in their efforts for the interests of the service. I feel sure that in no branch of the public service could the *esprit de corps* be higher than it has been among us. You can well understand that it is impossible without regret to sever one's connection with comrades such as these. At the end of my official career, however, I can truthfully claim to have striven to the utmost of my power for the welfare of the staff and for the scientific renown of the service. I have sought to secure the very best men whom it was possible to obtain, and I feel very confident that the Geological Survey, as regards the zeal, capacity and attainments of its members, may challenge comparison with any scientific institution in any country of the world. I rejoice to think that the service is being now put on a firmer footing than it has ever held before, that the prospects of pay and promotion have been lately broadened and brightened, and that, under the guidance of my distinguished friend and successor, the Survey may look forward to a future even more illustrious and more useful than its past. Gentlemen, I thank you all once more from the very bottom of my heart.

THE ROYAL SOCIETY SELECTED CANDIDATES.

FOLLOWING our usual course, we print the qualifications of the fifteen candidates selected by the Council of the Royal Society on Thursday last, for election into the Society :—

ALFRED WILLIAM ALCOCK,

Major, I.M.S., M.B., C.M.Z.S. Superintendent of the Indian Museum ; Professor of Zoology in the Medical College, Calcutta. Distinguished as a zoological investigator and teacher, and as a museum curator. Was Surgeon Naturalist to the Marine Survey of India, from 1888 to 1892, on board the Royal Indian Marine Ship *Investigator*, also to the Pamir Boundary Commission in 1895. Has devoted himself chiefly to the study of marine zoology with especial reference to fishes, crustacea, echinoderms and madreporaria, and to problems connected with the geographical distribution of the Indian representatives of these groups, and the phenomena of viviparity in fishes. Author of an extensive series of memoirs, papers and reports dealing with the aforementioned subjects, published during the past ten years in the *Proceedings* of the Royal Society, the *Journal* of the Asiatic Society of Bengal, the *Annals and Magazine of Natural History*, and in the series of publications of the Indian Museum, and "Scientific Memoirs" by the Medical Officers of the Indian Army, and elsewhere. Some of these (*e.g.* the series entitled "Materials for the Carinological Fauna of India") are revisionary monographs of the groups with which they deal, and in others (*e.g.* the Survey of the Deep Sea Zoological work of H.I.M.S. *Investigator* for 1884–1897, and the "Deep Sea Madreporaria") the general bearing of the zoogeographical problems arising out of the work are fully discussed in their association with the facts and theories of oceanographical research. In connection with the work of the *Investigator* he originated, in 1892, the serial publication, "Illustrations of the Zoology of the *Investigator*," now progressing.

FRANK WATSON DYSON,

M.A. (Cantab.), Chief Assistant (since 1894) Royal Observatory, Greenwich. Late Fellow of Trinity College, Cambridge. Secretary of Royal Astronomical Society. Author of various papers on mathematics and astronomy, among which may be mentioned :—"The Potential of Ellipsoids of Variable Densities" (*Quart. Journ.*, Pure and Applied Mathematics, No. 99, 1891); "The Potential of an Anchor Ring" (two papers—*Phil. Trans.*, 1893, pp. 43–95 and 1041–1106); "The Motion of a Satellite about a Spheroidal Planet" (*Quart. Journ.*, Pure and Applied Mathematics, No. 105, 1894); "The Effect of Personality in Observations of the Sun's Right Ascension on the Determination of the Position of the Ecliptic" (with W. G. Thackeray, *Monthly Notices, Roy. Astron. Soc.*, vol. liv., 1894); "Account of the Measurement and Comparison of a set of four Astrographic Plates" (with W. H. M. Christie, *ibid.*, vol. lv., 1894); "On the Determination of the Positions of Stars for the Astrographic Catalogue at the Royal Observatory, Greenwich" (with W. H. M. Christie, *ibid.*, vol. lvi., 1896); "New Division Errors of the Greenwich Transit Circle and their Effect upon the observed N. P. D.'s (with W. G. Thackeray, *Mem. Roy. Astron. Soc.*, vol. liii., 1899); "Comparison of the Diameters of the Images of Stars on the Greenwich Astrographic Plates, with the Magnitudes given in the 'Bonn Durchmusterung'" (with H. P. Hollis, *Monthly Notices, Roy. Astron. Soc.*, vol. lx., 1899). Distinguished as an astronomer.

ARTHUR JOHN EVANS,

M.A. Hon. Fellow of Brasenose College, Vice-President of the Society of Antiquaries, Keeper of the Ashmolean Museum, Oxford. Distinguished as an archæologist and anthropologist. Mr. Evans's recent discoveries in Crete have been of the highest importance as throwing an entirely new light on the early civilisation of the Ægean and Mediterranean areas, and proving the hitherto unknown fact that a Præ-Phœnician form of writing was in use within those areas during the Mycenæan period. Starting from certain engraved gems, some of them found in Crete, the figures on which he suspected to be alphabetic or syllabic signs, he was led by inductive reasoning to infer that in that island there must exist monuments of a præ-historic system of writing. For some years he has carried on investigations in Crete, with the final result of bringing to light, in what seems to be the Palace of King Minos, or the famous Labyrinth, upwards of a thousand clay tablets, inscribed with documents in both a pictographic and a linear system of writing, as well as remains of artistic work of remarkable interest. The existence of a high stage of Mediterranean culture, about 2000 B.C., has thus been established, and the use of writing among Hellenic peoples has itself been carried back to a date at least 500 years earlier than has hitherto been regarded as possible. Of Mr. Evans's other published works may be cited his researches in the anthropology and antiquities of Illyricum and Dalmatia, and his numerous memoirs relating to the Iron Age, the Mycenæan Period, the late Celtic or Early Iron Period, and generally the connection of Egypt and the East with the dawn of European civilisation. His works on the coinages of Tarentum and Sicily are standard authorities, and after the death of Prof. Freeman he completed that eminent writer's "History of Sicily."

JOHN WALTER GREGORY,

D.Sc., F.G.S. Professor of Geology in the University of Melbourne. Explorer of Mount Kenya, and author of "The Great Rift Valley." Has contributed a large number of papers to scientific publications on Palæontological, Petrological and Physiographical questions ; for example, on the Maltese fossil Echinoidea (*Trans. Roy. Soc.*, Edin.) ; on British Palæogene Bryozoa (*Trans. Zool. Soc.*) ; on the Echinoidea of Cutch and on the Corals of Cutch (Palæont. Indica) ; on Pseudodiadema Jessoni ; on Archæodiadema ; on Echinocystis, &c., besides the volumes in the British Museum Catalogue on the Jurassic and the Cretaceous Bryozoa. In Petrology he has written in the *Quarterly Journ. Geol. Soc.* on the Tudor specimen of Eozoon, the Variolites of the Fichtelgebirge, the Waldensian Gneisses, the Schistes Lustrées of Mont Jovet, the Geology of British East Africa (three parts), and (in collaboration) the Variolites of the Mont Genevre, the Geology of Monte Chaberton, the Eozoonal structure of ejected blocks, Monte Somma, &c., and among several papers in Physical Geology, the Glacial Geology of Mount Kenya, and (in collaboration) Contributions to the Glacial Geology of Spitzbergen.

HENRY BRADWARDINE JACKSON,

Captain, R.N., Naval Attaché to the British Embassy, Paris. Invented (1886) a practical system of electrically illuminating gun sights for firing at night, which was adopted and used for some years in H.M. Navy, but has since been replaced by later methods. Proved (1888) that considerable stability is necessary in order that a totally submerged automobile torpedo may maintain a straight course. Has given much attention to the theory and practice of aërial telegraphy. Invented a serviceable apparatus for signalling between ships at sea without wires. Proved that if the Hertzian oscillations are transmitted and received by vertical wires, the distance to which effective signals can be sent tends to vary within limits as the product of the lengths of the wires.

HECTOR MUNRO MACDONALD,

M.A., Fellow of Clare College, Cambridge. University Lecturer in Mathematics. Distinguished for original work in Mathematics and Mathematical Physics. Author of the following papers:—"Torsional Strength of a Hollow Shaft" (*Proc. Camb. Phil. Soc.*, viii.); "Self-induction of two Parallel Conductors" (*Trans. Camb. Phil. Soc.*, xv.); "Waves in Canals" (*Proc. Lond. Math. Soc.*, xxv.); "Waves in Canals and on a Sloping Bank" (*ibid.*, xxvii.); "Electrical Distribution on a Conductor bounded by two Spherical Surfaces cutting at any Angle" (*ibid.* xxvi.), and a Note on the same (*ibid.*, xxviii.); "Electrical Distribution induced on a Circular Disc placed in any Field of Force" (*ibid.*, xxvi.); "Electrical Distribution induced on an Infinite Plane Disc with a Circular Hole in it" (*ibid.*, xxvii.); "Electrical Distributions on Cones" (*Camb. Phil. Soc. Trans.*, "Stokes memorial" volume); "Note on Bessel Functions" (*Proc. Lond. Math. Soc.*, xxix.); two papers on the Zeroes of the Bessel Functions (*ibid.*, xxix. and xxx.); "Zeroes of the Harmonic $P_n^m(\mu)$ considered as a Function of μ" (*ibid.*, xxxi.).

JAMES MANSERGH,

M.Inst.C.E., Civil Engineer. President of the Institution of Civil Engineers. Author of "Lectures on Water Supply, Prospecting for Water, Prospecting and Boring," delivered at the School of Military Engineering, Chatham, also of "The Supply of Water to Towns," and other works. The designer of the waterworks and sewerage of Lancaster, Lincoln, Stockton, Middlesbrough, Rotherham, Southport, Burton-on-Trent, Melbourne (Australia), Birmingham and many other towns. These designs include some of the largest schemes of water supply and drainage ever carried out. Author of about 140 reports upon schemes of water supply, sewerage or sewage disposal for Halifax, Hereford, St. Helens, Darlington, Whitby, the Potteries, Derby, Southampton, Durham, Shrewsbury, Malvern, Cambridge, Edinburgh, Plymouth, York, Antigua, Philadelphia (U.S.), and other places. Was a member of the Royal Commission on Metropolitan Water Supply. Eminent as a hydraulic engineer.

CHARLES JAMES MARTIN,

M.B., D.Sc. (Lond.). Professor of Physiology in the University of Melbourne. Is eminently distinguished as an original investigator in Physiology. His chief original papers deal with the Chemistry and Physiological Action of Snake Venom, and with the action and reaction of Toxins and Antitoxins. Author of:—"The Chemistry of the Venom of the Australian Black Snake" (*Proc. Roy. Soc.*, N.S.W., 1892); "The Physiological Action of the Venom of the Australian Black Snake" (*ibid.*, 1895); "Curative Action of Calmette's Serum against Australian Snakes" (*Internat. Med. Journ.*, 1897-98, and *Proc. Roy. Soc.*, 1898); "Nature of the Antagonism between Toxins and Antitoxins" (*ibid.*, 1898, joint Author); "Separation of Colloids and Crystalloids by Filtration" (*Journ. of Physiology*, 1896); "Observations on the Anatomy of the Muzzle of *Ornithorhynchus*," with Dr. Wilson (Linn. Soc., N.S.W., 1892); "Observations on the Femoral Gland of *Ornithorhynchus*," with Dr. Tidswell (Linn. Soc., N.S.W., 1894); "An Investigation into the Effects of the Darling Pea, *Swainsonia galegifolia*" (Agricultural Department of N.S.W.); "Cerebral Localisation in Platypus" (*Journ. Physiol.*, 1899).

