THURSDAY, FEBRUARY 1, 1900.

A YEAR OF BIOLOGY.

L'Année Biologique. Comptes rendus annuels des Travaux de Biologie générale, publiés sous la direction de Yves Delage, professeur à la Sorbonne, avec la collaboration d'un comité de rédacteurs, Secrétaire de la rédaction Georges Poirault, directeur du Laboratoire d'enseignement supérieur de la villa Thuret, à Antibes. Troisième année, 1897. Pp. xxxv + 842. (Paris: Librairie C. Reinwald, Schleicher Frères, éditeurs. 1899.)

THIS biological annual has improved with each year of its life, and its third volume, which deals with the literature for 1897, commands our admiration and gratitude. There is no denying that the bibliographic lists are fairly full, and that the summaries give the gist of the books and papers reported It fills what was otherwise more or less of a gap in our bibliographic resources, and every biological laboratory throughout the world should make it a point of honour to have the volumes upon the shelves for reference. Furthermore, the work is being so well done that all those who are busy over the general problems of biology should see to it, in their own interest, as well as in that of science, that copies and abstracts of their papers are sent to the editors.

Believing that criticism is the sincerest form of flattery, we would use this opportunity to make a few suggestions. The "Annual" has not only improved every year, but it has grown steadily bigger, and it is now a most inconveniently heavy handful. Can it not be kept within more moderate compass? On this point we have three criticisms: (1) That over 160 pages are given to mental functions, which seems going a long way, seeing that we have *L'Année psychologique* as well; (2) that some of the reports are outrageously long, especially when the conclusion hinted at is that the paper is not worth very much after all; and (3) that the classification adopted favours overlapping and repetition. The last point seems to us so important that we venture to enlarge upon it.

As they stand at present the chapters are:—the cell; sex-elements and fertilisation; parthenogenesis; asexual reproduction; ontogeny; teratogeny; regeneration; grafting; sex, secondary sex-characters, and "ergatogenetic polymorphism"; metagenetic polymorphism, metamorphosis, and alternation of generations; latent characters; correlation; death, immortality, and the germ-plasm; general morphology and physiology; heredity; variation; origin of species; geographical distribution; nervous system and mental functions; general theories and generalities. Now, as each of these twenty chapters has its bibliography and introduction and summaries, there is bound to be needless printing and overlapping. Can the committee not invent something simpler and more logical? It is too soon to stereotype the arrangement.

Teratogeny and variation overlap; variation and the origin of species overlap; ontogeny and general physiology overlap; latent characters and heredity overlap; and so on. In short, there is a great lack of lucidity in the classification adopted.

Would it not be better to have a more general scheme? *e.g.* (1) morphological analyis:—cell-structure, tissue-structure, &c.; (2) physiological analysis:—cell-function, growth, correlation, death, &c.; (3) reproduction and sex—including chapters 2, 3, 4, 9, and perhaps others; and so on. There is room for much difference of opinion, but twenty chapters are twice too many.

It may be answered that the numerous divisions facilitate reference, but the separately designated subjects would not be less accessible if they were sub-divisions of larger categories. We would press this point on the consideration of the editorial committee the more urgently, since it seems to us that the elaborate classification has sometimes proved a snare. Thus we should like to know why papers by Karl Pearson and others dealing with "spurious correlation," &c., are included in the chapter on physiological correlation. Is not this a misapprehension?

In the same connection we may refer to the editorial note on polymorphism, which we regret our inability to appreciate. Three kinds of polymorphism are distinguished (which are treated of in three different chapters)—(*a*) ergatogenic polymorphism which depends upon division of labour (which should include not only the polymorphic adaptations of an ant-hill, but functional "modifications" as well); (*b*) metagenic polymorphism, associated with alternation of generations; and (*c*) œcogenic polymorphism which results from the action of the environment (a particular case, surely, of environmental "modification"). But why not also add variational polymorphism, which would be a *reductio ad absurdum* of the extended usage of the term?

Many of the chapters present some striking feature of interest, giving a charm of individuality to the workmanship. Thus the chapter on the cell includes an account by A. Labbé of the artificial cells which Ascherson made in the memorable year 1838. With his artificial emulsions he was a pioneer on a path which Bütschli and others have followed up, "and if he sought for homologies where there were but analogies, some moderns are open to the same reproach." The second chapter contains an essay of twenty pages by L. Guignard on chromatic reduction, which is very welcome; but the bulk of it has been printed elsewhere, and it seems far too long to be consistent with the precise scope of this annual. We are ungrateful enough to object also to Pruvot's fine essay on fresh-water faunas as too long and independent for the present publication. The thirteenth chapter is made conspicuous by the essay of Élie Metchnikov on senile degeneration, showing up the organism's seamy side—its imperfect integration, its anarchy, its struggle of parts—of which senility is the *débâcle*. Needless to say, the essay is original and charming; but to our thinking, it should have been published in the *Revue des deux Mondes*, and not here. It is magnificent, but it is not a "compte-rendu." We fear, indeed, lest these introductory essays, if not kept more sternly within bounds, will harm the annual instead of helping it.

As for criticisms of technique, they are not much to our liking, especially since the volume represents a portentous amount of disinterested labour, the results of which are of great value to all biological workers. There

has been great improvement, but it must be confessed that there is still need of increased carefulness. Thus, if we take (quite at random) p. 792, we have a paper by Bütschli stated to extend from p. 291 to p. 593 of the *Arch. Entwickmech.*, which is incredible; Haacke's text-book called a Grunddiss; Hertwig's "Streitfragen" wrongly spelt; Hickson's paper on the medusæ of Millepora cited where it seems irrelevant—trivial mistakes all of them, but too many for one page, and it is so elsewhere. All the same, this third volume of "L'Année Biologique" is a fine piece of work, and every biologist will wish it the success it deserves. J. A. T.

AN ARITHMETICAL MISCELLANY.

Exercices d'Arithmétique. Par J. Fitz-Patrick et G. Chevrel. Deuxième édition. Pp. xiv + 680. (Paris: A. Hermann, 1900.)

THIS second edition of a very entertaining book differs from the first by the inclusion of more than 500 new and unsolved examples, and a supplement on commercial arithmetic, which, no doubt, will be found very useful by the French schoolmaster, but is so incongruous with the rest of the work as to recall Horace's well-known parable of the mermaid and its analogues in literature and art.

Apart from this concession to the practical, the authors, largely imbued with the spirit of Edouard Lucas, have provided their readers with a varied store of illustrations of Diophantine arithmetic and of numerous fundamental propositions in the theory of numbers. Their solutions are very clear and simple (though they might, with advantage, have made more use of the notation of congruences), and they will undoubtedly succeed in promoting a more general and intelligent interest in the theory of arithmetic.

Many of the examples are of a very elementary character; but there are some which deserve the attention of expert mathematicians. For instance (p. 366), we have Lucas's determination of *all* the prime factors of $(a^{1265} - b^{1200})/(a - b)$, where a, b are the roots of $x^2 = x - 2$; the last five of these primes being

125541359, 25215201901, 34449677641, 153790567559, 733268745721.

This result is said to have been verified by M. Le Lasseur. Again (p. 158), the Rev. Father J. Pervouchine, of Perm, has found that $2^{2^{23}} + 1$, comprising 2525223 digits, is divisible by 167772161 ($= 5.2^{25} + 1$), which is prime. Here are mysteries which we must leave to Lieut.-Colonel Cunningham and Mr. Bickmore to unravel.

An agreeable element of humour is supplied by Question 399, on the interpretation of Art. 757 of the Civil Code; that ambiguous drafting is not wholly unknown on the other side of the Channel is a surprise which is not without its consolations.

It would be tedious to detail even the more conspicuous features of this handsome volume; enough to say that every student of arithmetic will find in it something to arouse his interest and extend his knowledge. If he is a novice, the study of this book will help him to appreciate the works of at least the earlier masters, such as Euler and Lagrange; if he is a veteran, he will find recreation in turning over its pages in his leisure moments.

There is one reflection which a perusal of the work can hardly fail to suggest. The province of arithmetic is so definite that one would expect its methods to be marked by a general uniformity. But this is far from being the case; and there is, in particular, an unmistakable contrast between Diophantine arithmetic and the severe, but noble science founded by Lagrange, Gauss and Kummer, which we may distinguish as the analytical theory of numbers. Their points of contact in such things as the elementary theory of congruences and of residues only serve, at present, to accentuate their divergences; it may almost be affirmed that they appeal to different classes of mind. To use a metaphor, we may say that one is the primitive gold-mining of the individual prospector, the other the systematic working of a quartz reef with the help of modern machinery. Just now the analytica method holds the field; there are several reasons for this—the development of the theory of algebraic integers, the influence of function-theory, the general "arithmeticising" of analysis; but a reaction is almost certain to come. It must be remembered that all the available evidence seems to show that Fermat's methods were essentially Diophantine; and there is very good reason to believe that he was in possession of some peculiar analysis, the secret of which died with him and still awaits rediscovery. Whether this is so or not, there can be no doubt that the cultivation of Diophantine methods deserves more attention than it receives. The risk of failure is great; but the chance of finding a treasure island exists, and ought to appeal to that spirit of adventure which dwells in every mathematician who is worthy of the name. G. B. M.

MISSIONARY ANTHROPOLOGY.

In Dwarf Land and Cannibal Country. A Record of Travel and Discovery in Central Africa. By A. B. Lloyd. With an introduction by the President of the Church Missionary Society. Pp. xxiv + 385. (London: T. Fisher Unwin, 1899.)

FURTHER information regarding the dwarfs of the north-eastern part of the Congo Basin is one of the main desiderata in African anthropology. We therefore turned to this volume hoping, from its title and size, for detailed measurements of these dwarfs, convincing evidence as to whether they belong to several tribes or are all clans of one tribe, and for further light on their beliefs and folklore. But we are disappointed, for the book adds practically nothing to our knowledge of this group of dwarfs, and the title is misleading. The book narrates the story of Mr. Lloyd's missionary labours and adventures from July 14, 1894, to the end of 1898; most of these three and a half years were spent in the Uganda Protectorate, and the author's acquaintance with the Congo dwarfs was obtained between October 6 and 15, 1898. The account of his experiences with this people occur only within some seventeen pages, whereas 368 are devoted to "Out of Dwarf Land."

The bulk of the book is occupied with an account of

Mr. Lloyd's voyage from England to Zanzibar *via* the Cape; of his journey from Zanzibar to Uganda by the German road; of his residence in Uganda and of his share in the operations against our unfortunate Soudanese troops, in which he and his colleagues took a prominent part, although, as the author remarks, "the honours and distinctions that were showered upon the military section did not reach the missionaries"; and finally of his plucky march across the Ituri forests to Ugarrowa (where Stanley first met with his dwarfs in this region), and return home down the Aruwimi and the Congo.

Mr. Lloyd's hurried march gave him few opportunities of studying the dwarfs, so that he adds little to the descriptions of Stanley, Stuhlmann, and Burrows. The only point worthy of notice is that his evidence supports the belief that the pygmies have a fetish worship. It is not clear from Mr. Lloyd's account what clan or tribe of pygmies he met with. How much has been lost by Mr. Lloyd's haste can be gauged from his remarks elsewhere on African customs. He looks on anthropological questions from a typically missionary standpoint. He has a low opinion of the "average African," whose universal laziness he deplores. He describes the aim of the Watoro festivals as "the indulgence in all the evil passions of human nature, fighting and murder, lasciviousness and wanton wickedness. Devil dances of a most disgusting character, witchcraft and fetishism are all practised upon these occasions, and it is at such times that one sees the utter degradation of heathenism." The customs of these Watoro "are most barbarous. For instance, they have an extraordinary practice of breaking off all the front teeth in the lower jaw"; this is "a thoroughly heathen practice."

Mr. Lloyd's contributions to the natural history of Central Africa are more startling than numerous. On p. 107 he gives us a photograph of a "boa constrictor" killed on Ukerewe, one of the islands in the Victoria Nyanza.

The main value of this book is its unwilling witness to the vast improvement effected in the Congo Basin since the establishment of the Congo Free State, twenty years ago. For instance, Mr. Lloyd was able to cross from the eastern frontier to the Atlantic in only a trifle over two months; he marched safely through the forests with a party of nineteen men; he found the cannibals of the Bangwa tribe always friendly, and remarks "that a jollier set of black men I never in all my life had to do with." This testimony as to the revolution of social conditions is the more striking because the author is even more critical of the Congo Free State than he is of the militarism of the Germans and the ritual of the Universities' Mission at Zanzibar.

TELEPHOTOGRAPHY.

Telephotography. By Thomas R. Dallmeyer. Pp. xv+148. (London: William Heinemann, 1899.)

IN this handsome volume all that is at present known about the theory and practical use of the telephotographic lens is brought together. Mr. Dallmeyer, as our readers may remember, was one of the first who tried to discover an arrangement of lenses which would produce an enlarged image of any distant object on the ground glass of a camera without any excessive length of camera, and the success which rewarded his labours is now well known.

It is interesting to remark that the author's attention was first directed to this subject by Dr. P. H. Emerson, who, as we are told in the preface, urged upon him "the necessity of a photographic instrument to enable the naturalist to record incidents that were then only possible by telescopic observation."

In the year 1892 Mr. Dallmeyer published a small pamphlet containing an interesting collection of papers that had been published relating to his new telescopic photographic lens, and he included in this numerous pictures illustrating the application to the photography of distant objects. This we understand is now out of print. The present volume will therefore be very acceptable to all who use, or intend to use, this form of lens, especially when one is reminded by Mr. Dallmeyer that, with the exception of one or two articles on the practical application of the lens by Mr. Lodge, Mr. Marriage, and Dr. Spitta, the subject has not been handled by any other English writer.

The author, in his treatment of the subject, introduces the reader first to the elementary properties of light; he then discusses the formation of images by the pin-hole camera, pointing out some valuable hints relative to the rendering of true perspective effects that may be gained from a study of the images obtained with such an instrument. The next two chapters deal with the formation of images by positive and negative lenses, and these serve as an excellent introduction to the following chapters, in which are described the methods of obtaining enlarged images by employing either two positive lens-systems or a combination of a positive and negative system, which constitutes the telephotographic lens.

From the theoretical the author turns to the practical side of the subject, and in the succeeding chapters he describes the use and effects of the diaphragm, practical applications and working data, concluding with a brief bibliography.

Quite a distinct feature of the volume is the fine series of illustrations, which brings out vividly, and more than mere words can describe, the great practical use of this form of lens, not only to the stay-at-home photographer, but to those whose duties lie in various directions. Nearly all the plates illustrate views taken, for the sake of comparison, with both the ordinary lens and the telescopic lens. Among these we find portraits which illustrate the value of this lens for obtaining correct perspective effects in the studio, enlarged pictures of the human eye, eclipse pictures, glaciers photographed at a distance of ten miles, views of an encampment taken from a balloon at a height of 800 metres, a photograph of a grounded man-of-war taken during war time at a distance of two miles, and lastly, reproductions of Mr. Lodge's excellent studies of birds and their nests. The variety of the illustrations gives one an idea of the numerous useful and valuable applications to which such a lens is specially adapted.

The now great popularity and wide use of the tele-

photographic lens makes us more than welcome Mr. Dallmeyer's book, which, besides supplying a distinct want, will be found a handsome and valuable addition to any photographic library. W. J. S. L.

NEW DATA FOR THE STUDY OF VARIATION.

Ueber einige Aberrationen von Papilio machaon. Von Dr. J. W. Spengel, Professor der Zoologie in Giessen. Pp. 48 Mit 3 Tafeln und 5 Abbildungen im Text. (Jena: Gustav Fischer, 1899.)

IT would be almost superfluous at the present time to offer an apology for the intimate study of variation in animals and plants. Evolutionists of whatever school of thought must necessarily be agreed upon the importance of variation as a factor in the production of new forms, though they may differ widely as to the means by which fresh species become established. In the present state of evolutionary theory it is of the utmost consequence to gain an insight into the laws which regulate variation, and this can only be done by the accumulation of accurate records of the results of experiment and observation. Many views on the subject are current, not one of which can be said to deserve more than a provisional acceptance, and all require to be rigorously tested in the light of facts. Hence any competent observer who—like Bateson, Standfuss, Merrifield and others—devotes himself to laboriously collecting and carefully recording data for the study of variation, whether natural or artificial, deserves well of all those who are interested in the progress of evolutionary theory.

The present treatise is a useful contribution to the mass of material that has lately been accumulating with reference to variation and aberration in the Lepidoptera. It was long ago pointed out by Bates and Wallace, and has often been insisted on since, that to the students of evolutionary law the wings of butterflies afford an unusually favourable field of observation. The days are gone by when the colour-patterns of insects were regarded as mere elegant curiosities, with no particular bearing on any question of scientific interest; and when deviations from the ordinary aspect of the species might be prized indeed by the collector for their rarity, but were thought to be beneath the notice of the genuine biologist. It is now fully recognised in most quarters that there is no real distinction to be drawn between "external characters" and points of structure; and, further, that while both sets of features are equally under the control of natural law, there are many principles of the first importance whose operation is more clearly discerned and more readily investigated in the former than in the latter. During the last few years much greater attention has been directed to the phenomena presented by colour-patterns than was previously the case; and many observers, both in this country and abroad, among whom may be reckoned Weismann, Eimer, Scudder, Mayer, Haase and Piepers, have attempted, with more or less success, to trace the history of existing patterns, and in some cases to formulate the laws under which certain changes of type have been brought about.

The author of the communication before us has occupied himself for many years with the study of natural variation in the "swallow-tail" group of the genus Papilio. The results of his investigation of over 2000 specimens still await publication; but in the meantime he has here put on record a very exact description of several forms of the common swallow-tail (*Papilio machaon*), mainly from the collections of Staudinger, Kratz, Standfuss and the Hon. W. Rothschild, which come rather under the head of aberration than of ordinary variation. Some of these have been the result of temperature-experiments, but the greater number have occurred under normal conditions in the open. Dr. Spengel makes no attempt to found any theoretical considerations on the deviations they present, but restricts himself to a statement of fact which, in point of fulness and accuracy, contrasts very favourably with the haphazard descriptions at one time thought sufficient. For details, the reader must refer to the treatise itself; but we may here draw attention to the co-existence of structural with colour-abnormality shown in the remarkable aberration described on pp. 9–16.

The figures are good, and greatly assist in the comprehension of the text. The author's system of nomenclature for the elements of the pattern is easily intelligible, and may be followed without difficulty through the pages of description. As a contribution to the stock of material hitherto available, Dr. Spengel's treatise, though limited in its scope, is of considerable value; and his further analysis of natural variation in allied forms will be awaited with interest. F. A. D.

OUR BOOK SHELF.

A. Koelliker's Handbuch der Gewebelehre des Menschen. Sechste umgearbeitete Auflage. Dritter Band. Von Victor v. Ebner. Erste Hälfte. Verdauungs-organe, Respirations-organe, &c. Pp. vi + 402. (Leipzig: W. Engelmann, 1899.)

FOR the first time in its history the "Handbook of Histology" of the famous Würzburg professor of anatomy appears with the name of an editor upon its title-page in place of the octogenarian master whose book, when it first made its appearance in the 'forties, created an epoch in the history of histological literature, and was made familiar to English readers by its translation by George Busk and Thomas Henry Huxley. The work was a mine of original investigation, and served for many years as a quarry which furnished the materials for the building up of many an account of the structure of the body, in which the source of information was too often, it is to be feared, ignored. In later editions the general style of the book became somewhat altered, as it became necessary for the author to refer to facts regarding microscopic structure which were becoming added by others as well as by himself; and it must be admitted that, while the book thereby accumulated a greater amount of information, it became less readable and unquestionably less original. Nevertheless, the parts of this last edition which have already appeared have fully maintained the place which v. Kölliker's "Gewebelehre" had taken as the first authority upon the subject of which it treats.

In Prof. v. Ebner's hands the character of the rest of the work has been so maintained, and even the literary style so closely imitated, that it would be difficult to detect the alteration in authorship. The amount of labour involved in producing a work of this kind can only be roughly guessed at by those who have never themselves undertaken the task, and Prof. v. Ebner is to be

congratulated upon the success which has attended his labours, which it would appear from the preface have extended over three years. The added illustrations are singularly true to nature, and as numerous as could well be desired The bibliography is somewhat limited for a work of this kind, and it would have been worth an effort to render the list of works bearing upon the structure of each organ as complete—at least, so far as recent years are concerned—as possible. Nevertheless, important papers are looked for in vain amongst the references. And the lack of an index cannot be too strongly condemned. For it is impossible to understand what object can possibly be served by dispensing with that part of a book the absence of which renders difficult the proper employment of all the rest! Why is it that it is only in German books that we still find this unaccountable tendency to omit the all-important index? Echo can only answer, Why indeed? They do not manage these things better in Germany. But they are beginning to improve.

The Evolution of Geography. A Sketch of the Rise and Progress of Geographical Knowledge from the Earliest Times to the First Circumnavigation of the Globe. By John Keane. Pp. xvi + 160. (London: Edward Stanford, 1899.)

THE second title is more descriptive than the first, which suggests a much more ambitious scheme than the author had before him. This little book makes no claim to originality in matter or method. It is a compilation from accessible sources, and, so far as it goes, is a piece of careful and conscientious work. It is neither critical nor learned, and it would be unfair to review it as if it pretended to such distinction. The chapters are concerned mainly with the history of discovery under the titles of ancient geography, the early Christian ages, the crusading impulse, early and mediæval maps, Henry the Navigator, aids to geographical expansion, and Magellan. The statements of generally acknowledged facts are accurate as a rule, and controversial matters are usually excluded. Mathematical and physical geography do not receive adequate notice, even for so small a scale as is employed.

The first part of the title of the book led us to hope for a philosophical study of the science of geography, and its rise from the earliest times to its present stage of development; but such a work is still to write. Still to write also are studies of early Chinese and Hindu geographical knowledge; indeed, the whole working of the early Oriental mind on geographical problems offers a nearly virgin field, but one that can only be entered by an author well-versed in modern geography and in Eastern languages.

In the present modest work the best feature is undoubtedly the collection of maps, most of them reproduced from previously published English books, but some now shown for the first time in outline on a small scale. It is hard to believe that Magellan's ship, the *Victoria*, really bore her name all along the side in huge letters like a modern light-ship, as the frontispiece shows; but the responsibility for this is relegated to Levinus Hulsius, who published the original drawing in 1602. H. R. M.

First Steps in Earth-Knowledge; being an Introduction to Physiography (Section I.). By J. A. Harrison, B.Sc. Edited by W. J. Harrison. vi + 290 pp. (London: Blackie and Son, Ltd., 1899.)