RONALD ROSS

Major (I.M.S., retired), M.R.C.S. (Eng.). D.P.H. (United Colleges, London). Pathological Investigator. Distinguished for work on Malaria and Kala-azar (Assam). Commenced these special studies in Tropical Hygiene and Parasitology in 1891. Papers on these subjects and on Histology of Blood, Indian Medical Societies and Journals. Parkes Memorial Prize and Gold Medal (Netley) for Essay on Malaria, 1894. Same year commenced experimental examination of Manson's Mosquito-Malaria theory, and studied malaria parasites at Secunderabad. Determined evolution of "crescents" in stomach cavity of gnats (Manson, *Brit. Med. Journ.*, March, 1896). Established animate nature of the flagellate bodies (*ibid.*, Jan., 1897). Finally succeeded in cultivating malaria parasites in gnats (*ibid.*, December 18, 1897; Feb., 1898). Next year elucidated life-history of a malarial parasite (*Proteosoma Grassii*) of birds; infected numerous healthy birds by bites of gnats, thus establishing mosquito theory. Also investigated Kala-azar (Reports to Govt. of India, 1898-99). Appointed Lecturer in Tropical Medicine, Liverpool School of Tropical Medicine, 1899. Continued malaria investigations in Sierra Leone (Report of Liverpool Expeditions, 1900). Author also of Notes on *Amœbæ coli* and *Cercomonas intestinalis* (*Indian Med. Gazette*, 1897); Report on Sanitation of Bangalore, 1896.. Also contributor to Quain's Dictionary of Medicine), and wrote "Instructions for Prevention of Malaria," 1900 (used by Government).

WILLIAM SCHLICH,

Ph.D., C.I.E., Doctor of Philosophy of the University of Giessen; Companion of the Order of the Indian Empire: Principal Professor of Forestry in the Royal Indian Engineering College, Coopers Hill. Dr. Schlich is well known for the impetus which he has recently given to the study of Forestry in England. Between 1871 and 1880 he was Conservator of Forests in Sind, Bengal and the Punjab successively, and in 1881 he was appointed Inspector-General of Forests to the Government of India. From 1885 to 1889 he was employed specially in England in organising the first English Forest School; and in 1889 he was appointed to his present office. He is a man in thorough sympathy with Science, and has attained great eminence in that branch of it to which he has devoted most of his life-work. Besides his well-known and comprehensive "Manual of Forestry," he is the author of the following papers:—Various Articles on Scientific Forestry, in the *Allgemeine Forst und Jagd Zeitung*, 1864-67; "The Pyinkado Forests of Aracan," 1869; a Series of Reports on the Forests of Bengal and Assam, 1872-75 [in 1875 he was honorary editor of *The Indian Forester*, which is the leading monthly journal of Forestry]; "The Forests of Darjeeling, Central Provinces, Hyderabad Assigned Districts, Chota Nagpore," 1882-85; "Afforestation in Great Britain and Ireland, Yield Tables for the Scotch Pine, the Douglas Fir, Effects of Forests on Climate, Forestry in the Colonies and India" (*Trans. of Colonial Institute*, 1886-89); "Forestry Education" (*Trans. Royal Arboricultural Soc., Scotland*, 1897); "Timber Supply of the British Empire" (*Imperial Institute Gazette*, 1897).

ARTHUR SMITHELLS,

B.Sc.(Lond.), F.C.S. Professor of Chemistry in the Yorkshire College, Leeds. Distinguished for his Investigations on the Chemistry of Flames. Author of the following Papers (among others): "Some Fluorine Compounds of Uranium" (*Journ. Chem. Soc.*, 1883); "Structure and Chemistry of Flames" (*ibid.*, 1892); "Structure of Luminous Hydrocarbon Flames" (*ibid.*, 1892); "Flame" (Discourse to Brit. Assoc., 1893); "Luminosity of Flames" (*Phil. Mag.*, 1894); "The Structure and Chemistry of the Cyanogen Flame" (*Journ. Chem. Soc.*, 1894, with Dr. Dent); "The Luminosity of Gases,"; "Spectra of Copper and Gold Salts" (*Phil. Mag.*, 1895); "Flame Temperatures and the Acetylene Theory of Luminous Hydrocarbon Flames" (*Journ. Chem. Soc.*, 1895); "The Source of Light in Flames" (*Proc. Roy. Inst.*). Has also taken an active part in improving science teaching in schools. Has edited revised edition of Schorlemmer's "Rise and Development of Organic Chemistry," 1894.

M. R. OLDFIELD THOMAS,

F.Z.S., F.R.G.S., M. Anthrop. Inst. Senior Assistant, Zoological Department, British Museum. In charge of the collection of Mammals in the British Museum since 1878, during which period it has increased materially in extent and completeness. Distinguished for his acquaintance with the structure, history and distribution of Mammals. Author of the

"Catalogue of Marsupialia and Monotremata" in the British Museum, 1888. Joint author with Dr. Sclater of "The Book of Antelopes." Author of upwards of 200 memoirs and papers in various journals on Mammals, their structure and distribution, amongst which are:—"On the Dentition of *Ornithorhynchus*" (*Proc. Roy. Soc.*, 1889); "A Milk Dentition in *Orycteropus*" (*ibid.*); "On the Species of *Hyracoidea*" (*Proc. Zool. Soc.*, 1892); "On Cœnoles, a still existing survivor of the *Epanorthidae* (*ibid.*).

WILLIAM WATSON,

B.Sc., Associate, Royal College of Science, London, and Assistant Professor of Physics. Late University Scholar in Experimental Physics, London University. In conjunction with Mr. Boys and Mr. Bristoe he published a paper on "The Measurement of Electro-Magnetic Radiation" (*Phil. Mag.*, 31-44, 1891). In conjunction with the late Mr. J. W. Rodger he published a paper "On the Magnetic Rotation of the Plane of Polarisation of Light in Liquids" (*Phil. Trans. Roy. Soc.*, 1895). This paper represented the results of four years' work. As Secretary of a Committee of the Brit. Assoc. he has, in conjunction with Prof. Rücker, been conducting a series of comparisons between the Magnetic Instruments in use in the British Observatories, and the results have been published in the Report of the Brit. Assoc. He is still at work on an instrument for comparing Thermometers (see his paper, *Phil. Mag.*, 44-116, 1897). He is now engaged in investigating the connection between the magnetic units employed in Observatories and the Ampere and Ohm.

WILLIAM CECIL DAMPIER WHETHAM,

M.A. Lecturer in Physics. Fellow of Trinity College, Cambridge. Author of the following scientific papers, &c.:—"On the Alleged Slipping at the Boundary of a Liquid in Motion" (*Proc. Roy. Soc.*, xlviii., p. 225, 1890, and *Phil. Trans.*, 1890, A., p. 559); "Note on Kohlrausch's Theory of Ionic Velocity" (*Phil. Mag.*, July 1891); "Ionic Velocities" (*Proc. Roy. Soc.*, lii., p. 283, 1893, translated *Zeits. für Physikal Chem.* xi., p. 220, 1893, also *Phil. Trans.*, 1893, A., p. 337); "On the Velocity of the Hydrogen Ion through Solutions of Acetates" (*Brit. Assoc. Reports*, 1894, p. 568): "On the Velocities of the Ions and the Relative Ionisation Powers of Solvents" (*Phil. Mag.*, 1894); "The Velocities of the Ions" (*Proc. Roy. Soc.*, lvii., p. 182, 1895, and *Phil. Trans.*, A., 1895, p. 507); "The Ionising Power of Solvents" (*Phil. Mag.*, July, 1897); "Report to the British Association on the Present State of our Knowledge in Electrolysis and Electro-Chemistry"; "The Theory of the Migration of the Ions and of Specific Ionic Velocities" (*Brit. Assoc. Report*, 1897, p. 227); "The Coagulative Power of Electrolytes" (*Phil. Mag.*, November, 1899); "The Ionisation of Dilute Solutions at the Freezing Point" (a paper read before the Royal Society); an elementary text-book on "Solution and Electrolysis" (Camb. Univ. Press, 1895); Letters and Articles in NATURE and *Science Progress*.

ARTHUR SMITH WOODWARD,

F.G.S., F.L.S., F.Z.S., F.R.G.S., &c. Assistant-Keeper of Geology, British Museum, Natural History, Cromwell Road, S.W. Studied at the Owens College, Manchester, 1880-82; entered British Museum, August 24, 1882; awarded Wollaston Fund by Geological Society, 1889; and the Lyell Medal in 1896. Distinguished for his knowledge of Fossil Fishes. Author of 150 separate papers, mostly on Vertebrate Palæontology: (142 on Fossil Fishes; 14 on Reptilia; 4 on Mammalia; and 14 on General Palæontology). Author of two monographs (1890-95) on the Fossils of the Hawkesbury Series (*Mem. Geol. Survey*, New South Wales (Palæontology), Nos. 4 and 9, Museum, Sydney, New South Wales); and on Fossil Crocodilia from the Cretaceous Rocks of Neuquen, Argentine Republic (*Anales Mus. La Plata*, 1896). Author of a British Museum Catalogue of Fossil Fishes, comprising: Part I. "The Elasmobranchii" (pp. i.-xlvii. and 1-474, plates i.-xvii. and 13 woodcuts, 8vo, 1889); Part II. "The Elasmobranchii" *continued* (pp. i.-xliv. and 1-567, plates i.-xvi. and 58 woodcuts, 8vo, 1891); Part III. "The Actinopterygian Teleostomi" (pp. i.-xliii. and 1-544, plates i.-xviii. and 45 woodcuts. (Printed by order of the Trustees, 1895.) Part IV. now preparing for press. Also "Outlines of Vertebrate Palæontology" (Camb. Univ. Press), 1898, pp. i.-xxiv. and 1-470, with 228 illustrations in the text.

REV. JAMES CHALMERS ("TAMATE").

FEW missionaries have been so widely known and so deservedly appreciated as the Rev. James Chalmers, of the London Missionary Society, whose death has recently been reported. Mr. Chalmers was transferred from Raratonga in the Hervey Group to New Guinea twenty-three years ago, and it is in connection with his later field that he has earned a recognition in scientific journals.

Tamate, as Mr. Chalmers loved to be called by his white as well as by his black friends, was a man of tremendous energy and enthusiasm, and he possessed a rare sympathy with the natives that was due to a deep knowledge of their nature and a personal love for them. His name was a password along very nearly the whole of the southern coast of British New Guinea, and in many places for some distance into the interior. Those natives who had only heard of him longed to see him, those who knew him loved him. Till Sir William Macgregor's arrival he had travelled more in British New Guinea than any other man, and, without appliances, he had increased our geographical knowledge of the possession.

It was always a regret to his scientific friends that Tamate did not publish more about the natives concerning whom he knew so much; but he confessed that he greatly disliked the effort of writing down his experiences, though when he did so he could write in a very vivid manner. His first book, "Work and Adventure in New Guinea" (1885), was written in collaboration with the Rev. Dr. W. Wyatt Gill, to whom anthropologists owe so much. In 1887 Chalmers published his very interesting "Pioneering in New Guinea." In the same year he published a paper "On the Manners and Customs of some of the Tribes of New Guinea" in the *Proc.* Phil. Soc. Glasgow, xviii. p. 56. A valuable "Report on the Toaripi and Korari Tribes" was printed in the *Report Austral. Assoc. Advanc. Sci.* ii. 1890, p. 311. In vol. xxvii. (1897) of the *Journal* of the Anthrop. Inst. he published "Vocabularies of the Bugilai and Tagota Dialects, British New Guinea" (p. 139), "Toaripi" (p. 326), "Anthropometrical Observations on some Natives of the Papuan Gulf" (p. 335). Mr. Chalmers has frequently sent ethnographical specimens to various museums. The bulk of one large consignment was acquired by the British Museum. These objects were carefully labelled and were accompanied by a descriptive catalogue, and many of his labels have been copied by Edge-Partington and Heape in their "Ethnographical Album of the Pacific Islands." These collections contained many specimens and the descriptions much information that was not previously known; for example, the collection included the first bull-roarer obtained on the mainland of British New Guinea.