As the German term "Erdkunde," or its literal rendering, "Earth-Knowledge," signifies something different from an elementary treatment of the fundamental laws of physics and chemistry, such as Mr. Harrison's book provides, his title is a little incorrect and likely to be misleading. At the same time the author gives what is on the whole a satisfactory introduction to science, such as is included in Section I. of the syllabus in physiography of the Science and Art Department and in the schedule of requirements for pupil-teachers, issued by the Education Department. The book is distinctly attractive, being clearly printed and well illustrated. But certain blemishes have revealed themselves in examining the contents more carefully. We have looked in vain for any reference to the anomalous expansion of water when heated, and no method of determining the temperature at which it possesses its maximum density seems to be given. As so much attention is bestowed upon the construction of thermometers, and the reasons for the employment of mercury are duly tabulated, this omission is rather a grave one. In explaining reflection and refraction of light no reference is made to the simple pin methods of demonstration which are so useful in enabling students to deduce the laws for themselves. The chemistry section would have been improved if a more rational plan of treatment had been adopted.

Die Orkane des "Fernen Ostens." By Prof. Dr. Paul Bergholz. Pp. xii + 260. With 31 lithographed charts, 33 tables, and 7 figures. (Bremen and Shanghai: Max Nössler, 1900.)

THE Kaiser's remark, "Our future lies on the water," has induced Dr. Bergholz, in charge of the Bremen Meteorological Observatory, to devote a great deal of his time to the study of tropical hurricanes, and particularly to those of the Eastern Seas, because, as he states in his preface, the increase of German trade is especially noticeable in Eastern waters, a fact which is demonstrated to Englishmen by the continued transfer of Asiatic steamship lines from the British to the German flag. Dr. Bergholz has summarised all that has previously been written on typhoons, so that the present work is the concentrated essence of our knowledge of these terrible meteors. Every feature in the life-history of a typhoon seems to be carefully dealt with—the origin of the disturbance, its progress, the circulation and the force of the wind, the behaviour of the barometer, the thermometer, the sea, the clouds, and the rainfall. Several special instances are dealt with in detail, and a chapter is devoted to such anomalies as gales unaccompanied by rain, rapid falls of the barometer without increase of wind, strong winds with a slight decline of the barometer, and so on; all which go to prove that old Dampier was right when he declared that the storms of the Temperate Zones, the hurricanes of the West Indies, the cyclones of the Indian Ocean, and the typhoons of the China seas differ only in name. A selection of charts accompanies the work; but while it is permissible to begin the meteorological year with December, in exhibiting the monthly variations of pressure and temperature, there is no sufficient reason why October and November should fall between May and June. The method adopted in drawing the isobars will not meet with the approval of meteorologists, areas of high pressure not being separated in the natural way by areas of low pressure, and *vice versâ*, but merely by a dividing line where contrary winds must meet without any intervening calm space. H.

Volumetric Analysis. By John B. Coppock. 92 pp. (London: Whittaker and Co., 1899.)

THIS fragment of science is intended as an appendage to existing books on qualitative analysis so as to meet the requirements of certain examinations in chemistry held by the University of London and the Department of Science and Art. But recent books on analysis which have already come before our notice have met the contingency to which Mr. Coppock refers. Moreover, this is not the first little book with the same object in view. Mr. Coppock covers familiar ground in a familiar way and is, as far as we have seen, a trustworthy guide.

LETTERS TO THE EDITOR.

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

The University of London Election.

As a graduate of the University in two of its faculties, and as one who has spent a quarter of a century of the best years of his life in the work of scientific education, I may be allowed to feel that I am voicing the higher intelligence of the University in venturing to thank you for putting the present issue so clearly before the constituency in your article in NATURE of January 25.

I look upon all reference to the internal economy of the University in estimating the claims of the respective candidates as so much mere electioneering "dribbling." That work, which has excited so much controversy the last twenty years or so, has produced its happy result, and we may say well of all those controversial matters, "let the dead past bury its dead."

Strange it is that even such a constituency should so far exhibit the inherent stolidness of John Bull as to be unable to face about and view things in their real and ghastly proportion, when all the civilised world is amazed at the spectacle of an invasion of the Queen's Empire (by a race of more primitive civilisation), and the debility of the Empire, with all its wealth and resources, to stem the tide of invasion for weeks and weeks, simply because *science* has been called in to utilise and direct the energies of the enemy.

Looking at the history of the University of London, as constituting one chief factor of the intellectual progress of the Victorian Age, showing even to the "ancient universities" the way to bring scientific studies to the forefront in the academical world, there is no constituency in the country that can speak, and ought to speak, with greater emphasis at this critical stage of our Imperial existence. But it must find (and has, I believe, found in Sir Michael Foster) the man with the tongue of the learned, who can efficiently voice the mind of the University, if it is to cause to ring through Parliament to each remote corner of the Empire the question (which every loyal subject of the Queen is trying to ask), whether in the future the interests and the safety of the English race are to be entrusted to a military system with an *empirical basis* (which snubs scientific studies and drives them into a corner) as in the past, or to a rejuvenised system with a *scientific basis*, such as Germany presents to the world. A. IRVING.

Floating Stones.

IN reference to Dr. Nordenskiold's communication *re* "Floating Stones" (No. 1577, vol. lxi.), it is a common thing to see grains of sand and small shells floating upon the waters of seas and estuaries, &c., when the surfaces are unagitated. The sand-grains must be dry; they are, therefore, only lifted and floated off by a rising tide after exposure to dry air.

In this way material is being constantly conveyed from one place to another during the *flow* of the tide, and does not return with the ebb.

The grains float as patches composed of fine and coarse material clinging together; the presence of the very fine grains appears to facilitate the flotation of the larger grains and shells. The phenomenon is more frequently seen where shell-sands occur, and is, I suppose, due to surface-tension.

If a few grains of dry sand be placed separately on various parts of a water-surface, they will eventually unite to form a patch; if this experiment be conducted carefully, the surface of the water can be completely covered by sand before any sinks to the bottom of the vessel. The tenacity of a large patch is remarkable; when once formed the vessel may be considerably agitated, and the patch even pressed down by the finger, without the grains becoming disunited.

London, January 24. CECIL CARUS-WILSON.

I AM interested in an article headed "Floating Stones" in your number of January 18, for I have observed the same phenomenon nearer home, namely, at Kimmeridge, where the flaky nature of the beach material renders the appearance of floating stones very common.

The only conditions necessary are a very gently rising tide after a dry day, during which the small flakes of "Kimmeridge clay" have had time to dry thoroughly.

If some of these dry flakes are on a very gently sloping surface of rock, or on top of a smooth stone, or any position where the water can rise and surround the flake gently (of course, this is below the shingle belt, for at the shingle the water is too broken), then the flake rises with the water, and floats away just as a needle will on the surface of water; a few bubbles may cling to the under-surface occasionally, and would, when present, assist the floating.

Since reading the article I have tried pieces of broken roof slate, and I have found that a small piece of dried slate about 1·5 × ·75 cms. by about ·1 cm. floats easily on tap water when gently placed on the surface. R. C. T. EVANS.

9, Heathcote-street, Gray's Inn-road, W.C., January 29.

THE GERMAN ANTARCTIC EXPEDITION.[1]

THE German Antarctic Expedition will leave Europe, in a single ship, in the autumn of 1901. The simultaneous dispatch of a second ship is not proposed, as this does not appear to be necessary, either for the solution of the scientific problems or for the safety of the Expedition. A second vessel would be expedient only if it were intended to carry out oceanographical researches around the Antarctic area at the same time as a southward advance is made by the first ship. This is rendered the less necessary, on account of the work which has been done by the German Deep Sea Expedition in Antarctic waters south of the Indian Ocean, the side on which the German Expedition will endeavour to penetrate the ice.

The designs for the Antarctic ship have been completed with the advice of the Construction Department of the Imperial Navy. The building of the ship has been undertaken by the Howaldt works in Kiel, which, in response to the circular inviting estimates, worked out an admirable plan. In designing the vessel special attention has been paid to seaworthiness, on account of the severe storms and high seas which prevail in the Southern Ocean; and, of course, she will be made as strong for ice-navigation as it is possible to build her. The necessary strength will be secured by a system of internal supports and a triple planking of oak, pitch-pine and green-heart. The hull will not be so much rounded as in the case of the *Fram*, such a cross-section appearing unsuitable for a ship which will have to encounter heavy seas, and the necessary resistance to ice pressure may be obtained with a somewhat fuller form. It need not be said that the vessel will be built entirely of wood. She will be rigged as a three-masted topsail schooner, and will be provided with an engine and two boilers of power sufficient to ensure a speed of seven knots and more if necessary.

The dimensions of the ship have been decided upon after taking account of the number of the scientific staff, officers and crew who will be carried, as well as the time which the Expedition is expected to be absent. The scientific staff will be five in number, and there will be five officers, including the first engineer, and eighteen to twenty men. The Expedition is expected to be absent for two years, but it will be equipped for three in case it should be found necessary to prolong it. These requirements demand a length of 151 feet, and a depth of about 16 feet below the water-line. The cost of building the ship will be about 30,000*l*.

The scientific staff of five, including the doctor, will be so chosen that each important branch of science will be represented. Each member of the staff will be able himself to carry out all the work of his own department; but every one will be capable of assisting in the special work of any other, or if necessary of taking his place.

[1] Translated from Prof. von Drygalski's MS. by Dr. H. R. Mill.

The author of this article, who has been appointed leader of the Expedition, will undertake the physico-geographical, oceanographical and geodetic work; Dr. E. Philippi, of Breslau, will take charge of the geological, palæontological and chemical investigations; Dr. E. Vanhöffen, of Kiel, will act as zoologist and botanist; Dr. H. Gazert, of Munich, will be the surgeon; and the fifth member of the staff, who will have charge of the magnetic and meteorological observations, is not yet selected.

The five officers, including the captain and the first engineer, will be fully occupied with their duties in the management and navigation of the ship during the voyage. But during the year to be passed at the scientific station which will be founded by the Expedition, and near which the ship will remain, the officers will take such part in the scientific work as may be decided at the place and time by the leader of the Expedition. They will probably be occupied principally with astronomical observations at the station, topographical and hydrographical surveys in its neighbourhood, and with pendulum and magnetic observations on the land-journeys and at the station. The crew also, the amount of whose assistance to the scientific staff during the voyage must be regulated by their duties on the vessel, will be allocated, at the winter quarters, to the different members of the scientific staff for training, so that they will become able to lend a hand on occasion. The captain, officers and crew have not yet been appointed.

As indicated above, the work of the Expedition may be divided into two parts; one carried out on board during the voyage, the other on shore at the winter quarters. The projected route of the Expedition is of importance with regard to the first part. It is intended to enter the Antarctic from the direction of Kerguelen, and the details of the route, particularly the deviations from a straight course, are planned with regard to oceanographical, geological and magnetic requirements. The oceanographical considerations are the existing lacunæ in our knowledge of the depths of the sea; the geological are the collection from various island groups of specimens for comparison with those obtained in the Antarctic; the magnetic conditions make it desirable to cut the lines of equal value of the various magnetic elements in as many points as possible. Taking all these conditions into account, I propose not to run directly south from Kerguelen, but first to sail eastwards to about 90° E., and then turn towards the south, as on that meridian deep-sea soundings are wanting. For the same reason the route from Cape Town to Kerguelen would be curved southward between Prince Edward and Crozet Islands, while, on the other hand, on the return voyage the line between South Georgia and Tristan da Cunha will be straight, because it is desirable to investigate the southern extension of the great Atlantic rise.