Mr. Chalmers greatly assisted the Cambridge expedition to Torres Straits by lending his mission boat on more than one occasion, and he hospitably entertained several members of the expedition and otherwise rendered valuable aid.

A noble life of self-sacrifice was laid down for the cause of peace, for, according to the telegram, he met a glorious death while endeavouring to stop a tribal fight on the Aird River, a region which had not yet come under missionary influence and over which the Government had no control. A very promising young coadjutor, the Rev. Oliver Fellows Tomkins, who was dearly loved by Chalmers, and twelve students, are reported to have been murdered at the same time.

Since the above was written a telegram has been received confirming the former rumours. Mr. Chalmers, like several other missionaries in New Guinea, has falsely been reported to have been murdered on more than one occasion; but we fear this time the news is only too true.

A. C. HADDON.

NOTES.

SIR W. ROBERTS-AUSTEN, K.C.B., on leaving the chair as president of the Iron and Steel Institute, at the meeting on Wednesday, announced that Mr. Andrew Carnegie had increased the gift of 6500*l.*, which he made last year to the research fund of the Institute, to 13,000*l.*

AT the recent meeting of the U.S. National Academy of Sciences, Mr. Alexander Agassiz was elected president of the Academy. The Henry Draper Medal was awarded to Sir William Huggins for his work in astro-physics. The following were elected foreign associates:—Dr. J. Janssen, M. Lœwy, director of the Paris Observatory, M. E. Bornet, Prof. Hugo Kronecker, Prof. A. Cornu, Prof. F. Kohlrausch, Sir Archibald Geikie and Prof. J. H. van 't Hoff.

THE movement in Cambridge to secure a portrait of Prof. G. D. Liveing has already received large and influential support. The secretaries think that there are many friends of the professor both in Great Britain and abroad who would like to join in the proposal and who have not yet had notice of it. Such friends should apply to Prof. Lewis, Cambridge, who will be glad to receive their names.

MR. W. LANGDON has been nominated for election as the new president of the Institution of Electrical Engineers. M. Mascart has been elected an honorary member of the Institution.

PROF. ZEILLER, professor of palæobotany at the Paris School of Mines, has been elected a member of the section of botany of the Paris Academy of Sciences, in succession to the late M. Chatin.

A MEETING of the Institution of Mining Engineers will be held in the rooms of the Geological Society, Burlington House, on May 23–25, with Mr. H. C. Peake as chairman. Among the subjects of papers to be read or taken as read are the field-work of photographic surveying as applied in Canada; gold-dredging; the production of copper and its sources of supply; geology of the mineral deposits of the Transvaal; and auxiliary ventilation.

AN expedition against the Anopheles mosquito will be despatched this month to West Africa, under Major Ronald Ross, by the Liverpool School of Tropical Medicine. A leading Glasgow citizen has placed at the disposal of the school and Major Ross a sum of money sufficient to defray the expenses of one year's trial in some malarious city.

A SPECIAL committee has been appointed by the Trinity House, with the deputy-master, Captain G. R. Vyvyan, as chairman, to carry out numerous practical experiments with sound-producing instruments as coast fog signals at St. Catherine's Point, in the Isle of Wight, including comparisons between different forms of sirens and reed instruments sounded by means of compressed air, the observations being made from the Trinity steamer *Irene* at various distances and under varying conditions of weather, &c. The committee will have the advantage of Lord Rayleigh's advice and assistance in the investigations. Representatives of the Admiralty, the Board of Trade, and of the Northern and Irish Lighthouse Boards will also be present.

REFERENCE has frequently been made in these columns to the enlightened and progressive way in which agriculture is carried on in New South Wales and other Australian colonies. Every advantage is taken of modern methods, and the bearings of scientific investigations upon agricultural practice seem to be well appreciated. We are, therefore, not surprised to see in the *Natal Mercury* that Mr. F. R. Moor, Secretary for Native Affairs, who has been on a visit to Australia, has returned to Natal with strong convictions as to the urgent necessity for radical improvements in the methods of agricultural industry in that colony. It is acknowledged that in the past the colony has been depending more upon commercial business as a distributing medium for the interior States than on its productive resources; but the changing conditions demand that the productive capacity should be increased if Natal is to prosper. The obsolete methods of farming now adopted must give place to a system based upon science and carried on with appliances which modern inventive genius has placed at the disposal of agriculture. As Mr. Moor is a member of the Ministry, as well as a farmer of more than average ability, his visit to Australia should not only direct attention to the need for progress in the science and art of agriculture, but also lead to changes which will in the course of time bring Natal into line with other progressive colonies.

THE Board of Trade has given its decision in the inquiry held with reference to the regulation allowing the consumer to veto any change in the pressure at which he is supplied with electric energy. A summary of the evidence given at the inquiry has already appeared in NATURE (vol. lxiii. p. 587). As was generally anticipated the decision now given is in favour of the undertakers depriving the consumer of the absolute power of veto which he has hitherto possessed. In future, when the consumer shall refuse to consent to the change after the undertakers have offered to comply with the conditions laid down by the local authority and to pay the reasonable costs of making the change, the undertakers can appeal to the Board of Trade. The Board may give their consent to the change under such conditions as they may think fit, and this consent shall reckon as equivalent to the consent of the consumer. The Board may, if they consider it desirable, refer to a single arbitrator the question as to what terms and conditions it would be proper to impose, the arbitrator being appointed by themselves.

THE recent conversazione held by the American Institute of Electrical Engineers at Columbia University appears to have been a great success. According to an American contemporary, one of the most interesting exhibits was that made by Mr. P. C. Hewitt, who showed a number of electric vacuum-tube lamps. The lamps consist of glass tubes filled with mercury vapour, through which a current of electricity is passed. The positive electrode is of iron and the negative of mercury. The lamps are arranged to burn directly on the ordinary 100- or 200-volt lighting mains, but they need an extra high voltage to start them, this being obtained by the use of a Wehnelt interrupter or by other suitable means. The light is said to be very steady and brilliant, but poor in red rays; the disagreeable colour due to this defect can, it is stated, be avoided by the use of red reflecting screens. Lamps of 500 and 1000 candle-power were shown burning on the 115-volt direct current mains, the consumption of energy being only half a watt or less per candle. This is much in advance of any other artificial light, and if the lamps can be made commercially in a convenient form and for small candle-powers they should have a great future before them.

WE have received from Dr. J. M. Pernter, director of the Austrian Meteorological Service, an interesting account of the present state of modern "weather-shooting" as practised in Austro-Hungary and Italy—being a reprint of an article contributed to the journal *Die Kultur* (Vienna). The modern experiments were inaugurated by M. Stiger, Burgomaster of Windisch-Feistritz in Steirmark, and the apparatus, consisting of a mortar with a long funnel, was improved by M. Suschnig, of Graz. The theory is that by firing large charges of gunpowder a series of atmospheric rings or whirls are generated and that they penetrate the clouds with sufficient force to prevent the formation of hail, or to disperse it. The idea gained

ground so rapidly that, at the present time, there are no less than some 1400 shooting stations in Hungary and many more similar stations in Italy. Dr. Pernter and others were delegated by the Austrian Ministry of Agriculture to witness and report upon the results of experiments as to the efficacy of the system. The experiments were made both in horizontal and vertical directions, with the result that in the horizontal direction the whirls which on leaving the mortar attained a velocity of, say, 170 miles an hour were reduced, at a distance of 80 to 100 metres, to less than 100 miles an hour, and in the vertical direction an initial velocity of 200 miles an hour was reduced to about 75 miles an hour at a height of about 110 metres. It was estimated by Dr. Pernter that the whirls would in no case reach a greater height than 400 metres. The only thing that can at present be positively asserted is that it is not impossible that the shooting may sometimes prevent hail; it is, however, improbable that the energy of the whirls—except under the most favourable conditions—can directly influence its formation.

THE unexpected death of Dr. Kohlstock, which occurred at Tientsin on April 15, causes a great loss to the medical department of the German Army, in which he was regarded as one of the best and ablest organisers. At the time of his death he was forty years of age and was sent, some months ago, to Tientsin, with a view to directing the military hospital there. Prof. Kohlstock will be best remembered in this country by the conspicuous part he played in 1896 in his capacity as Prof. Robert Koch's first assistant during the former's sojourn in South Africa for the purpose of investigating and combating the rinderpest. In Germany, however, his name is associated with several other by no means less important scientific researches. In 1890 he began some special bacteriological studies under the superintendence of Prof. R. Koch, and in the following year the "Seminar für orientalische Sprachen" was founded in Berlin, and Dr. Kohlstock, upon Prof. Koch's recommendation, became lecturer on tropical hygiene at that institute. To his connection, as a teacher, with this institute he mainly owes the title of professor, which was conferred upon him by the German Government in 1898. But his activity and interest were not confined to this work alone, indeed his subsequent appointment as a scientific adviser to the German Foreign Office in matters bearing upon tropical hygiene very largely increased his usual work and brought him into public prominence, with the result that he was soon requested by several private colonial associations to accept a post similar in character to that he held in connection with the Foreign Office, but he declined these offers. His scientific and literary contributions are numerous, but they are entirely devoted to the domain of clinical and bacteriological research in connection with malaria and yellow fever. One popular book, however, which he wrote about two or three years ago is likely to survive him for some time to come, namely, his "Aerztlicher Rathgeber für Ost-Afrika und andere tropische Malaria-Gegenden." Lastly, in conjunction with Prof. Koch he originated the scheme for the establishment of the so-called "Deutsche Anstalt für Tropen-Hygiene," which was recently erected in Hamburg.

MR. J. H. HART'S Annual Report on the Royal Botanic Gardens of Trinidad for the year 1900 deals, as usual, with the botanical and meteorological work in the Gardens, and also the monthly rainfall statistics at some scores of points of observation throughout the island. Several seismographic records were supplied to Prof. Milne, the most important being that of the Caracas earthquake of October 29, the shock commencing suddenly, without any preliminary tremors, and agitating the instrument for two hours. In the herbarium several fungi and parasitic insects injurious to vegetation were under investigation, and also a disease occurring in the cacao plantations of Surinam. A course of agricultural education for elementary school teachers having been inaugurated appears to have proved highly successful, four courses being attended by 112 teachers and 10 cadets. Sugar cane experiments were confined to the raising and trial of new seedlings, and the cultivation of small areas of a few standard kinds for control purposes, no manurial experiments being attempted. From May 1899 to May 1900 there were 170 new canes analysed, 131 being Trinidad seedlings, the rest Demerara, Barbados and standard kinds. The question of the pollination of the cane by wind or insects is still unsettled, but it is found that the greatest variety and the best kinds of canes come from seed harvested where several distinct varieties are planted closely together. Notes are given on the experimental cultivation in the Gardens of rubber, nutmegs, coffee, oranges, guava and other plants. Botanical officials in other West Indian islands supplied as many as seventy varieties of sweet potatoes, but in all cases their yield was very poor.

IN his natural history notes Mr. Hart states that in the St. Ann's and Maraval rivers two species of small fish are found, one not so large as the English stickleback, the other slightly larger. They are commonly found in garden fountains and tanks, and both destroy the larvæ and eggs of mosquitoes. The question of the benefit of introducing these or similar fish into noted malarial districts is well worthy of consideration. It is a fact that the common gold-fish or carp does not increase in their presence owing to the smaller fish devouring the eggs of the larger. Gold-fish, however, are said to destroy mosquito eggs and larvæ. The study of living specimens of insects is rendered difficult by the behaviour of small ants, which attack and destroy nearly every form of insect. All experiments have, therefore, to be conducted in receptacles standing above water. In tapping Para rubber trees it is found that some of the coagulated rubber is cut up and carried away by a large species of black ant. Species of bees, genus Trigona, have also been observed carrying off the coagulated rubber fluid from the stems of *Castilloa elastica*. Similar species use resinous exudations from the *Garcinias* and other trees as ready-made wax for their nests, and in some cases actually cut the bark in such a manner as to cause a flow of the desired fluids.

THE April number of the *Journal of the Franklin Institute* contains the first part of a paper by Mr. Edwin Swift Balch, entitled "Antarctica: a History of Antarctic Discovery." In the introduction to his paper, the author says—"Not long since Sir Clements Markham proposed in the *Geographical Journal*, for November, 1899, to divide the Antarctic into four quadrants, each covering 90° of longitude, and to bear English names. The advantages of this proposition on the score of convenience are not self-evident. Moreover, it is only just to remember that, besides Englishmen, mariners of many other nations have made discoveries in the Antarctic. A letter that I wrote on this matter was published in the *Nation*, New York, May 10, 1900, and also in the *Evening Post*, New York, of the same date. Up to that time I had made no special study of Antarctic geography, and discovered then how difficult it was to find accurate data." In the present instalment the author covers, with considerable detail, (*a*) Voyages leading from a belief to a disbelief in a Terra Australis Incognita, and (*b*) Voyages up to the discovery of a South Polar Continent.

SIR MARTIN CONWAY has drawn up, in the form of a pamphlet entitled "The Rise and Fall of Smeerenburg, Spitsbergen," and privately printed, the results of much careful and laborious investigation into the history of the rival fisheries carried on in Spitsbergen during the seventeenth century. In 1614 the Noordsche or Greenland Company, which had obtained the monopoly of the whale fishery for the Dutch Republic, sent up a force "which the English, under Captain Joseph, were too

weak to drive away." They sent some ships to Fairhaven, and probably settled on Amsterdam Island on the flat ground at its south-east angle, the site of the future Smeerenburg, or Blubbertown. Sir Martin Conway traces, so far as they can be traced, the fortunes of Smeerenburg, from its rise in the manner described, to its fall, or rather through its decline, when the whales began to find Fairhaven too dangerous for them. They "began to be shy of the Cookeries and anchorages of the ships, shallops, and what pertained to them; next of the bays, and then of the shallows along the coast, where they were constantly pursued," apparently about 1639; in 1646 "the season was only opened off Smeerenburg, and the whales were then followed to sea or along the north coast." By 1650 the whales had abandoned the banks and Smeerenburg became valueless as a place for trying-out the train-oil. As late as 1671 it remained a place of refuge for refitting ships, but twenty years later nothing was left but the foundations of a few houses. Sir Martin Conway gives many useful references to cartographical and other authorities, and adds a section on the topography and nomenclature of Fairhaven and its neighbourhood.

THE Geological Survey of India has attached to its staff as "Mining Specialist" Dr. F. H. Hatch, who has lately reported on the Kolar gold-field in Mysore (*Memoirs*, vol. xxxiii. part 1, 1901). The auriferous lodes consist of a series of parallel quartz veins in the Dharwar schists, and they conform generally to the direction of the foliation planes of these rocks. They are therefore regarded as "bedded veins," formed by the deposition of quartz and other minerals from solution along open channels or planes of weakness which in general coincided with the foliation of the schists. To this fact is ascribed their lenticular character; they swell and pinch at irregular intervals. As a rule, gold is not visible in the hand-specimens of quartz, which is of a dark bluish-grey colour. In places the quartz has been subject to great stress consequent on the bending of the vein into acute folds, and there it has a well-developed banded or laminated structure. Along the axes of the folds, where the vein is doubled back on itself, large and valuable bodies of ore are found; and where slickensides have been formed by differential movements in the vein, the gold sometimes occurs as a fine film on the smoothed and polished surface. Dr. Hatch deals exhaustively with the methods of working and production of this gold-field.

THE two leading formulæ at present in use in performing interpolations by central differences are due to Newton. In a note reprinted from the *Journal* of the Institute of Actuaries, xxxv. p. 452, Prof. Everett proposes a new formula containing only even differences, which appears to be very simple and convenient.

M. PELLAT contributes to the *Journal de Physique* (April) a short note on the laws of nature in which he points out, as a consequence of the principle of degradation of energy, that, as applied to the universe, the notion of infinite time necessitates that of infinite space.

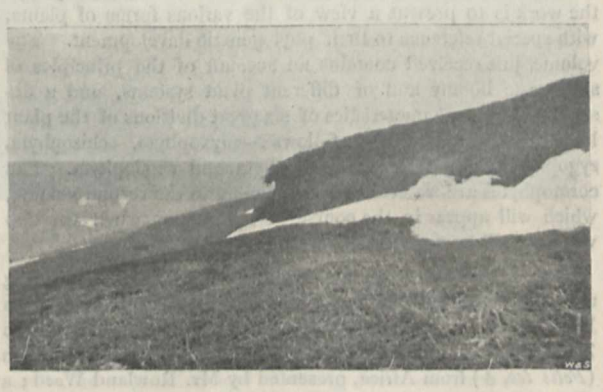
MR. J. A. THIRD contributes to *Mathesis*, 1900, a short note on trihomologous triangles. Such triangles have three centres of homology, in each of which the lines joining the vertices of one triangle to those of the other are concurrent, the three centres being got by joining different vertices taken in order. They therefore have three axes of homology, on each of which lie the three points of intersection of three sides of the one with three sides of the other. The theorems now proved relate to certain conics connected with the two triangles and lead to a number of particular cases including certain properties of Steiner's ellipse.

TO the May issue of the *Entomologists' Monthly Magazine* Sir George Hampson contributes a long list of abnormalities among Lepidoptera, as illustrated by a series of specimens recently presented to the British Museum by Mr. South, who had spent many years in collecting them.

DR. C. S. MINOT sends us a copy of "Notes on Anopheles," which recently appeared in the *Journal* of the Boston Society of Medical Science (vol. v. p. 325). They are based upon observations made upon the larvæ of these mosquitoes by the author so long ago as 1879, and are illustrated by excellent figures of the larvæ and pupæ of Anopheles and Culex. These observations, it is believed, are the earliest which have been made on the first stages of the life-history of the two insects, and accord well with those recently recorded by other writers.

TO the same author we are indebted for a report (from *Science*) of his Middleton Goldsmith lecture delivered before the New York Pathological Society on March 25. The subject is the embryological basis of pathology, the lecturer claiming that a scientific study of pathological phenomena is in a greater degree a superstructure upon embryology than it is upon anatomy. "The fundamental problems of pathology and embryology are," it is urged, "alike, not only in being problems of cell life, but also in being similar and even identical problems of cell life. Widely as the two sciences differ, they rest on a common foundation."

WE have received information of the occurrence of a considerable landslip in Danby Dale, a deep valley drained by a tributary of the Esk in the moorlands of East Yorkshire, about seven miles west of Egton. The region is one in which many landslips have from time to time occurred, owing to the undermining



and breaking away of the Dogger and Lower Estuarine Sandstones and Shales which overlie the Alum Shale. In the present instance, the slip appears to have affected about sixty acres of ground, while the fissure along which the subsidence took place extended for a distance of more than half a mile. The fall represented in the accompanying picture, reproduced from a photograph taken by Mr. George A. Macmillan, is about ten or twelve feet high. The fissure at the foot was filled with snow when the photograph was obtained.

A BEAUTIFUL coloured plate illustrating the remarkable resemblance presented to their inanimate surroundings by certain spiders forms the most attractive feature of vol. xxxi. part 2 of the *Travaux* of the Imperial Society of Naturalists of St. Petersburg. It accompanies an article, by Dr. W. A. Wagner, on colouring and mimicry among animals, of which there is a summary in German, the full text being in Russian. In several instances the spiders are represented on lichen-clad bark, the resemblance being most remarkable in the case of a species of Epeira on very dark bark shown in Fig. 7. Still more curious is a blue spider of the same

genus nestling amid a rosette of azure lichen. Other examples show white or yellow spiders in flowers of similar colour, the resemblance being most complete in the case of a Vatia, whose yellow body is spotted with red to accord with a yellow and red flower. After tracing the gradual evolution of this type of "mimicry" among spiders from the dull-coloured to the bright-hued species, the author refers to certain well-known difficulties as to the origin of resemblances of this nature.

A LARGE Mycenæan *pithos* in the First Vase Room, British Museum, was inadvertently stated on p. 13, col. 1, line 6 from bottom, to have come from Ialysos in Rhodes. In reality it was brought from Knôssos itself by Mr. Minos Kalochairinos, who essayed several excavations at Kephala in years gone by.

WE learn, from the *Journal of Botany*, that a new society, to be called the International Botanical Association, is to be inaugurated at a meeting to be held in the botanical laboratory of the University of Geneva on August 7. The chief object of the Association will be "the foundation of a bibliographic periodical, criticising in a perfectly impartial manner all botanical publications. . . . The criticisms will, at the desire of the contributors, be published in English, French or German." The editor, who will be responsible to the Association for this absolute impartiality and the cyclopædic knowledge which it involves, will be Dr. J. P. Lotsy, of Wageningen, Holland; and the subscription to the Association, including the periodical, is not to exceed 25*s.* per annum.

THE first volume of a "Handbuch der systematischen Botanik," by Prof. R. R. v. Wettstein, has been published by Herr Franz Deuticke, Leipzig and Vienna. The chief object of the work is to present a view of the various forms of plants, with special reference to their phylogenetic development. The volume just received contains an account of the principles of systematic botany and of different plant systems, and a description of the characteristics of six great divisions of the plant kingdom, distinguished as follows:—myxophyta, schizophyta, zygophyta, euthallophyta, phaeophyta and rhodophyta. The cormophytes are reserved for treatment in the second volume, which will appear in the course of next year, when the two volumes will be noticed together.

THE additions to the Zoological Society's Gardens during the past week include three African Sheep (*Ovis aries*) from Bida Nigeria, a Bateleur Eagle (*Helotarsus ecaudatus*) from Zebba Nigeria, presented by Mr. Fanshawe Abadie; a Lion (*Felis leo*, ♂) from Africa, presented by Mr. Rowland Ward; a Chough (*Pyrrhocorax graculus*), British, presented by Mr. W. H. St. Quintin; a Black-pointed Teguexin (*Tupinambis nigropunctatus*) from South America, presented by Mr. G. P. Ogg; a Turkish Gecko (*Hemidactylus turicius*) from Western Asia, presented by Miss Kensington; six Ceylonese Terrapins (*Nicoria trijuga*), a Changeable Lizard (*Calotes versicolor*) from India, three Blue-tongued Cyclodus (*Tiliqua scincoides*), three Black and Yellow Cyclodus (*Tiliqua nigro-luteus*) from Australia, a Chained Snake (*Coluber catenifer*) from California, two Ten-lined Snakes (*Contia decemlineata*) from North America, two —— Snakes (*Contia rothi*) from Syria, four Lacertine Snakes (*Coelopeltis monspessulana*), four Vivacious Snakes *Tarbophis fallax*), an Æsculapian Snake (*Coluber longissimus*), a Dahl's Snake (*Zamenis dahli*), two Dark Green Snakes (*Zamenis gemonensis*), a Common Snake (*Tropidonotus natrix*, var.) two Glass Snakes (*Ophiosaurus apus*), South European, two —— Ground Snakes (*Typhlops vermicularis*) from Asia Minor, a Black-necked Stork (*Xenorhynchus australis*) from Malacca, deposited; two Smews (*Mergus albellus*), a Velvet Scoter (*Ædemia fusca*), four Wigeon (*Mareca penelope*), European, purchased.