The point which the German Expedition has in view for commencing the penetration of the Antarctic region is the still hypothetical Termination Island. The British Expedition being intended to follow the northern side of Wilkes Land, the east coast of Victoria Land, the great ice wall, and beyond that to investigate the Pacific side of the Antarctic, the German Expedition is planned to strike southwards from Termination Island in order to discover the western side of Victoria Land, and to clear up its possible connection with Kemp Land and Enderby Land, and ultimately to sail round the Atlantic side of the Antarctic and investigate, wherever it may be possible, the southern extension of the Atlantic Ocean and Weddell Sea. If the two expeditions carry out this common plan, the geographical division of the work gives the best basis for co-operation in all other questions.

The second part of the German programme is the establishment of a scientific station in the Antarctic, at which a full year will be spent in geographical and biological work, and which will serve as a starting-point for longer or shorter land-journeys. It is, of course, impossible to say where this station will be, as the site must depend on the results of the discoveries made in pushing southwards. An effort will be made to establish it on the west side of Victoria Land, where one may expect to find an extensive land surface which will offer a favourable opportunity for carrying on the various researches; such a position would be particularly desirable for magnetic observations, on account of its proximity to the south magnetic pole.

The great Antarctic ice-cap could probably be best reached and explored on an extensive land which might perhaps enable one to travel towards the South Pole itself. An extensive land also offers richer opportunities for the study of plant and animal life, if such exist, and also for geological phenomena, than separate islands; and observations on gravity also are of more value on a large land surface. Briefly, an effort must be made to build the German station on the coast of an extensive land, and for this purpose the west coast of Victoria Land appears the most suitable, as it is the intention of the British Expedition to land some of their party on the eastern coast, and this proximity will afford an opportunity for effective co-operation.

I can naturally only refer briefly to the particulars of the projected expedition, the main plan of which has been sketched above. The fundamental fact is that the scientific preparation will be so complete that every kind of work can be carried out which the present condition of science requires, and for which time and opportunity offer. What will actually be done must naturally be decided on the spot. The members of the Expedition must be so prepared that they can distinguish the important from the less important, the necessary from the merely desirable; in a word, the purely Antarctic, if one may so say, from what could be carried out equally well in other parts of the world. The desiderata of Antarctic exploration are innumerable. It is essential to make a proper choice, and this is the first object to be served by thorough preparation.

For this purpose general instructions likely to be of service will naturally be subject to the initiative of the investigators themselves when they arrive at the field of work.

I shall here only mention a few of the problems with which the German Expedition will be occupied. Amongst these, geographical studies will take the first place, since they supply the necessary foundation for all other investigations. An effort will be made, not only to lay down the coast-lines, but, in some places at least, to follow out the general contour and, wherever it is possible, to study the forms of the land. The ice which gives its special character to the Polar regions will be studied as regards its nature and structure, its temperature, its transport of land-waste, and its movement, and this should permit conclusions to be drawn as to the land which it covers. With regard to the sea, soundings will be made in the regions where they are still wanting along the intended route—that is, in the whole area south of 40° S. and in some places also to the north of that parallel. It has already been pointed out that the route has been chosen with special regard to the regions where soundings are most required. Of course, observations will be made at the same time on the physical conditions of the sea with regard to temperature, density, composition of the water and the deposits, colour, dissolved gases, and circulation. It would be of great value also if pendulum observations could be carried out during the voyage, as it is intended to make this a special feature of the work on shore, and particularly in the neighbourhood of the station.

The geologist's duties will include the study of the samples of deep-sea deposits brought up by the sounding-rod, and also the chemical investigation of the sea-water, the physical properties of which will be studied by the geographer. The geologist will, of course, be busily employed at every landing. He will take part in sledge journeys from the land station, along the coast, and occasionally towards the interior. Special attention will be devoted to fossil plants, if such should be found to exist in the far south, as well as to all other palæontological and petrographical questions which are likely to allow comparisons to be made between the South Polar region and the rest of the world.

The Expedition promises a particularly wide field of work to the zoologist and botanist. His prospective collections should include every form which can be preserved or carried on board the ship, and they will apply equally to the fauna and flora of the land, of freshwater lakes, of the littoral zone and of the deep sea. Special attention will be paid to the seasonal differences in the occurrence of the various animal forms, and to their development. Biological investigations will, of course, be carried out in close relation to the physical; in order, for example, to recognise the dependence of plant and animal life on the conditions of the sea-water and the nature of the currents. For this purpose vertical and closing tow-nets have been planned to be used in the different regions, and from the station at different seasons. By comparing the results and those of surface gatherings at the various seasons, data will be obtained for the study of ocean currents. As the Expedition is not primarily intended for deep-sea investigation, it is not proposed to carry on deep-sea observations to a depth greater than 1000 metres. The gear required for dredging at greater depths would be too cumbrous an addition to the necessary equipment of the ship. This limitation is the less serious since the deep-sea fauna in warmer regions reaches up to within 700 metres of the surface, and in cold regions still higher.

The surgeon of the Expedition will, in addition to the treatment of such illness as may arise, endeavour to collect information on Polar hygiene by a careful study of the state of health of the members of the Expedition. These observations should enable him to advise the leader on many questions connected with the arrangements and manner of life of the Expedition. Further physiological studies will also be carried out, and the surgeon will assist the biologists in observations on the development of various organisms, and especially with bacteriological research.

The magnetic and meteorological work of the Expedition, like that of the other departments, will be the sole charge of one member of the staff, but he will be assisted in reading the instruments and in other mechanical work by members of the ship's company, and the officers will co-operate in the various physical observations at the station.

Regular meteorological observations will be taken during the voyage every four hours, if possible, and at the station three times daily. For wind, cloud, and similar phenomena, it will be desirable to organise a system of continual observation of the sky. Self-recording apparatus will be employed for pressure, wind, temperature, humidity and duration of sunshine, and in case these should become ineffective through extreme cold their place will be taken by as many eye-observations as can be managed. Special observations during the cruise will be required for such questions as the time of the daily maxima at sea, the best arrangement for a rain-gauge on board, twilight phenomena in the open sea, water-spouts, &c. At the station it is intended to carry out observations on the upper regions of the atmosphere, but to what extent and in what manner cannot be decided until the balloon equipment is definitely arranged. A captive balloon will certainly be carried for the purpose of geographical reconnaissance; sufficient gas to fill the balloon about ten times, and a lifting power which will make it possible to raise an observer about 500 metres, seem to be all that is necessary. It appears to be better to carry the hydrogen for filling the balloon in compressed form rather than to prepare it on the spot, that is, if compressed gas can be carried safely on board, a point on which further information is necessary.

The programme for magnetic work is not yet definitely settled. Pending the results of further consideration and advice, the following may be looked upon as likely to form part of it. During the voyage the magnetic elements will be determined at least once a day with the standard compass, the Fox apparatus (dip-circle), and perhaps also with the deviation magnetometer. The magnetic apparatus will be installed upon the navigating bridge of the ship, in the neighbourhood of which no iron will be used in the construction. At the station variation observations will be made with photographic registering apparatus, controlled by direct readings. Magnetic observations will also be provided for on the land journeys.

Particular attention will be paid to the study of the *Aurora Australis*, especially with regard to its form and height, perhaps also as to its spectrum, and the coincidence of auroral displays and magnetic disturbances; but the measurement of earth-currents is considered as beyond the scope of the Expedition.

In connection with the arrangements for magnetic work at the station there will be provision made for seismological observations.

Astronomical determinations of latitude and longitude, and geodetic measurements will, of course, be carried out. During the voyage, and on land-journeys, the former will be fixed by means of the prismatic reflecting circle; but at the station, where a more exact astronomical determination is necessary, a large transit theodolite, and a good telescope for occultations, will be employed. At the points on the shore connected with the station a smaller universal instrument, or a prismatic circle, will be utilised. Continued time determinations will naturally be carried out in connection with absolute observations for latitude and time conversions; pendulum observations will be made as often as possible. Geographical surveys on the scale of about 1 : 50,000 will be desirable in the neighbourhood of the station, and in such other places as may be interesting from a cartographical point of view, or which present important physical phenomena, such as ice-movement or ice-structure, or where the pendulum observations make a special survey desirable. For this purpose the smaller or even the larger universal instrument will be employed, as well as a Stampfer's level with staves. Opportunities may also occur for the use of photographic surveying instruments. Attention will be given to the anomalous refraction which, from the observations of previous Polar travellers, appears to be due to some atmospheric conditions different from any that occur in our latitudes.

This sketch of the German programme naturally does not exhaust the problems with which we have to deal. It was, however, less my intention to give an account of the work which we hope to attempt than to indicate the directions and lay down the limits of our proposed operations, as that will be of service in finally settling the methods of international co-operation. From this point of view, the large number of the problems mentioned does not appear dangerous. It might, however, become so if the Expedition were tied down to definite instructions, and not left free to act as time and opportunity demand. It seems the wisest course to provide a complete equipment for all branches of scientific work,

opportunities for doing which may offer themselves, and leave it to the leader of the Expedition to decide on the spot and at the time what work will be done.

I have already pointed out that the basis of international co-operation has been laid in the choice of routes and the consequent division of districts within which the land stations are to be established. The German Expedition takes the Indian Ocean and Atlantic side, and the British the Pacific side of the Antarctic area. An expedition from a third side would find a wide and important field of activity to the south of South America. As regards physico-geographical, geological, biological and gravity observations, scarcely any further co-operation is required than the simultaneous carrying out of observations in the different areas. Should the British Expedition include a second ship, it would be possible to carry on biological deep-sea research round the Antarctic area over a much wider circle than we can attempt with one vessel.

A clearer understanding is still required, in my opinion, for co-operation in meteorological and magnetic research, to decide, in the first place, the scope and the methods of research to be pursued during the voyage and during the year's sojourn at the land station; and in the second place, what additional work beyond that undertaken by the two expeditions it may be possible to arrange. My scheme for the first of these plans is already sketched out as far as regards the meteorological work; the magnetic programme requires still further consideration. The understanding with the British Expedition on this question is now under discussion. For both branches of science the choice of routes and of districts in which the stations will be placed is very appropriate, as observations will be made in the vicinity of the south magnetic pole on two sides, and both stations lie in the probable position of the Antarctic anti-cyclone, which appears to extend furthest north on the Indian Ocean side. The second point, which concerns the organisation of simultaneous observations outside the Antarctic area, is still unsettled. The British Antarctic Expedition has already in view the establishment of a scientific station in New Zealand, while Germany is planning a branch station on Kerguelen. These would furnish valuable data for comparison with the results obtained by the expeditions themselves. Yet, we must go further, but not so far, I think, as M. Arctowski suggested in his Paper to the British Association at Dover. It is greatly to be wished that during our expeditions the Observatories of Melbourne and Cape Town would undertake similar observations, and it would also be a good thing if a station could be placed near Cape Horn or in South Georgia, as well as one in the North Polar region, say at Bossekop. Thus the problems of the Antarctic regions could be attacked simultaneously from without and from within.

A resolution of the St. Petersburg Meteorological Congress, in August last, in favour of such co-operation was received with pleasure. The International Geographical Congress at Berlin went further, and unanimously approved the appointment of a committee charged with (1) Laying down the scope and the means of investigation for the magnetic and meteorological work of the expeditions; (2) The organisation of similar series of observations on the expeditions, and perhaps also exerting influence for the establishment of observations at other places.

On the German side, the members of this joint committee are Profs. Hellmann, v. Drygalski, Eschenhagen and A. Schmidt; and on the British side, Dr. R. H. Scott, Dr. Buchan, Prof. Schuster and Capt. Creak. The programme prepared on the German side for the meteorological and magnetic work has already been sent to the British members of the Committee to be considered by them, and afterwards discussed and definitely settled by the whole committee. We may expect in this, as in all other points, a complete and useful co-operation between the two expeditions.

ERICH VON DRYGALSKI.

THE VAN 'T HOFF CELEBRATION AT ROTTERDAM.

ALLUSION has already been made in the columns of NATURE (No. 1575, vol. lxi.) to the celebration of the twenty-fifth anniversary of the doctorate of Prof. van 't Hoff, which took place at Rotterdam on the 22nd of last December. The following further particulars may perhaps be of interest to English readers.

Some eighteen months ago it was decided by a committee of old students that the event should be celebrated in a suitable manner. To this end, in the first place, invitations were sent out to all former students of van 't Hoff, requesting them, if possible, to contribute a paper to a volume to be presented to the savant on his jubilee day. The invitation was responded to most cordially, and before the end of last September some twenty-six papers had been received by the committee. The original intention was to publish these in book form, but, as the result of a later suggestion and the kindness of Prof. Ostwald, the publication took the form of a jubilee volume of the *Zeitschrift für physikalische Chemie*.

The jubilee ceremony itself was held on the date above-mentioned in Rotterdam, the birthplace of van 't

Prof. J. H. van 't Hoff.

Hoff, where by reason of family ties he is usually to be found during the last days of each year. The "Bataavsche Genootschap voor Natuurwetenschappen" had invited a considerable number of Dutch and foreign men of science, as well as all old students of the professor, to a special meeting of the society at 3 o'clock in the afternoon. At the appointed time the hall was crowded with enthusiastic admirers of Holland's great physical chemist, many of whom had travelled far to pay their tribute. Not a few had come from Germany, and in addition Belgium, Switzerland, Austria, Japan and England were represented. Amongst the number present were Profs. Ostwald, Spring, Lobry de Bruyn, Roozeboom, Abegg, Goldschmidt, Hamburger, Hollemann, Lorenz, and Drs. Bredig, E. Cohen, Meyerhoffer, Reicher. Presently, amidst the cheers of the audience, van 't Hoff, supporting

his aged mother, entered the hall, followed by the various members of his family. The proceedings were opened by an address from the Mayor of Rotterdam, whose words, however, like those of some of the following speakers, being Dutch, were only intelligible to a limited number of the audience. Suffice to say that van 't Hoff was the recipient of a series of memorials and congratulatory addresses from various scientific corporations. The University of Utrecht, van 't Hoff's *alma mater*, sent a deputation, and the chemical students of Amsterdam, where van 't Hoff till recently occupied the chair of chemistry, were also officially represented. The afternoon's programme concluded with the presentation to the professor of his own biography by Dr. Ernst Cohen, and of the before-mentioned jubilee volume on behalf of former students by Dr. Meyerhoffer. To each of the speakers van 't Hoff replied in a few words, expressing his thanks for the honour accorded to him, in simple and unaffected language.

In the evening a highly successful dinner took place. It was interrupted by continual bursts of applause, as congratulatory telegrams arrived from almost all parts of the civilised world. To the series of toasts proposed in his honour, van 't Hoff replied in his native tongue, making, however, a graceful variation in excellent English to acknowledge his appreciation of the presence of a guest from England at a time of national embitterment.

An account of the jubilee celebration at Rotterdam would scarcely be complete without a reference to the life and work of the man in whose honour it was held. For a complete and extremely interesting account readers are referred to Cohen's biography,[1] which has been consulted by the present writer in this connection.

Jacobus Henricus van 't Hoff was born on August 30, 1852, at Rotterdam, where his father still practises as a medical man. While at school he showed an intense interest for natural science; many of his leisure hours were spent in carrying out simple chemical experiments at home. After passing through the Hoogere Burgerschool in Rotterdam, his parents decided that he should have a technical training, and for this purpose he was sent to the technical school at Delft. Two years' study at Delft sufficed for him to pass his technical examination, whereupon he proceeded to Leyden, devoting most of his time to the study of mathematics and physics. Remaining but one year at the latter University, he was attracted by Kekulé to Bonn, then at the height of its fame as the school of structural chemistry. Later, in the same year, we find him in Würtz's laboratory in Paris.

In September of the following year (1874) van 't Hoff published in Utrecht a pamphlet, the contents of which form the foundation of our present stereochemistry. The proud structure built up on the ideas first expressed in this modest publication is one of the greatest chemical achievements of modern times. The adverse criticisms of Kolbe and other then existing authorities on structural chemistry are historical, but after twenty-five years' subjection to the crucial test of experiment, we can assert that the theory of the asymmetric carbon atom is one of the most firmly established in chemical science.

In December 1874, three months after the publication of his views on chemical structure, van 't Hoff graduated as doctor of mathematics and physics at Utrecht, the title of his thesis being "Contributions to our knowledge of cyanacetic and malonic acids."

That the path of fortune has not always run smoothly for him appears from his experiences during the months following graduation. Repeated attempts to obtain a post as teacher failed, and finally leaving home, he departed to Utrecht with the intention of giving private instruction. During this period he devoted his spare hours to writing "La Chimie dans l'Espace." Finally, in 1876, the desire to devote himself to teaching was gratified by his appointment as lecturer at the Royal Veterinary School at Utrecht.

In October 1877, on the elevation of the old Amsterdam Athenæum to the status of a University, van 't Hoff obtained the post of lecturer on theoretical chemistry, and scarcely a year had elapsed before he was appointed professor of chemistry, mineralogy and geology, a chair he held until the commencement of 1896.

The activity he showed during his connection with the University of Amsterdam is well known. Notwithstanding very onerous routine duties, he continuously produced work of first class importance, and by his inspiration created a distinguished school of chemists.

"Physicam chemiae adjunxit" is the maxim which characterises the life work of van't Hoff. His endeavours to fill up the gap in our knowledge of the connection between constitution and chemical properties led to the production of his "Études de Dynamique Chimique," to the setting up of a most important theory of equilibrium, and to the overthrow of Berthelot's principle of maximum work.

Closely bordering on the theory of equilibrium the problem of affinity next attracted his attention, and the application of thermodynamics to Pfeffer's osmotic experiments brought forth his great theory of solutions, according to which the physical laws (Boyle's, Gay-Lussac's, Avogadro's) holding for the gaseous state, apply equally well to dilute solutions. The most immediate result of this theory was the formulation by Arrhenius of the theory of electrolytic dissociation. The changes thus brought about in the nature of our chemical conceptions have been enormous, and the rapid development of electrochemistry in recent years stands in direct connection with the establishment of van't Hoff's laws of solutions. In 1890 the extension of his theory of solutions to the case of solids enabled him to show the existence of simple laws in solid aggregates, and much of our present knowledge with regard to the solid state of matter dates from this discovery.

In spite of seductive offers on the part of another Dutch University in 1893, and of two German Universities in 1887 and 1894, van 't Hoff remained true to Amsterdam until 1895, when the Prussian Academy of Sciences made him a most brilliant offer. Not only was he elected a Member of the Academy, but at the instance of the latter, the Prussian Government placed at its disposal the necessary funds whereby van 't Hoff is enabled to devote himself entirely to his work as investigator. In this way a foreign Government has recognised his services to science and provided the means for his searching genius to exert itself to its fullest extent.

During the past few years van 't Hoff's attention has been chiefly turned to that province of physical chemistry dealing with transition phenomena, double-salt formation and double decomposition, and his present goal is the explanation of the formation of oceanic salt deposits on the basis of such investigations. Already a great deal has been accomplished, and especially for geologists most important results have been brought to light. From a politico-economic point of view the importance of such research for the great Stassfurt salt industry is obvious.

Prof. van 't Hoff's laboratory is situated in Wilmersdorf, a suburb of Berlin. It consists of some four or five small rooms forming the ground story of an ordinary house. Here van 't Hoff works with at most three or four students. He is in the happy position of a professor not obliged to lecture more than once a week, and not expected to do more than extend the bounds of human knowledge.

H. M. DAWSON

[1] "Jacobus Henricus van 't Hoff." Von Ernst Cohen. Mit einem Porträt und Bibliographie. Price M. 1.60. (Leipzig: Verlag von W. Engelmann.)

THREE NEW BIRD BOOKS.[1]

THE issue of these three works, which have no connection with one another, save as regards the approximate time of their birth, serves to indicate the increasing popularity of ornithology, and a consequent demand for histories of the avifauna of each and every country. As regards Great Britain, systematic treatises on its bird-fauna are, as we all know, to be counted by the dozen; and the chief business of the ornithologist of the future should accordingly be concentrated on the habits and distribution of the birds inhabiting this area. In America, on the other hand, much doubtless remains to be done in the working out of the details of local faunas; and there is accordingly in all probability ample room for the second and third volumes on our list. Although these are primarily intended to popularise the subject, they both possess a certain amount of importance to the systematic naturalist as being, apparently, accurate lists of local faunas. Not that by this statement we intend in any way to disparage the value of the work standing first on the list; we ourselves being at the present day inclined to assign a higher value to treatises dealing with the habits and environment of animals than to those devoted to their taxonomy.

The brothers Kearton appear to have set themselves the task of photographing and describing the nest and eggs of every species of bird known to breed in the British Islands; and although their labours are still unfinished, the issue of the present volume brings them not very far from their goal. To those who have not made the attempt (and, so far as we are aware, the Messrs. Kearton stand alone in this respect) it may be difficult to realise the amount of labour in the task which the author and his brother have set themselves. But when we are told in the preface that the mere railway and steamboat travelling hitherto undertaken totals up to something like ten thousand miles, while many valuable hours and days have been spent in unsuccessful tramps across bog and fell, it becomes evident that the task is no sinecure, either from the point of view of time or expense. Only strong enthusiasm could, indeed, have enabled the author and his brother to have persevered thus far, and it may be hoped that circumstances will permit them to complete their arduous labours.

The volume in which the nests of the commoner British birds were figured was published in 1895; and as the present issue contains figures of the nidification of no less than fifty-seven additional species, it is evident that neither author nor artist have been idle since that date. Exquisite as are the illustrations in the first volume, those in the present issue are in many cases even more successful, and bear self-apparent testimony to the care spent on them by the artist. As an example, we reproduce the figure of Fulmar Petrels nesting. Neither is the letterpress less attractive. Naturally, the brothers met with many adventures during their wanderings, and we may particularly direct attention to the account on p. 109 of the manner in which the great Skua attacked one of them as he approached its nest. Very curious, too, is the habit these birds have of building an additional nest in the neighbourhood of the one in use, to which the eggs or young may be conveyed when the former is flooded or otherwise damaged. The author by no means confines himself to the description of the nests and eggs, but gives an interesting account of the kind of country in which they are found, a view of the scenery distinctive of the habitat of particular species being frequently given.

As already said, the text, from a natural history point of view, is thoroughly satisfactory; but it must be confessed that it is not altogether free from literary blemishes. Take, for example, a sentence in reference to the Siskin (p. 104), which runs as follows:—"The nest has been found sparingly in various parts of England from time to time, but in Scotland it breeds regularly in many of the great pine forests so well suited to its habits."

The foregoing mention of the great Skua reminds us that Mr. Kearton has much to say regarding the efficiency or otherwise of the regulations in force for the protection of the rarer birds and their eggs, his remarks on this subject being well worthy the best attention of County Councils and landowners interested in bird protection. While not one of those who urge that on no account should a comparatively rare species ever be shot, as witness his observations in reference to the Peregrine Falcon, he considers that the present wild bird protection laws are almost a dead letter. After stating that eggs of species specially protected by law are openly hunted for by people of all ages and conditions, he adds: "I have no hestitation in saying that the only real good done in the United Kingdom in the way of bird preservation has been accomplished by private efforts." He then goes on to say that, as a matter of fact, the enforcement of the law as it stands frequently ends in the destruction of the bird it strives to protect by calling attention to the places where it occurs. His remedy is to restrict protective laws to the dozen species or so for which they are most urgently needed, and to afford effective protection to such selected species during the whole of the breeding season by means of reliable watchers.