OUR ASTRONOMICAL COLUMN.

COMET *a* (1901).—A further telegram concerning the new comet has been received from Kiel announcing its observation at Arequipa, in Peru, on May 2, at 6h. 48·6m. p.m. Its position then was

R.A. = 3h. 30m.
Decl. = − 1° 0′.

A later telegram gives particulars of another observation at the Cape at the position

R.A. = 3h. 54m. 29s.
Decl. = −0° 18′ 27″ } 1901 May 4d. 6h. 28·8m.
Daily Motion in R.A. = +14m.
,, ,, Decl. = +13′.

It has been observed at Eastbourne by Mr. Chambers, who saw it about 3.0 a.m. on May 2. Reports in the daily Press also state its frequent observation at Melbourne and the Cape, but its motion is there stated to be north-westerly.

STELLAR PHOTOGRAPHY WITH A SIDEROSTAT.—Some little interest has been evinced during the past few months in connection with the practical elimination of the rotation of the field which occurs when a siderostat is used to follow the diurnal motion. In *Comptes rendus* (vol. cxxxii. pp. 931–932) Prof. Lippmann suggests a mechanical contrivance, to be attached to the slide carrying the photographic plate, which shall be so geared to the driving mechanism of the siderostat itself as to compensate for the rotation of field.

Prof. Cornu, in the same number, pp. 1013–1017, calls attention to a method he has previously recommended and which he thinks very good as regards mechanical efficiency. The essential factor is the employment of a universal joint, the angle between the component axes depending on the polar distance of the direction of the reflected beam. The plate holder is rotated by means of a subsidiary mechanism through the medium of the joint. He was led to the device by having to design a mechanism to represent a formula in connection with polarised light in isotropic and other media, this formula being of the same type as that showing the rotation of field of a siderostat.

From Prof. Cornu's suggestions M. Gautier constructed the necessary apparatus for this purpose, which is used with the 50-inch refractor shown at the Paris Exhibition of 1900.

FORMULÆ FOR VARIATION OF LATITUDE.—The observations of latitude made by Profs. Doolittle and Gratchof (*Astronomical Journal*, Nos. 490 and 495) lead Prof. S. C. Chandler to consider that they afford evidence of changes in the annual component of latitude variation; he therefore proposes to include such changes in the numerical theory, and gives formulæ and tables of reduction which may be used for such observations (*Astronomical Journal*, No. 495).

POSITION OF NOVA PERSEI.—Prof. E. C. Pickering gives, in the *Astronomische Nachrichten* (Bd. 155, No. 3706), the following mean position adopted from numerous measures with the transit circle at Harvard College Observatory:

R.A. = 3h. 24m. 28·10s.
Decl. = + 43° 33′ 54″·8 } (1901·0).

PHOTOGRAPHS OF THE ZODIACAL LIGHT.—In *Popular Astronomy* for April Mr. A. E. Douglass, of the Lowell Observatory at Flagstaff, Arizona, describes some successful photographs of the western zodiacal cone which he was fortunate enough to obtain on February 13 of this year.

The lens he employed was made in 1899 by Messrs. Alvan Clark and Sons especially for this purpose; its aperture is 0·9 inch, focus 1·8 inches, the intensity being thus 1:2.

Previous to this date many exposures had been made of an hour or more, but the short exposure tried on the 13th was most successful. It appears that when the zodiacal light is at its best, exposures of about eight minutes are ample; when not so clear, about thirty minutes should suffice. Glycin or hydroquinone were found most trustworthy for development, the former being especially free from any tendency to produce general fogging of the plate. Reproductions from three of the photographs taken at intervals of a few minutes accompany the paper. They all show some trace of condensation about the centre of the illuminated cone.

FOG FORMATIONS.

BRIEF reference has already been made (vol. lxiii. p. 161, December 13, 1900) to some interesting observations and photographs of fog made by Mr. A. G. McAdie on Mount Tamalpais, a little to the north of San Francisco. Several articles upon the subject have been contributed by Mr. McAdie to the U.S. *Monthly Weather Review*, and the particulars given below have been derived from one in the issue of November, 1900. We are fortunate in being able to reproduce one of Mr. McAdie's striking photographs of fog, through the courtesy of Prof. Cleveland Abbe.

Fog is very prevalent on the central coast of California, especially in the vicinity of the Bay of San Francisco. The topography of the district is remarkable, because of the close juxtaposition of ocean, bay, mountain and foothill. A valley, level as a table, 450 miles long and 50 miles wide, having afternoon temperatures of 100° or over, is connected by a narrow water passage with the Pacific Ocean, the mean temperature of the water in this locality being 55°. Thus within a distance of 50 miles in a horizontal direction there is frequently a difference of 50° in temperature, while in a vertical direction there is often a difference of 30° in an elevation of half a mile. High bluffs, ridges and headlands are at such an angle to the prevailing strong westerly surface air currents that an air stream is forced with increased velocity through the Golden Gate, and there must of necessity be considerable piling up of both air and water vapour at this point. The locality may indeed be considered as a natural laboratory, in which experiments connected with cloudy condensation of water vapour are daily wrought, and it is therefore of more than passing interest to the meteorologist.

Much faithful work has been done in physical laboratories on the behaviour of water vapour at varying volumes, pressures and temperatures. Regnault, Thomson, Broch, Aitken, Kiessling, R. von Helmholtz, Hertz, Rayleigh, von Bezold, Barus, Marvin and others have worked upon the change of state from vapour to liquid and from liquid to solid, and while many irregularities are noted in the behaviour of water vapour, the general problems of decreasing volumes and increasing pressures until condensation points are reached have been solved; and it is well understood that the vapour-liquid and liquid-solid condensations are in themselves but two phases in a chain of condensation phenomena. The problem of fog is therefore a limited one. It may be considered as a special case of cloud development, occurring in the first and second stages of Hertz, viz., the unsaturated and saturated stages. Condensation in the free air, as in these fog formations, takes place under conditions different from those obtaining in the laboratory. There are no fixed restraining walls, though the strongly stratified outlines suggest sharply limited air streams. Again, saturation as it occurs in free, constantly changing air and true adiabatic saturation are not identical. Saturation in the free air must be studied in disadvantageous circumstances, for the work must be done at a distance, with instruments neither sufficiently delicate nor accurate, and there is no control of conditions possible.

An attempt has been made at the Mount Tamalpais station to correlate the surface pressure conditions with fog. There are, however, many different types of fog. The conditions prevailing in winter, when tule fog, formed in the great valleys, drifts slowly seaward, are very different from those prevailing in summer, when the sea fog is carried inland. A typical pressure distribution accompanying sea fogs has been recognised. In general, a movement southward along the coast of an area of high pressure in summer means fresh northerly winds and high temperatures in the interior of the State, with brisk, westerly winds, laden with fog, on the coast.

Direct cooling by contact or radiation is shown by von Bezold to be more efficient as a cause of rainfall than cooling by mixture, but in the production of fog it is probable that cooling by mixture (except in the case of ground fogs) is the most important factor to be considered. It is to be noted that reverse pressures should also be studied, for perhaps a close watch upon the conditions prevailing when fog is rapidly dissipating might conversely throw light upon the order and relative importance of the three ways of cooling, viz., mixture, expansion and radiation.

Von Bezold's deductions may be thus summarised: More vapour condenses when a stream of air and vapour at low temperature impinges on a mass of warmer air than with reversed conditions. Ocean fogs, as a rule, form when cool air flows over warm, moist surfaces, but in the case under discussion, where the ocean surface temperature is 13° C. (55° F.) and the air temperature may reach 27° C. (80° F.), it is evident that the above does not hold. It is more probable that condensation is the result of the sharp temperature contrasts at the boundaries of certain air currents having different temperatures, humidities and velocities, and that the contours of the land play an important part in the originating and directing these air currents. The summer afternoon fogs of the San Francisco Bay region, then, are probably due to mixture more than radiation or expansion. The winter tule fogs of the Sacramento and San Joaquin valleys are probably pure types of radiation fog, where the process of cloud building is from the cooled ground upward. Occasionally in summer, when the warm air has been pumped out of the valleys and there is rapid radiation, ground fog forms. An illustration of this is given in the accompanying figure, where fog covers a number of valleys.

FIG. 1.—Lifted fog. Height above the ground, about 500 metres. View from U.S. Weather Bureau Observatory, Mount Tamalpais.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—Prof. Townsend, the new Wykeham professor of physics, delivered an inaugural lecture at the Clarendon Laboratory on Friday, April 26, upon the recent developments of electro-optics.

Mr. N. V. Sidgwick, of Christ Church, has been elected to an official Fellowship in Natural Science (Chemistry) at Lincoln College.

Mr. A. S. Hunt has been elected to a research fellowship at Lincoln College in order to enable him to prosecute his researches upon Egyptian papyri.

The degree of D.Sc. has been conferred upon Prof. A. H. Church, F.R.S., in recognition of his contributions to chemical and mineralogical science.

No honorary degrees will be conferred at the Encænia this year.

Mr. J. L. Myres and Dr. H. R. Mill have been appointed examiners for the newly-instituted diploma in geography.

The following grants have been made from the Craven University Fund :—100*l.* to Mr. D. G. Hogarth to enable him to continue his researches in Crete ; 80*l.* to Mr. T. Ashby towards the cost of publishing the results of his researches in the Campagna Romana.

Mr. J. Passmore Edwards has given to the University the sum of 1675*l.* for the promotion of the study of English literature in its connection with the classical literatures of Greece and Rome.

Scholarships in natural science are advertised for Merton College, New College and non-collegiate students on June 18.

The new Radcliffe Library (presented to the University by the Draper's Company) and the new Pathological Laboratory are approaching completion. The latter and the pathological collections deposited in the University Museum will be, probably, placed under the charge of the reader in pathology, Dr. Ritchie.

The Junior Scientific Club held their 224th meeting on Wednesday, May 1. The papers read were: "Experiences in South African Hospitals," G. H. H. Almond (Hertford); "Organic Compounds of Phosphorus," S. P. Grundy (Balliol).

CAMBRIDGE.—The new Board of Agricultural Studies in their annual report give a favourable account of their first year's working. The number of students attending the special courses of instruction is thirty-nine. The experimental farm is in working order, and no less than thirty-two special experiments on crops, stock, manures, &c., are being conducted in various local stations at the instance of neighbouring county councils. The Board of Agriculture has this year made a grant of 1000*l.* in aid of the work of the department. The special examination in agricultural science for the B.A. degree, and the examinations for the University Diploma in Agriculture, begin on May 29 and extend to June 8.

The Vice-Chancellor will represent the University at the meeting of universities and learned societies in connection with the millenary commemoration of King Alfred the Great at Winchester, to be held this summer.

Prof. Allbutt and Prof. Sims Woodhead will represent the University at the British Congress on Tuberculosis to be held in London next July.

THE following external examiners, among others, have been appointed by the Council of the University of Birmingham. We notice with regret the absence of Astronomy from the subjects. Mathematics, Prof. Horace Lamb, F.R.S.; Physics, Prof. J. J. Thomson, F.R.S.; Chemistry, Prof. H. McLeod, F.R.S.; Zoology, Dr. S. F. Harmer, F.R.S.; Botany, Prof. Reynolds Green, F.R.S.; Geology, Prof. T. G. Bonney, F.R.S.; Anatomy, Prof. Alex. Macalister, F.R.S.; Physiology, Prof. J. G. McKendrick, F.R.S.; Pathology, Prof. G. Sims Woodhead; Medicine, Dr. Donald MacAlister; Public Health, Dr. George Reid.