Commending these important suggestions to those

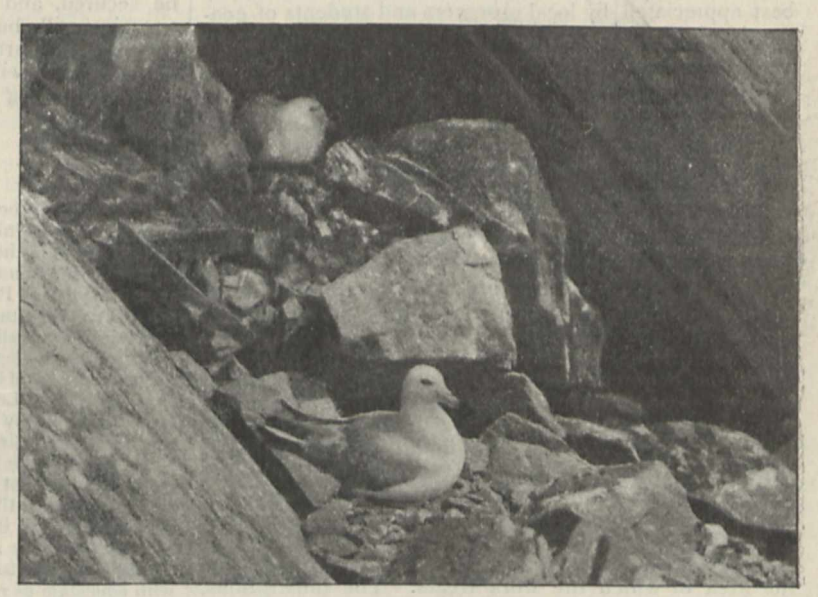

FIG. 1.—Fulmar Petrels Nesting (from Kearton's "Rarer British Breeding Birds").

[1] "Our Rarer British Breeding Birds; their Nests, Eggs, and Summer Haunts." By R. Kearton. Illustrated from photographs by C. Kearton. Pp. xvi + 149. (London: Cassell and Co., Ltd., 1899.)

"The Birds of Rhode Island." By R. H. Howe, jun., and E. Sturtevant. Pp. 111. Illustrated. Privately printed, 1899.

"The Birds of Eastern North America—Water Birds." Part I. Key to the Families and Species. By C. B. Cory. Pp. ix + 142. Illustrated. (Chicago: Field Columbian Museum, 1899.)

they most concern, we take leave with regret of one of the most attractive little volumes on birds it has been our fortune to peruse.

Of a very different type is the work standing second on our list, although here, too, we have to call attention to some excellent illustrations of the environment of particular species of birds. Apart from the classified list of species frequenting Rhode Island, the leading idea in Messrs. Howe and Sturtevant's little volume seems to be the peculiar nature of bird migration in this district, much of which takes place to seaward of the island itself. Especially interesting are certain local migratory movements, both along the coast and in Narragansett Bay; foremost among which is the westward migration of white-winged Scoters in May. These birds winter in the neighbourhood of Cape Cod, and during their spring migration fly west, it is said in millions, across Rhode Island, and then shape their course in a north-westerly direction for the great lakes, where they breed.

Following a list of the nesting times of the various species breeding on the island, the authors give an interesting account of "Cormorant Rock," which appears to be the favourite bird-haunt. This is followed by the detailed list of species; the special interest of which can be best appreciated by local observers and students of geographical distribution. In reference to the description of "Cormorant Rock," we may point out to the authors that it is somewhat redundant to speak of the "Island of Rhode Island"; and that the "mesa top of the rock" is a phrase of which the meaning is not quite as apparent as it might be.

Of the third member of the trilogy we cannot at present speak very fully, since the part before us appears to be only a small instalment of what promises to be a work of some size and importance. Mr. Cory is already well known to bird-lovers by several works devoted to the avifauna of North America and the West Indies; while to the sportsman his name is familiar as the author of "Hunting and Fishing in Florida."

In the present work it appears to be his object to teach the beginner the external anatomy of a bird (if such an expression be permissible), and then to lead him on to learn how to distinguish and recognise the various kinds of "water birds" found in eastern North America. Although using the latter term in a very wide sense, and including under it such diverse forms as Auks, Gulls, Ducks, Herons, and Snipe, his "keys" appear to be carefully drawn up, and to suffice for the identification by an artificial method of the various species inhabiting the area of which the work treats. The illustrations, although some are on an unduly small scale, are for the most part of a high grade of excellence, and serve to elucidate the technical matter of the text. It is, however, distinctly a subject for regret that the author has seen fit to multiply in a most unnecesssary degree the number of "families" of water birds. He divides the Limicolæ, for instance, into the *Phalaropodidae*, *Recurvirostridae*, *Scolopacidae*, *Charadriidae*, *Aphrizidae*, and *Haematopodidae*, whereas in the British Museum Catalogue the whole of these are included in a single family. Moreover, if such divisions were necessary the term *Himantopodidae* should have been employed, instead of *Recurvirostridae*, for the Stilts and Avocets.

Neither is the author quite happy in some of the statements in the Introduction, as, for example, when he speaks of the extinct New Zealand Eagle (*Harpagornis*) as being the prototype of the "Roc of nursery lore." In all probability the honour of that position belongs to the extinct Malagasy *Æpyornis*, and most assuredly the legend does not owe its origin to the "nursery."

On the whole, however, the work, so far as we can judge at present, appears well adapted for its purpose, and we shall look forward with interest to its completion.

R. L.

THE LONDON UNIVERSITY ELECTION.

EVERY graduate of the University of London who has the advancement of learning and the best interests of his University at heart, will give careful consideration to the address which has been drawn up by Sir Michael Foster's Election Committee, and the accompanying letter from Sir Michael Foster himself. These two documents should completely remove the impression that the return of Sir Michael Foster would mean the neglect of the rights and privileges of private students. The position of such students and the system of open examination for them have already been definitely settled by Parliament, and it is improbable that any change will be made no matter which candidate is elected. It is therefore not reasonable to think that the electors will let this question influence their votes. Sir Michael Foster stands both for external and internal students, and not for any particular party or as the champion of any one section of the graduates. As a man of distinguished eminence, who has shown his regard for the welfare of the University, we claim for him the suffrages of an intellectual electorate. By returning him to Parliament, not only will the progress of the University be secured, and a member be obtained whose best energies will be used to further the interests of all branches of learning, but the existence of a University representative will be justified.

The following correspondence has been sent to the electors:—

1, *New Court, Carey Street,*
Lincoln's Inn, London,
January 26, 1900.

SIR,—It will soon be the duty of the Members of the Convocation of the University of London to choose a representative in Parliament in the place of Sir John Lubbock.

It is now generally admitted that University constituencies should send to Parliament men distinguished in learning, science, or literature, and qualified therefore to strengthen the Legislature in dealing with those questions which most nearly concern the intellectual interests of the community. This has been recognised of late years in the election of Sir George Stokes, Prof. Jebb, Mr. Lecky and Sir William Anson, in which cases the example set by the University of London in its election of Mr. Lowe and Sir John Lubbock was followed by the older Universities. We hope that the graduates will not now depart from the precedent set on those occasions.

At the present time, when the reconstruction of the University is imminent, it is most important that the representative selected should be a graduate of the highest literary or scientific distinction, able to speak with authority on matters connected with education or research. The new duties which the University will have to undertake must raise questions on which the Government and Parliament will look to the representative of the University for guidance; while the graduates will desire that the claims of the University shall be adequately supported by their member.

So far as the domestic policy of the University is concerned, it should be borne in mind that this is now definitely and permanently settled by the Act of Parliament of last Session, which provides guarantees for the maintenance, in unimpaired efficiency, of the system of open examination for external students. No interference with this settlement on the part of the Legislature or the Government is to be expected or will be required.

Sir Michael Foster, K.C.B., M.D. (Lond.), Senior Secretary of the Royal Society, and now President of the British Association, has, at our earnest request, consented to be nominated for the vacant seat. He holds, in the estimation of the public, as well as in that of scientific men, such a distinguished position—not only among the graduates of the University, but among the leaders of scientific thought in Europe—that it is altogether unnecessary for us to dwell on his qualifications in this respect. We may say, however, without fear of contradiction, that there is no one whose opinion on questions affecting scientific education and research or the study of medicine would have greater weight in the House of Commons. His long academical experience, first at University College, London, and subsequently at Cambridge, together with his full knowledge of University

questions, will enable him to be of the greatest service in Parliament. The election of so distinguished a graduate will be an honour to the University.

Sir Michael Foster's claims to your support are not put before you in the interest of any political party. We think it more important that a fit representative of the University, as an institution for the promotion of learning and science, should be sent to Parliament, than that a member should be added to one or the other side of the House. There is, however, one question upon which the country, independent of party, is agreed—that the Government must be supported in prosecuting the present war to a successful conclusion—and on this Sir Michael Foster is at one with the country.

It is of the utmost importance that those graduates who will support Sir Michael Foster should inform the committee at once, and you will please therefore fill up, sign, and post the enclosed card as soon as possible.

We enclose with this a letter from Sir Michael Foster.

We are, Sir,

Your obedient servants,

J. F. ROTTON, M.A., LL.B., Q.C., *Chairman.*
H. J. WARING, M.S., M.B., B.Sc.,
H. J. HARRIS, B.A.,
C. E. WILSON, M.A. (Camb.), B.A. (Lond.), } *Honorary Secretaries.*

The following letter has been received from SIR MICHAEL FOSTER *in answer to one from the Chairman of his Committee informing him of the steps which were being taken in respect of his candidature.*

January 24, 1900.

MY DEAR ROTTON,—I learn from your letter, and from other sources, that the Members of Convocation on whose behalf you write have been led to invite me to represent them in Parliament because they strongly hold the opinion that the representative of the University should be chosen not on account of his political opinions, but by reason of his fitness to advance in the House of Commons the interests of science and learning and of the University, and because they think that I possess this fitness.

I cannot but be gratified that so many eminent graduates hold me in so much esteem; and, while not so confident myself as they are of my fitness for the post, I feel it my duty to accept the great honour which they offer me in the spirit in which it is proposed.

If my candidature should prove in the end acceptable to the majority of the Members of Convocation, I shall feel that I enter the House, not with a mandate to support this or that political party, but for the purpose of placing at the disposal of the House the experience gained by many years' service in the courts of learning and science, and in more than one University.

Any other position would be impossible for me; and if the Members of Convocation do me the honour to select me, it must be on the understanding that I am not thereby pledged to any political party. Still, the man in the lecture room, no less than the "man in the street," has his political views; and neither would the University expect its Member to take part in the business of the House only when academic questions were being dealt with, nor should I desire to play such a part. Indeed, purely political questions may be brought forward on which, were I elected, I should think it wrong to abstain from recording my vote. Bearing this in mind, I think it right to say that had I been in the House of Commons some years ago, I should have voted against the Irish policy of Mr. Gladstone; and that at the present moment I think, not only that the present war should be vigorously prosecuted until the results so essential to the welfare of the Empire are attained, but that the nation is justified in having entered into it. So far I should support the present Government. At the same time I wish to state plainly that on many other questions my views, and perhaps still more my sympathies, are those which used to be denoted by the term "liberal." Not having, however, looked forward to the honour of entering into Parliament I have never attempted to integrate my opinions into a compact whole capable of being marked with a party sign; and even now I feel a great difficulty in attempting to do so.

As regards the affairs of the University of London itself, Members of Convocation are well aware that such efforts as I have been able to make have been directed towards developing the University in the direction which has often been denoted by the words "teaching University." In this I have been guided by a desire to promote the interests, not so much of teachers, as of teaching and of learning. Though a somewhat long experience as an examinee and an examiner has shown me the weak points of examinations, I owe too much to the University of London in its old form as an examining University not to feel deeply how much good it has done. When called upon as a witness before the Cowper Commission, the only evidence I ventured to give was to emphasise the desirability of enlarging the old University, as against setting up a new one. I thought then, and I think now, that the changes which it is proposed to make, so far from doing any one part of the University harm, will do good to the whole; and that he whom it is proposed to call an "external student" will share, with the "internal student," the benefit which must follow upon the recognition of the principle that the true function of a University, whatever else it may be called upon to do, is not to grant titles, but to develop learning and to promote the advancement and spread of knowledge. If elected, I should regard myself as the representative of the educational interests of external students and internal students alike.

Yours, &c.,

MICHAEL FOSTER.

PROFESSOR D. E. HUGHES, F.R.S.

DAVID EDWARD HUGHES was born in London on May 16, 1831. His parents were Welsh, from Bala, in Merionethshire. He spent his early years in the United States, to which place his parents emigrated in 1838, and he became a citizen of the United States. He never abandoned this citizenship, and this is probably the reason why the English Government never recognised his eminent scientific services. Being a musician, like so many of those who spring from our Welsh hills, he was appointed professor of music in Bardstown, Kentucky, at the age of nineteen. He also held the chair of natural philosophy. At the age of twenty-four he invented his celebrated Roman type-printing telegraph that spread his fame throughout the civilised world. He struck a new line. His instrument was based on synchronism, and each letter was struck by one current. His apparatus was adopted in the United States, but it was very little used there, and he came to England in 1857 to try and introduce it here. He came at an unfortunate time. Telegraphy was in the hands of several private companies, whose capital was locked up in promoting other patents. Competition was excessive and ruinous; but in 1863 the United Kingdom Telegraph Co. took up Hughes's instrument, and on the transference of the telegraph to the State, in 1870, it came into the possession of the Post Office. It was also employed by the Submarine Telegraph Co. for their communications to the Continent, and now the largest Hughes's type-printing telegraph station in the world is probably the cable room of the Post Office in St. Martin's le Grand. In his occasional visits to the General Post Office he never failed to express his delight at the great advances made by the Post Office Technical Staff in the development and working of his beloved child. It was driven electrically, and it worked duplex.

Hughes's instrument was made the international type of apparatus, and every country in Europe adopted it. Honours and wealth were showered on him. Being a man of very simple habits and of few wants, his annual expenditure was small; but his income was great. His riches accumulated, and it is now generally known that he has been most generous in endowing various scientific institutions and hospitals with large sums of money.

On April 13, 1859, a paper was read before the Society of Arts describing not only his apparatus, but an original form of cable, which separated two layers of gutta-percha insulation by a film of semi-fluid viscid oil, so that flaws or punctures in the insulation were automically repaired.

This novel and ingenious idea was never practically tried, but it established the fact that Hughes was the inventor of oil insulation.

In 1878 he brought out the microphone. No one who remembers the period can ever forget the sensation produced by his simple apparatus and striking experiments. Bell had just brought out the telephone, Edison had patented his carbon transmitter and invented the phonograph; but Hughes captured the town by causing the footsteps of a house fly to resound like the tread of an elephant.

In 1879 he showed how to eliminate the effects of mutual induction from lateral wires by using a metallic circuit and twisting the wires around each other.

This was followed by his beautiful induction balance, and subsequently by a series of elegant researches in magnetism and inductance. Hughes was essentially an experimenter. His manipulation of rough materials was phenomenal. He scorned the scientific instrument maker. Pill boxes, common nails, sealing wax, bonnet wire, knitting needles, tumblers, cheap copper were enough for him. His cells, galvanometers and telephones were all home-made. He was not a mathematician, nor was he deeply versed in scientific literature; but he had an instinctive perception of truth, and he jumped by intuition to facts which he could speedily verify with his own hands in the crudest fashion and by the homeliest aid. He loved science, and his constant attendance at the Royal Society and the Royal Institution evidenced his interest in scientific progress.

The Royal Society presented him with a Royal Medal in 1885, and he was awarded the Albert Medal by the Society of Arts in 1897. He was President of the Institution of Electrical Engineers in 1886, and was for many years a manager of the Royal Institution.

He was a genial, charming companion, and his presence will be very much missed by many who knew him well.

The funeral of Prof. Hughes took place on Saturday, January 27. The pall bearers were Lord Lister, Prof. A. W. Rücker, Mr. Choate (the United States Ambassador), Prof. S. P. Thompson, Prof. Dewar and Major-General Webber. Among the other men of science present at the special service at All Souls', Langham Place, some of whom went on to Highgate Cemetery, where the interment took place, were Mr. E. Clodd and the Servian Consul, Lord Kelvin, Sir William Crookes, Sir Frederick Bramwell, Dr. J. H. Gladstone, Dr. Johnstone Stoney, Sir Henry Mance, Mr. R. E. Crompton, Prof. Perry, Prof. Meldola, Mr. A. Siemens, Mr. A. B. Kempe, Mr. J. Swinburne, Mr. J. Wimshurst, M. Dæschner (secretary of the French Embassy), the Greek Chargé d'Affaires, Sir F. Abel, Sir H. T. Wood, Mr. A. P. Trotter and Mr. C. E. Spagnoletti. The Duke of Northumberland and Sir W. Preece were represented.

NOTES.

THE Geological Society of France has received a legacy of forty thousand francs from Mme. Beaucourt, for the encouragement of investigations which assist geological progress.

THE *Engineer* states that the War Office is making an allowance of 3000*l.* for the provision of apparatus for use by the electrical engineer volunteers going to South Africa.

THE Institute of France has accepted the conditions of the gift by M. Daniel Osiris of a sum of money for the foundation of a triennial prize of one hundred thousand francs, to be awarded for the most remarkable discovery or work in science, art, or letters.

THE Special Meeting of the Manchester Literary and Philosophical Society for the presentation of the Wilde and Dalton Medals, and for the delivery of the Wilde Lecture on "Flight, natural and artificial," by Lord Rayleigh, F.R.S., will be held on Tuesday, February 13, at 4.30 p.m.

THE death is announced of General Alexis de Tillo, the distinguished Russian geographer, and correspondant of the Paris Academy of Sciences, in the section of geography and navigation. For more than twenty years General Tillo was one of the most active and earnest members of the Russian Imperial Geographical Society, and contributed many papers on the hypsometry, terrestrial magnetism, and climatology of Russia.

BARON LE BAUME PLUVINEL, who has been to Spain on behalf of the French Astronomical Society, to inquire into the weather prospects during the forthcoming solar eclipse at various places along the line of totality, and to make arrangements for the accommodation of the members who will go to observe it, will give an address to the Society on February 7, on the results of his visit.

THE twenty-seventh annual dinner of the old students of the Royal School of Mines was held at the Hotel Cecil on Friday, January 26. Mr. H. G. Graves was in the chair, and was presented with a loving cup, &c., in consideration of his service for several years as secretary, by Mr. H. Bauerman, on behalf of the committee. The other speakers were Sir W. Roberts-Austen, Prof. C. Le Neve Foster, Prof. Perry, Mr. Bennett H. Brough, Mr. H. Hatfield, Mr. Teall, Mr. F. W. Harbord, Mr. E. Woakes, and the present secretary, Mr. H. C. McNeill.

MR. SAMUEL BARBER informs us that a very brilliant meteor was observed at Chesterton, near Peterborough, on January 28, about 5.56 p.m. Attention was drawn to the meteor by an almost blinding flash that resembled lightning. Then the ball of light was observed "travelling across the sky like a large rocket, in an easterly direction, and with a conspicuous trail a few degrees wide on either side of its course. Before vanishing there was a distinct gap left, in which the trail did not appear, *i.e.* between the point of departure of the meteor and the end of the trail. The meteor disappeared instantaneously. No sound was heard."

THE researches undertaken by the Institution of Mechanical Engineers were referred to in the report of the council, presented at the annual meeting on January 26. The fifth report of the research committee on alloys was presented and fully discussed a year ago, and Sir William Roberts-Austen, the reporter, is now at work upon the effect of annealing and tempering on the properties of steel, which will form the principal subject of the next report. The gas engine research has been further advanced by Prof. Burstall, who hopes to be able to present his report early in the present year. The value of the steam-jacket is the subject under investigation by Prof. Beare, who has accumulated further data towards his fourth report. The compound steam-jacketed condensing engine at King's College, London, has been working. Prof. Capper has not yet been able to commence the first series of complete tests, but promises his first report soon.

THE annual general meeting of the Mathematical Association was held at University College on Saturday, January 27, the President of the Association, Sir Robert S. Ball, being in the chair. Papers were read by Sir Robert Ball, Prof. R. W. Genese, and Messrs. R. F. Davis and J. A. Third; and several other papers were received, the authors of which were unable to be present. It was announced that the *Mathematical Gazette* would in future be issued six instead of three times a year. The aim of the Association in publishing the *Gazette* is to supply a journal which is of direct and special interest to mathematical teachers. It is intended that among its special features shall be articles suggestive of improvements in

methods of teaching, or covering ground not satisfactorily treated in text-books, and reviews of books of the first importance, or groups of text-books on kindred subjects, giving an elementary presentation of the history and treatment of the subject. Vol. ii., which commences with the present year, will contain a series of articles by Prof. C. A. Scott, on von Standt's *Geometrie der Lage*.

PROF. A. E. WRIGHT describes in the *Lancet* the statistical results of the anti-typhoid inoculations made by him among British troops at a series of military stations in India. It appears that altogether 11,295 men were under observation, of whom 2835 had been inoculated and 8460 had not. The percentage of cases of typhoid fever amongst the uninoculated was 2·5, and amongst the inoculated 0·95, a difference sufficiently great to warrant further extensive trials taking place. With regard to the mortality the results are not so marked. Amongst the uninoculated the percentage of deaths was 0·34, and amongst the inoculated 0·2. A certain measure of protection seems thus to have been conferred by the inoculation of the quantities of dead typhoid culture, and when Prof. Wright's remarks on the conditions under which the inoculations were carried out are considered this conviction becomes intensified. For instance, the inoculated men were, taken as a whole, men who were much more liable to contract typhoid fever than the uninoculated men, for the inoculated consisted to a large extent of young men who had only recently arrived in India, while the uninoculated consisted mainly of older and more seasoned—in other words, of less susceptible—individuals.

THE relations of forest fires to insect ravages, insects to forest fires, diseases of trees to insects, and insects to fungous diseases, are not obvious at first sight, but Dr. A. D. Hopkins shows in a report on the insect enemies of forests in the north-west, just issued by the U.S. Department of Agriculture (Division of Entomology), that there is a close connection, and, to a certain extent, inter-dependence, of all these factors in the destruction of valuable forest products. Trees dying from injury by fires, or weakened in vitality, offer favourable conditions for the multiplication of vast numbers of destructive insects. Moreover, trees which have been killed by insects furnish, in their fallen branches, standing and fallen partly decayed trunks, and dry bark, a most favourable condition for the starting, rapid spread, and perpetuation of forest fires. It is well known that forest trees weakened by disease contribute to the multiplication of their insect enemies; therefore the study of the insects associated with unhealthy forest trees should lead to results of economic importance. As an example of insects contributing to the spread of fungous diseases, Dr. Hopkins reports that the heartwood of the white fir throughout the region examined by him was commonly rendered worthless by decay as the result of wounds in the living bark made by Scolytus bark beetles.