THE Association of American Universities has recommended the fourteen universities in the United States to extend the Christmas vacation every year to include the first week in January, in order to permit scientific men to attend annual meetings then instead of in the summer. *Science* says: "Columbia University has the honourable distinction of being the first to adopt the important innovation, and has already changed its calendar for 1901–1902, setting free the week of January first for convocation purposes. It is expected that several other universities also will soon announce their adherence to the plan, and it is hoped that in a short time the majority of American and Canadian universities will adopt the recommendation under consideration."

THE Technical Education Board of the London County Council is offering for competition five senior county scholarships of the value of 60*l.* a year for three years, together with payment of tuition fees up to 30*l.* a year. The scholarships are open to young men and young women who are resident within the administrative County of London, and whose parents are in receipt of an income not exceeding 400*l.* a year; and they are tenable at Universities, University colleges, or technical colleges, whether in England or on the Continent. Candidates must be under twenty-two years of age on May 1, preference being given to those who are under nineteen years of age. In addition to the senior county scholarships the Board offers a limited number of free places at University College, King's College and Bedford College, London. The scholarships and grants of free places are awarded, not on the result of an examination, but on a consideration of the past record and achievements of the candidates. Application forms may be obtained from the secretary of the Technical Education Board, 116, St. Martin's Lane, W.C., to whom they should be returned not later than Monday, May 13.

THE Education Bill of the Government was introduced into the House of Commons on Tuesday, and was read a first time. The object of the Bill is to establish in every part of England and Wales a local education authority for the supervision of educational work of all grades; and it is hoped that this authority will ultimately have control over all schools within its area of influence, whether elementary, secondary or technical. The proposal of the Government is to make county and borough councils, acting through statutory committees, the educational authorities, and it is hoped that small counties will combine to form an education area. The new education committee will have no power of rating, but will merely spend the money placed at its disposal by the county council. This money will be derived chiefly from the local taxation receipts, so that the committees will become the successors of those at present responsible for technical instruction. A county council will also have the power of levying a rate, limited to 2*d.*, either upon the whole county or upon any part of it for which it might be desirable to make provision, and the sum so raised will be entrusted to the education committee. School Boards and School Board rates are not touched by the Bill, but their ultimate absorption by the new educational authorities is contemplated.

THE Report of the U.S. Commissioner of Education for the year 1898–99 has been received. Much of this bulky volume is taken up with tables referring to the condition and progress of various branches of education, but there are also a number of interesting articles and summaries. A detailed statistical account is given of the institutions for higher education in the United States. A table is given showing the number of students in higher education to every million persons in the United States. In the year 1872 there were 852 of such students to 1,000,000 people, and in 1898–99 the proportion had risen to 1874 college students per million. In the year 1898–99 the total number of students in collegiate, graduate and professional departments of institutions for higher education and in professional schools was 147,164, of which 43,913 were enrolled as professional students in law, medicine and theology, leaving 103,251 students reported as pursuing studies in the liberal arts and applied science. The number of degrees conferred on men after passing through a recognised course was 10,794, and on women 4293. The total value of property possessed by institutions for higher education amounted to more than seventy million pounds. The endowment funds amounted to thirty-one million pounds, and the remainder represented the value of grounds, buildings, &c., used for instruction and research. The total income for the year covered by the report, excluding benefactions, amounted to about six million pounds. The gifts and bequests reported as having been received during the year reached the magnificent total of nearly five million pounds.

WE are glad to notice another movement for the extension of facilities for higher education. A short time ago a council was formed to consider the possibility of establishing a University College for North Staffordshire, and to promote interest in the educational needs of the district. The executive committee now report that the chairman of the council, Mr. Alfred S. Bolton, has purchased, as a site for the College, about three acres of land in a good position at Stoke-on-Trent, and has thus given generous aid to the educational cause of North Staffordshire. Principal Oliver Lodge has become a vice-president of the council in order to show that the scheme has the sympathy and good wishes of the University of Birmingham. It was pointed out by the committee which first started the inquiry into higher education in North Staffordshire that "The nature of the local industries demands special scientific instruction of a more systematic and thorough character than is at present provided anywhere in the district, and foreign competition by nations recognising the practical advantages of such instruction will

prove disastrous to the district if the matter is continually neglected." The district is at present remarkably deficient in opportunities for higher education. With a population approaching half a million within easy reach of the centre, there is no institution where young people who have left the secondary school can obtain higher instruction nearer than Manchester (thirty-seven miles) or Birmingham (forty-five miles). Evidently there is room for further provision of educational facilities by the establishment of an institution of the rank of a University College; and it is satisfactory to know that another locality is being aroused to a sense of its educational deficiencies.

SCIENTIFIC SERIAL.

Bulletin of the American Mathematical Society, April, 1901.—Prof. F. N. Cole opens with an account of the proceedings at the February meeting of the Society in New York City, and, in addition to the titles of the nineteen papers communicated, gives an abstract of several of them. Three of the papers are printed. Their titles are: (1) Green's functions in space of one dimension, by Prof. M. Bôcher. The results arrived at are given, but the proofs and further developments are reserved; (2) Possible triply asymptotic systems of surfaces, by Dr. L. P. Eisenhart. This supplements a note by the author, in the January *Bulletin*, entitled, "A demonstration of the impossibility of a triply asymptotic system of surfaces." Instead of the general negation previously given, the author now gives the qualified one: The only triple systems of surfaces cutting mutually in the real asymptotic lines of these surfaces are composed of properly associated families of hyperboloids of one sheet and hyperbolic paraboloids; (3) Note on Hamilton's determination of irrational numbers, by Dr. H. E. Hawkes. The purpose of the note is to call attention to Hamilton's use of the partition (Schnitt) in his definition of certain irrational numbers (*Trans.* of the R. Irish Academy, vol. xvii. 1837, p. 293).—On a system of plane curves having factorable parallels, by Dr. V. Snyder, was read before the December meeting of the Society. The type of scrolls contained in a linear congruence, and having factorable asymptotic lines, gives rise to a class of plane curves whose parallels have a similar property (cf. a paper by the author, in the *American Journal of Mathematics*, vol. xxiii., on a special form of annular surface). Mr. Bromwich gives a very useful analysis of Dr. P. Muth's "Theorie und Anwendung der Elementartheiler" (1899, xvi. and 236 pp.), and hopes that the book may induce its readers to take up the special part of invariant theory treated in it. Mr. Bromwich has done good work in this direction (see *Proc.* of London Math. Soc. vol. xxxii. 1900, p. 98), where he gives a list of papers on the subject.—Short notices follow of Dr. R. Fricke's "Kurzgefasste Vorlesungen über Verschiedene Gebiete der höheren Mathematik, mit Berüchsichtigung der Anwendungen" (1900), and Dr. R. Böger's "Ebene Geometrie der Lage" (1900), both by Prof. H. S. White.—The notes are very copious and interesting, giving account of the courses of lectures in the Continental and home Universities, and the usual new publications close the number.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, February 28.—"A Preliminary Account of the Development of the Free-swimming Nauplius of *Leptodora hyalina* (Lillj.)." By Ernest Warren, D.Sc. Communicated by Prof. Weldon, F.R.S.

March 14.—"On the Preparation of Large Quantities of Tellurium." By Edward Matthey, A.R.S.M. Communicated by Sir George Stokes, Bart., F.R.S.

March 28.—"On the Enhanced Lines in the Spectrum of the Chromosphere." By Sir Norman Lockyer, K.C.B., F.R.S., and F. E. Baxandall, A.R.C.S.

In the recently published account (*Ast. Phys. Journ.* vol. xii. p. 307, 1900) of the spectroscopic results obtained by members of the expedition from the Yerkes Observatory during the solar eclipse of May 28, 1900, Prof. Frost claims to have established a close relationship between the bright lines in his eclipse spectra and the stronger lines of the Fraunhofer spectrum, and states that "61 per cent. of the latter were measured as bright on the plates."

He also states that "these plates give no evidence of any relationship between the bright lines and the 'enhanced' lines, or lines distinctly more intense in the spark than in the arc spectrum, although Sir Norman Lockyer has attached much significance to a supposed connection between them." He quotes specially the cases of titanium and iron lines, and of 48 enhanced lines of the former element acknowledges that 29—or 60 per cent.—correspond with lines in his eclipse spectra

The authors of the present paper show that if a difference of 0·3 tenth-metres be allowed between the wave-length of an eclipse line and that of the corresponding metallic line (and in some cases Prof. Frost accepts a difference of 0·35 or more between his adopted wave-length and Rowland's wave-length of the corresponding Fraunhofer line), there are 38 of the 48 enhanced titanium lines—or 80 per cent.—which have corresponding lines in the eclipse spectra, thus showing a closer relationship between the enhanced lines of titanium and the eclipse lines than that claimed by Prof. Frost between the latter and the stronger of the Fraunhofer lines.

To show the difference in behaviour in the eclipse spectra of the enhanced and unenhanced lines, several tables have been compiled. The first contains all the Fraunhofer lines in the region covered by Frost's eclipse spectra which have an intensity of 2 or greater, and which Rowland has ascribed to titanium only. These are 53 in number, 20 are enhanced lines and 33 are not. The comparison table indicates that 19 of the 20 enhanced lines have corresponding lines (nearly all prominent) in the eclipse spectra, the remaining one being probably masked by $H\gamma$. Of the 33 unenhanced lines, 23—or 70 per cent.—do not correspond with eclipse lines. Of the nine eclipse lines which do agree in position with unenhanced titanium lines, three are nearly certainly due to other metals, and the remainder are lines of insignificant intensity.

The second table gives the enhanced lines of titanium which are recorded by Hasselberg in the arc spectrum, and a comparison is made with Frost's eclipse lines. This table shows that though the "arc" intensities of the enhanced lines vary from 2 to 7 (max. = 8), they have nearly all corresponding lines in the eclipse spectra, the majority of the latter being quite prominent.

The third table contains all the strongest lines (Int. 7 and 8) in Hasselberg's list of arc lines which are unenhanced. It is shown that only 7 out of 20 have corresponding eclipse lines. To three of these Frost gives no origin, to the others he gives compound origins, three of them involving titanium. In no case is the eclipse line as strong as the majority of those which are the representatives of the enhanced lines.

In the case of iron a similar analysis is given, but only over a limited region of the spectrum (λ 4500 to λ 4600) owing to the great number of lines in the iron spectrum. The same results are arrived at, viz., that the enhanced lines, though insignificant in the iron spectrum so far as intrinsic intensity is concerned, are, in the main, represented in the eclipse spectra by lines of abnormal intensity, whereas many of the stronger iron lines are either not represented at all, or only by weak lines.

"On the Arc Spectrum of Vanadium." By Sir Norman Lockyer, K.C.B., F.R.S., and F. E. Baxandall, A.R.C.S.

In this paper the authors give a list of lines in the arc spectrum of vanadium which have been measured from photographs taken at Kensington with a Rowland concave grating of 21½ feet focus and 14,438 lines to the inch. The region of the spectrum investigated extends from λ 3887 to λ 4932. The sources of the spectrum were (1) vanadium chloride, and (2) a pure sample of vanadium oxide supplied by Sir Henry Roscoe. These were volatilised in the arc between poles of the purest silver obtainable, and which were furnished by Sir W. C. Roberts-Austen.

The lines are compared with those published previously by Rowland (*Ast. Phys. Journ.* vol. vii. p. 273, 1898) and Hasselberg (*Svenska-Vetenskaps. Akad. Handl.* vol. xxxii. No. 2, 1899). The three records contain many lines in common, but there are also many differences between any two of them. The lines special to any one list have been analysed with the object of either properly establishing their claim to be accepted as true vanadium lines, or possibly tracing them to their true origin. Lines in the Kensington spectra which are due to impurities have been eliminated, as far as possible, by comparing the vanadium spectrum directly with those of forty-three other elements. They are twenty-nine in number, and are traces of the strongest lines only of Fe, Mn, Cr, Co, Ca, Al, Sr and Ag.

Forty-four lines occur in Rowland's list only; thirteen of these have been traced with certainty to impurities of Ca, Mn, Al, Pb or Sr. No origin other than vanadium has been found for the remainder. A list of lines is given which Rowland has previously identified with solar lines, but which, for some reason or other, are missing from his latest list of vanadium lines.

There are 194 lines which occur in the Kensington list only. No other origin has been found for them from a comparison of the vanadium spectrum with those of the forty-three metals which have been photographed on the same scale. As they appear both in the spectrum of the chloride and oxide they are probably genuine vanadium lines.

"The Growth of Magnetism in Iron under Alternating Magnetic Force." By Ernest Wilson. Communicated by Prof. J. M. Thomson, F.R.S.

The subject of the shielding effects of induced currents due to changes of magnetic induction in plates of iron has been dealt with theoretically by Profs. J. J. Thomson (*Electrician*, vol. xxviii. p. 599) and J. A. Ewing (*Electrician*, vol. xxviii. p. 631). The same subject has been attacked by experiment in the case of iron cylinders (*Phil. Trans.* R.S. A vol. clxxxvi., 1895, pp. 93-121, and *Journal* Inst. Elec. Engineers, vol. xxiv. p. 195), and the object of the present paper was to carry out further experiments with alternating magnetic force.

The magnet consists of a solid iron cylinder 12 inches in diameter and 18 inches long, around which the magnetising coil is wound. The magnet circuit is completed by means of a ring concentric with the cylinder and a circular slab of iron at each end.

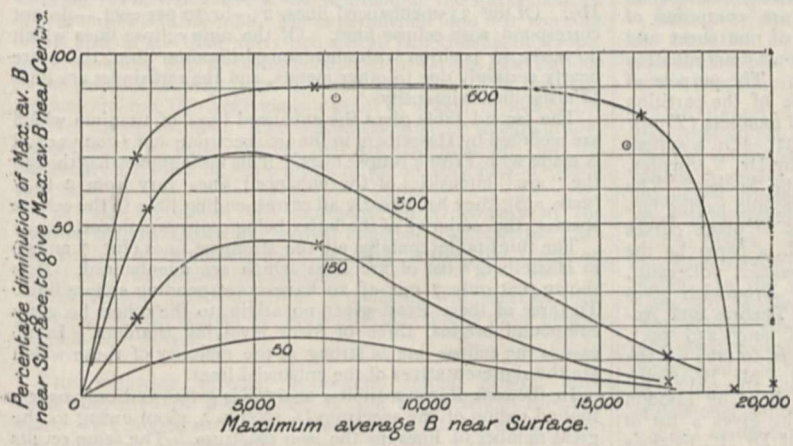


FIG. 1.

In order that changes of magnetism may occur at the centre of the cylinder it was necessary to employ alternating currents of long periodic time. Such times vary from 2·5 to 10 minutes in the experiments. It would be difficult to obtain such currents by means of electro-magnetic apparatus. A liquid reverser consisting of copper plates in dilute $CuSO_4$ solution was employed and gave satisfactory results.

For the purpose of observing the changes of magnetic induction at different points of the cylinder a series of holes were drilled in a plane perpendicular to the axis and half way along its length. Insulated copper wires were then threaded through these holes in such manner that each circuit enclosed an element of the cross-sectional area of the cylinder. Four such elements were enclosed between the centre and the circumference, and a fifth coil was wound completely round the cylinder, as it was required to take account of the average change of induction over the whole area. In the circuit of each of these five coils was placed a dead-beat galvanometer, the deflection of which enabled the E.M.F. to be observed. The epoch for the simultaneous observations of E.M.F. as well as the current in the magnetising coil was determined by the operator at the reverser counting seconds aloud. The E.M.F. curves were ultimately plotted in terms of time and integrated.

Before dealing with the experiments it may be stated that the results obtained are applicable to cylinders of other diameter than 12 inches. Similar electric and magnetic events will happen in cylinders of different diameters, but at times varying inversely as the square of their linear dimensions. Thus a periodic time of 10 minutes with the 12-inch cylinder corresponds to a frequency of 150 periods per second with a wire 1 mm. diameter.

Two variables have been dealt with, namely the frequency of the magnetising force H, due to the current turns in the copper coils of the magnet, and its amplitude. The figure gives one set of results obtained at 15° C. Each curve refers to a definite periodic time, and the number near it gives the frequency for a wire 1 mm. in diameter. The point of interest is that for a given frequency when the limits of the induction density, B, at the surface, are small, that is, the average permeability is small, the limits of B at the centre of the cylinder do not differ greatly from those at the surface. With larger limits of B at the surface, corresponding to a large average permeability, the limits of B at the centre are very much smaller than at the surface. Finally, when the limits of B at the surface are great, corresponding to a small average permeability, the limits of B at the centre are again more nearly equal to those at the surface.

Referring to the average induction over the whole core, that is, taking account of phase displacement as well as variation in amplitude, it may be stated that as the limits of B at the surface increase from zero, the maximum average B over the whole area grows less than B at the surface and then more nearly approximates to it. The curves are similar to those in Fig. 1, but the percentage diminution for a given frequency and a given value of B at the surface is not so great.

The magnet was heated to 53° C. and the effect was to tend to equalise the limits of B over the whole core. In the figure the points ⊙ were obtained when the magnet was at this temperature. The same maximum average B over the whole core is obtained with slightly less amplitude of magnetising force. On account of a greater phase displacement of the change of induction as the centre is approached, the maximum average B over the whole section is not greatly altered for a given maximum value of B at the surface.

Chemical Society, April 18.—Prof. Emerson Reynolds, president, in the chair.—The following papers were read:—Action of alkyl haloids on aldoximes and ketoximes. Part 2. Alkylated oximes and isoximes and the constitution of aliphatic oximes, by W. R. Dunstan and E. Goulding.—The supposed existence of two isomeric triethyloxamines, by W. R. Dunstan and E. Goulding.—Nitrocamphene, aminocamphene and hydroxycamphene, by M. O. Forster. On treating 1:1-bromonitrocamphane with silver nitrate, 1-nitrocamphene,

$$C_8H_{14}\begin{matrix}\diagup\!\!\diagdown CH \\ \diagdown\!\!\diagup C.NO_2\end{matrix},$$

is produced, and on reduction gives the corresponding 1-aminocamphene, $C_8H_{14}\begin{matrix}\diagup\!\!\diagdown CH \\ \diagdown\!\!\diagup C.NH_2\end{matrix}$. On heating the sulphate of this base with potassium nitrite it is converted into 1-hydroxycamphene, $C_8H_{14}\begin{matrix}\diagup\!\!\diagdown CH \\ \diagdown\!\!\diagup C.OH\end{matrix}$. This substance is of importance as being the enolic isomeride of ordinary camphor, into which it is converted by warm mineral acids.—A contribution to the chemistry of the triazoles, by G. Young and W. H. Oates. The authors discuss the possibility of isomerism in the triazole series as compared with the pyrazoles; they have prepared a number of substituted triazoles from the corresponding semicarbazones.—Researches on moorland waters. Part 2. On the origin of the combined chlorine, by W. Ackroyd. The author concludes that the common salt in the water of the Widdop reservoir in Yorkshire is derived from the winter rainfall.—Robinin, violaquercitrin and osyritrin, by A. G. Perkin. The composition $C_{33}H_{38}O_{20},8H_2O$ is now assigned to the glucoside

robinin, which on hydrolysis yields a colouring matter, $C_{15}H_{10}O_6$, identical with campherol. Osyritrin has the composition

$$2C_{27}H_{28}O_{16},H_2O,$$

and is identical with violaquercitrin.—Preparation of orthodimethoxybenzoin, and a new method of preparing salicylaldehyde methyl ether, by J. C. Irvine. An excellent yield of salicylaldehyde methyl ether is obtained by treating a mixture of salicylaldehyde and methyl iodide with dry silver oxide; it is converted into orthodimethoxybenzoin by potassium cyanate, and this is converted quantitatively into its methyl ether by methyl iodide and silver oxide.—Action of hydroxylamine on the anhydrides of bromonitrocamphane, by M. O. Forster.—On the estimation of cocaine and on diiodococaine hydriodide, by W. Garsed and J. N. Collie. On adding excess of decinormal iodine solution to a dilute solution of a cocaine salt, diiodococaine hydriodide, $C_{17}H_{21}NO_4,HI,I_2$, is precipitated and the excess of iodine may be determined by titration with thiosulphate solution.—Note on acetonylacetone, by T. Gray. The molecular refraction of acetonylacetone agrees with the value required for the ketonic formula.—Condensation of acetonylacetone with hydrazine hydrate, by T. Gray.—Preparation of synthetical glucosides, by H. Ryan and W. S. Mills. Acetochlorogalactose reacts with α-naphthol and potash yielding α-naphthylgalactoside, $C_6H_{11}O_5.O.C_{10}H_7$. Metacresylglucoside is similarly prepared from acetochloroglucose and metacresol.—The influence of cane sugar on the conductivities of solutions of potassium chloride, hydrogen chloride and potassium hydroxide; with evidence of salt formation in the last case, by C. J. Martin and O. Masson.—The aluminium-mercury couple. Part 3. Chlorination of aromatic hydrocarbons in presence of the couple. The constitution of the dichlorotoluenes, by J. B. Cohen and H. D. Dakin.—A modification of Gutzeit's test for arsenic, by E. Dowzard.—On the chemistry of *Nerium odorum*, by R. C. L. Bose. In addition to neriodorein and neriodorin, already known to exist in the plant, the author has extracted a new resin-like substance from the sweet-scented oleander, *Nerium odorum*; this has the composition $C_{21}H_{49}O_6$, and is named karabin.—Change and interaction in organic compounds, by A. Lapworth.—The mechanism of the Claisen reaction, by A. Lapworth.—A new series of di-mercuri-ammonium salts, Part 1, by P. C. Rây. Ammonia acts on mercuric nitrite giving a di-mercuri-ammonium nitrite of the composition

$$2NHg_2NO_2,H_2O.$$

This yields salts of the types $NHg_2Cl,4HCl$ and $2NHg_2Cl,H_2O$, with the halogen acids.

Royal Microscopical Society, April 17.—Mr. Wm. Carruthers, F.R.S., president, in the chair.—Mr. Enock gave a demonstration on the metamorphoses of one of the dragon flies, *Æschna cyanea*. In his endeavours to obtain a complete set of photographs from life which would show every stage in the metamorphoses of the nymph of the dragon fly he had taken over 1000 photographs before he was successful; those he was about to show were taken from the same individual and recorded every stage of the process, which occupied a period of six hours only. Considerable patience and constant watching were required, as after the first indication of change was noticed the dragon fly might emerge at any time in the following three days, and when the process of emergence began it went on rapidly, so rapidly, in fact, that three photographs were taken within the space of six seconds. Mr. Enock then showed on the screen photographs of a nymph to illustrate the remarkable movements of the mask by which the insect was enabled to capture its prey. These were followed by a series of about thirty slides, illustrating every stage of the metamorphosis from the nymph to the perfect insect.—Mr. Nelson exhibited a slide of podura scales under polarised light.

Royal Meteorological Society, April 17.—Mr. W. H. Dines, president, in the chair.—Mr. W. Marriott read a paper on the special characteristics of the weather of March 1901. From March 1 to the 12th or 13th the temperature was slightly above the average, the prevailing winds being from the south-west and often strong in force. About the 13th a change set in, when north-easterly winds became predominant and low temperatures prevailed. This continued with increasing intensity until the 29th, the last two days of the month being nearly of average temperature. The most remarkable period of the month was the five days from the 25th to 29th, when the temperature was more than 10° below the average all over the country. The north-easterly winds were strong in force and particularly keen and dry. At the Greenwich Observatory the relative humidity was only 52 per cent. on the 26th and 54 per cent on the 27th. The only other instance during the past 54 years of as low a relative humidity in the month of March was on March 1, 1886. In consequence of this keen and cold weather, vegetation was at a standstill. Snow showers were frequent but not very heavy, except on the 20th in the south-west of England, when on Dartmoor nearly as much snow fell as in the great blizzard of March 1891; and on the 29th, when a very heavy fall of snow and rain occurred in the north-west of England and Wales. Although the death-rate was below the average, there was a considerable increase in the deaths due to diseases of the respiratory organs.—A paper by Mr. R. Strachan, on vapour tension in relation to wind, was also read.

Anthropological Institute, April 23.—Prof. A. C. Haddon, F.R.S., in the chair.—Specimens of Neolithic implements from the Wilts border of Berkshire were exhibited by Mr. L. J. Shirley.—Mr. Franklin White exhibited stone implements, pottery and silver ornaments from Central Rhodesia; he then read a paper on the ruins of Dhlo-Dhlo, or Mambo, illustrated by lantern slides, photographs and plans. The author gave a detailed description of the nature, dimensions, ornamentation and state of preservation of the ruins, and showed that the theories of the late Mr. Theodore Bent with regard to the Zimbabye ruins would not apply to the ruins of Dhlo-Dhlo, the orientation and other details depending mainly on the character of the ground.—Papers on the Baganda, by Rev. J. Roscoe, and on folktales of the New Hebrides, by Mr. S. H. Ray, were taken as read.

MANCHESTER.

Literary and Philosophical Society, April 23.—Prof. Horace Lamb, F.R.S., president, in the chair.—Dr. Elie Metchnikoff, Paris, was elected an honorary member of the society. Mr. Charles Bailey was elected president of the Society for the session 1901-2.—Prof. S. J. Hickson communicated two papers by Miss E. M. Pratt, upon a collection of Polychaeta from the Falkland Islands, and some notes on the bipolar theory of the distribution of marine organisms. In the first paper Miss Pratt described a small collection of Polychaeta collected in shallow water off the shores of the Falkland Islands. There are no new species, but considerable interest attaches to certain forms which are new to the southern hemisphere, amongst them being *Arenicola claparedii*, now recorded for the first time outside the northern temperate region. The second paper contained a review of the facts of zoology bearing upon the theory that the marine organisms found around the two poles of the earth have been derived from a common or universal fauna, which existed in the past history of the world, at a time when the seas were of a more uniform temperature. It was shown that the evidence in favour of the theory is increasing rapidly, and our knowledge of the details of anatomy of the north and south representative species reveals a closer relationship between them than might have been anticipated.

PARIS.

Academy of Sciences, April 29.—M. Fouqué in the chair.—On the mechanical compensation of the rotation of the optical field furnished by the siderostat and heliostat, by M. A. Cornu. The theoretical solutions of this problem given by Turner and by Lippmann have been anticipated practically by M. P. Gautier, who has devised a simple mechanism for moving the photographic plate with an angular compensating movement sufficiently precise to obtain a good negative with a short exposure (see p. 42).—On the use of oxygen in ascents at great heights, by M. L. Cailletet. A description of an apparatus by means of which liquid oxygen can be used by aëronauts. Its great practical service was demonstrated in a balloon ascent of 5500 metres.—On the stability of a system having a movement of rotation, by M. P. Duhem.—M. Zeiller was elected a member in the Section of Botany in the place of the late M. A. Chatin.—On a generalisation of a definite integral, by M. H. Lebesgue.—On the analytical integrals of differential equations of the first order in the neighbourhood of initial singular conditions, by M. Henri Dulac.—On the equations of certain groups, by M. de Seguier.—On the laws of Belgrand and the formulæ for the delivery of a water-course, by M. Edmond Maillet.—The isochores of ether from 1·0 to 1·85 c.c., by M. Edouard Mack. The experiments confirm the law of Amagat that at constant volume the pressure is a linear function of the temperature.—On the measurement

of the period of electric oscillations by the rotating mirror, by M. L. Décombe. A discussion of the precision to be obtained by means of the rotating mirror method and a criticism of results previously published on the same subject by M. Tissot. —On the band spectrum of nitrogen in the oscillating spark, by M. G. A. Hemsalech. It is shown that the band spectrum obtained with the oscillating spark with certain metals is identical with the band spectrum of nitrogen at the negative pole.—The rapid measurement of surface tensions, by MM. Ph. A. Guye and L. Perrot. A study of the conditions under which the method of falling drops gives accurate results for the surface tension of liquids.—On the variation of composition of mineral waters and of spring waters as brought out with the aid of the electric conductivity, by M. P. Th. Muller. The composition of a water having been once determined chemically any variation of its composition from time to time can be most easily detected by determining its electrical conductivity.—On myrcenol and its composition, by M. Ph. Barbier. By studying the oxidation products of this substance it would appear to have the same constitution as that attributed to licareol by Tiemann, but as the physical and chemical properties of myrcenol are altogether distinct from those of licareol it is necessary to reconsider the formula attributed to the latter substance.—On ethyl nitroacetate, by M. A. Wahl. Since the substance obtained by the action of ammonia upon ethyl nitro-dimethylacrylate gave an ethyl nitroacetate which was not identical with the specimen obtained by M. de Forcrand, an attempt was made to prepare this compound by an independent method. The decomposition of ethyl nitromalonate by boiling with potash was finally found to give the compound sought for, which agreed in its properties with the ester previously prepared by the author, but differs from the nitroacetate of de Forcrand.—The preparation of the isomeric ortho-, meta- and para-nitrobenzoylcyanacetic esters and of orthonitrobenzoyl chloride, by M. Mavrojannis.—A new reaction of saccharin, by M. Alex. Leys.—On the migration of nitrogenous and ternary matters in annual plants, by M. G. André.—On the *Voandzou*, by M. Balland. An analysis of the seeds of this plant showed that the proportions of fat, nitrogenous material, starch and ash are exactly those required for human food. It is the first example of a natural product presenting the chemical characteristics of a perfect food.—Contribution to the microchemical examination of alkaloids, by M. M. E. Pozzi-Escot.—On the phenomena of histolysis and histogenesis accompanying the development of the endoparasitic Trematods of terrestrial mollusca, by MM. Vaney and A. Conte. —On the evolution of the blastodermic leaflets in the Nematods, by M. A. Conte.—On a new subfamily of marine Hemiptera, the *Hermatobatinae*, by MM. H. Coutière and J. Martin.—Researches on the physical constants which influence the electrical stimulation of the nerve, by M. Georges Weiss.—The direct measurement of the wave-length in a nerve following short electrical stimulations, by M. Aug. Charpentier.—Some remarks on the otoliths of the frog, by M. Marage.—The influence of the sterilisation of the medium, the air respired and the food absorbed upon the animal organism, by MM. Charrin and Guillemonat. The comparative experiments upon guinea-pigs would tend to show that the absence of bacteria in the air and food is distinctly prejudicial to the animal, which loses its vitality and resisting power to disease.

DIARY OF SOCIETIES.

THURSDAY, MAY 9.

ROYAL SOCIETY, at 4.30.—Discussion of Special Report.

MATHEMATICAL SOCIETY, at 5.30.—(1) A Case of Algebraic Partitionment; (2) On the Series whose Terms are the Cubes and Higher Powers of the Binomial Coefficients: Major MacMahon, R.A., F.R.S.—A Property of Recurring Series: G. B. Mathews, F.R.S.—The Product of Two Spherical Surface Harmonic Functions: J. B. Dale

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Storage Batteries in Electric Power Stations, controlled by Reversible Boosters: J. S. Highfield.

IRON AND STEEL INSTITUTE, at 10.30.—Annual Meeting.

FRIDAY, MAY 10.

ROYAL INSTITUTION, at 9.—The Response of Inorganic Matter to Mechanical and Electrical Stimulus: Prof. J. C. Bose.

PHYSICAL SOCIETY, at 5.—Applications of Elastic Solids to Metrology: Dr. C. Chree, F.R.S.—The Thermal Properties of Isopentane compared with those of Normal Pentane: Prof. S. Young, F.R.S., and J. Rose-Innes.

SOCIETY OF ARTS, at 8.—Polyphase Electric Working: Alfred C. Eborall.

MALACOLOGICAL SOCIETY, at 8.—Description of a New Species of Voluta from Natal, with a List of the Known Forms of Volutidæ from South Africa: E. A. Smith.—Description of a New Species of Voluta, *Cymbiola mangeri*: H. B. Preston.—On Three New Operculates (Cyclotus) from Columbia: S. I. Da Costa.

ROYAL ASTRONOMICAL SOCIETY, at 5.—Results of Double Star Measures made at Windsor, New South Wales, in the Years 1899 and 1900: John Tebbutt.—The Visual Spectrum of Nova Persei: Rev. A. L. Cortie.—The Spectrum of Nova Persei, Note 4: Rev. W. Sidgreaves.—*Probable Papers*: Additional Note on the Position of Nova Persei, and a Comparison of Photographic Magnitudes of Neighbouring Stars with those of Father Hagen's Chart and Catalogue: F. A. Bellamy.—The Cambridge Machine for Measuring Celestial Photographs: A. R. Hinks.—Further Observations of the New Star in Perseus: Radcliffe Observatory, Oxford.

SATURDAY, MAY 11.

ROYAL INSTITUTION, at 3.—The Rise of Civilisation in Egypt: Prof. W. M. Flinders Petrie.

MONDAY, MAY 13.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Survey in Baffinland: Dr. Robert Bell, F.R.S.—Explorations in the Great Bear Lake Region: J. Mackintosh Bell.

SOCIETY OF ARTS, at 8.—Alloys: Sir W. C. Roberts-Austen, K.C.B., F.R.S.

TUESDAY, MAY 14.

ROYAL INSTITUTION, at 3.—Cellular Physiology: Dr. A. Macfadyen.

WEDNESDAY, MAY 15.

ROYAL METEOROLOGICAL SOCIETY, at 4.30.—The Periodicity of Cyclonic Winds: Rupert T. Smith.—An Account of the Bequest by the late G. J. Symons, F.R.S., to the Royal Meteorological Society: William Marriott.

ROYAL MICROSCOPICAL SOCIETY, at 8.—Exhibition of Aquatic Life.

SOCIETY OF ARTS, at 8.—Syntonic Wireless Telegraphy: Guglielmo Marconi.

THURSDAY, MAY 16.

CHEMICAL SOCIETY, at 8.—The Nutrition of Yeast, Part III.: Dr. A. L. Stern.—Derivatives of Methylfurfural: H. J. H. Fenton and Miss Mildred Gostling.—The Preparation and Optical Inversion of Optically Active Nitrogen Compounds. dextro- and Lævo-α-benzylphenyl-allylmethylammonium Salts: W. J. Pope and A. W. Harvey.

FRIDAY, MAY 17.

ROYAL INSTITUTION, at 9.—Turkish Kurdistan: Earl Percy.

SOCIETY OF ARTS, at 8.—Polyphase Electric Working: A. C. Eborall.

SATURDAY, MAY 18.

ROYAL INSTITUTION, at 3.—Rise of Civilisation in Egypt: Prof. W. M. Flinders Petrie.

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