THE *Scientific American* states that one of the most interesting exhibits which will be sent from the United States to Paris for the forthcoming Exhibition will be a huge map of New York city, which is now in progress of construction under the chief topographical engineer of the Board of Public Improvements. It measures 28 feet by 24 feet, and is on a scale of 600 feet to the inch, and includes all the boroughs of the great city and a large part of the adjoining territory. The map shows all the trees, parks, piers, ferries and railway lines, and displays contour lines and elevations of every point in the city; more than 1,000 square miles of the territory are embraced, and all buildings of any importance whatever are indicated.

TWO novel swing-bridges over the river Weaver at Northwich were described by Mr. J. A. Saner at the meeting of the Institution of Civil Engineers, on January 23. Owing to the nature of the foundations in the salt district, which, as is well known, are seriously affected by the abstraction of brine and salt from the subsoil, the design of the bridges presented unusual difficulties. The average subsidence at the Northwich bridge has been about 4½ inches per annum during the last seventeen years, necessitating the raising of the girders to give headway for the river traffic; and it being impossible to raise the streets in the immediate neighbourhood without partially burying or raising the adjoining houses, the road gradients have become as steep as 1 in 11. To obviate this inconvenience, and to provide for the more efficient carrying on of the salt and other trades on the Weaver, and also with the idea of eventually passing coasting vessels with fixed masts, two exactly similar swing-bridges have been built a little distance apart, in order that one may be available in case of a breakdown.

THE superstructure of the two new bridges at Northwich, each of which may be considered as weighing 300 tons, is supported by a roller path and rollers, which in turn are carried upon a set of piles, strongly braced together. Connected with, and exactly under the centre of gravity of, the superstructure is a circular pontoon or buoy, divided into two chambers. This pontoon has the appearance of being suspended from the superstructure, and in reality would be if the water were not present, as it is entirely clear of both bottom and sides of the chamber in which it is placed. Of this large buoy the lower chamber, which has a displacement equal to 250 tons, is perfectly watertight and always submerged, so that its displacement is practically constant. The upper chamber is open at the top, and either serves as an access to the lower chamber; or, by varying the amount of water allowed to enter it, increases or decreases the buoyancy of the whole. It will be seen that the downward pressure on the rollers and paths, due to the weight of the superstructure, is partially counteracted by the upward tendency of the pontoon, and is thus reduced, in the case under consideration, to 300 − 250 = 50 tons. By emptying the upper part of the pontoon this may be further reduced within certain limits. The difficulty presented by subsidence entailed careful consideration as to the motive-power to be adopted for the bridge. Pressure pipes of any kind being inadmissible, Mr. Saner decided to adopt electrical power, and to use wire rope for turning, as giving the most flexible connection between the bridge and motor. The bridges are moved with remarkable facility, and the consumption of current after they had been working a short time, and all the bearings, &c., were free, only amounted to ¼ a Board of Trade unit for the complete cycle of operations, viz. withdrawing wedges, opening and closing the bridge, and replacing the wedges.

WE have received Part i., vol. xi., of the *Indian Meteorological Memoirs*, containing the observations recorded during the solar eclipse of January 22, 1898, at 154 stations, seven of which were in close proximity to the central line of totality. The observations were taken at intervals of five to fifteen minutes, and includes the barometer, thermometer, wind and cloud, and occasionally other elements. These have all been reduced and tabulated in the Calcutta Office according to Madras time, and are, therefore, in this respect, strictly comparable. Beyond this, no attempt is made to discuss the data. In looking over the observations at the stations of greatest obscuration one is struck by the fact of the lull of the wind at the time of total eclipse. For instance, at Seoni, where full obscuration lasted from 1h. 27m. to 1h. 28½m. p.m., the observer remarked, "Everything quite quiet and calm, wind totally stopped from 1h. p.m. to 2h. 10m. p.m." The decrease of temperature amounted to about 5° at several places.

THE Report of the Meteorological Council for the year ending March 31, 1899, has just been issued. The Office continues, as in the past, to collect data relating to the meteorology of the ocean, for which purpose complete outfits of meteorological instruments are supplied to officers of the Mercantile Marine who are willing to take observations. The number of such ships supplied during the year was 114. All ships in the Royal Navy are also supplied with instruments, and the Council receive valuable observations from this source. The results of the weather forecasts issued by the Office show a complete or partial success of 83 per cent. during the year 1898; the average success during the last ten years is 81·4 per cent. The special hay harvest forecasts issued to a number of selected stations attained an average success of 89 per cent., and in the district which includes the south of England the complete and partial success reached the high figure of 96 per cent. The Office continues to subsidise and to retain an intimate relationship with a small number of observatories of the highest class; the information from these is supplemented by observations at stations where the observers are volunteers. Among the miscellaneous investigations may be mentioned those on atmospheric electricity, by Mr. C. T. R. Wilson, of Cambridge, and the diurnal range of rainfall, by Mr. R. H. Scott. An appendix to the Report contains a correspondence relating to allowances made by the Meteorological Council to the Ben Nevis Observatories. For some time past the Council have also had under their consideration the necessity of making systematic provision for superannuation allowances to members of the staff. Such allowances will apparently have to be provided from the vote for meteorological observations, and reductions in some directions will have to be made in order to provide the means for a satisfactory arrangement. It is hoped that this may be effected without any material diminution of the scientific usefulness of the Office.

TWO communications on telegony and the inheritance of acquired characters have recently appeared;—the one, in the December number of the *American Naturalist*, taking the form of a critical review of Prof. Ewart's "Penycuik Experiments," and the other, a paper by Mr. C. J. Bond in the *Transactions* of the Leicester Literary and Philosophical Society, describing some experiments in rabbit-breeding and plant-grafting. While giving his adherence to Prof. Ewart's conclusions, the former writer urges the needs of further experiments on the same lines. Mr. Bond likewise ranges himself on the same side, stating "that the evidence in favour of the transmission of acquired, as opposed to congenital characters, breaks down in that group of cases in which the supposed occurrence of telegony was thought to prove such transmission; that the explanation of this phenomenon is reversion, and that this may also account for certain phenomena following budding and grafting in plants. Many of the remaining results can be explained by the direct action of the pollen on the maternal tissues without inheritance."

IN the above-mentioned issue of the *American Naturalist*, Mr. C. E. Mead makes the important announcement that in New Mexico a beetle of the genus *Collops* has been observed feeding on the larva of the dreaded Colorado potato-beetle. This leads to the belief that the main crop of potatoes in the district in question is mainly saved by the predaceous habits of the *Collops*, whose presence seems worth many hundreds of dollars to the potato-growers of San Juan county. If this be substantiated, steps should be immediately taken to introduce the *Collops* into other districts affected by the Colorado beetle.

THREE papers on Wehnelt's interrupter form a noteworthy feature of the *Atti dei Lincei* viii. (2) 12. Drs. R. Federico and P. Bacei have determined the form and frequency of the interruptions by allowing the current to circulate round a solenoid, by which magneto-optic rotation is produced, and thus obtaining a photograph in which the interruptions are represented by light bands on a dark ground. The conclusions are (1) that the interruptions do not alway occur at equal intervals; (2) the interruptions are of short duration, averaging about one-sixth of the interval between them; (3) during the interruption the current does not absolutely cease, but only falls to a minimum; (4) a magnetic field does not affect the number of interruptions per second, but reduces their duration; (5) the frequency of the interruptions varies with the electrolyte, a solution of bichromate and sulphuric acid giving a frequency 1½ times greater than with a solution of sulphuric acid only; (6) the bichromate solution does not become turbid, and its heating is less than with sulphuric acid. Dr. O. M. Corbino investigates, among other results, the mathematical expressions determining the form of the interruptions as deduced from the equations of mutual and self induction, assuming the phenomenon to be due to Joule's law. In a subsequent paper, Dr. Corbino investigates the dissymmetry of the currents obtained in the circuit of a transformer when the current in the primary is broken by Wehnelt's interrupter.

THE whole of the October number of the *Journal of Comparative Neurology*, comprising 302 pp., and five beautifully coloured plates, is devoted to an elaborate memoir by Mr. C. J. Herrick on the nerve-components of the bony fishes, as exemplified by the cranial and first spinal nerves of *Menidia*. For the benefit of those not familiar with the theory of nerve-components, it may be mentioned that this is an extension to the cranial nerves of what has been already done for those of the spinal system, which (not to refer to the "four-root theory") are divisible into motor and sensor portions. Similarly the cranial nerve-trunks may contain several varieties of sensory fibres, having different functional and morphological relations, certain of which may be present in a single segmental nerve. In spite of many technical difficulties, and our imperfect knowledge of their exact relations, enough has been accomplished to permit of the statement that the several lobes of the medulla oblongata, so characteristic of fishes, may be associated with the respective cutaneous or visceral sense-organs as definitely as the olfactory nerves are associated with the olfactory lobes, or the electric lobes of the torpedo with its electric organs. An excellent example of this association occurs in the so-called "sea-robins," in which certain free rays of the pectoral fins have become modified into finger-like tactile organs, while their sensor nerves, together with the corresponding dorsal nerves of the spinal cord, have been enormously hypertrophied. Although the criteria of the nerve-components are primarily the central and peripheral distribution of the nerves themselves, it has been found in practice that in fishes each component has certain definite and characteristic structural peculiarities, by means of which it may be at once recognised, thus rendering the work of the investigator much easier than would otherwise be the case.

AMONG the several interesting papers contained in the last numbers of the *Izvestia* of the Russian Geographical Society, we notice especially one, by General Tillo. It deals with the results of the meteorological observations which were made for two years in the Lukchun depression of Central Asia, in connection with the expedition of Roborovsky and Kozloff. This depression was discovered, as is known, by the brothers Grum-Grzimailo. Owing to the absence of places in the neighbourhood of the Lukchun, the altitude of which would have been measured geometrically, it is evidently impossible to finally determine the real altitude of the depression; but from three separate comparisons of the observations of the barometer which were made at this place from November 1893 to October 1895

with those made at Barnaul and Irkutsk, as also with the normal isobars, General Tillo comes to the conclusion that the probable altitude of Lukchun must be 17 metres below the sea-level, with a probable error of ± 15 metres. The spot where the barometer was observed is not, however, the lowest part of the depression, as its altitudes are in different places from 36 to 110 metres *below* that place—thus giving negative altitudes as deep as 130 metres ± 15 metres below the sea-level at Tash-tura. A good map of the depression is given with the paper. Besides, the meteorological observations made at Lukchun are most interesting in themselves, as it appears from them that the yearly amplitudes of the barometer are greater at this place than anywhere on the earth—the monthly averages for January being by full 30 mm. in excess of those for July, while the daily amplitudes in the winter are as great as in some tropical lands. The highest temperature observed in July (48° C) is also one of the highest observed in Continental Asia, and is truly Saharian. So is also the dryness of the air.

A PAPER, on a "New Basis for the Foundation of Geometry," has been issued, bearing the signature "E. G. L," but whose author invites criticisms addressed to Mr. F. Wheatcombe, of Manchester. The writer of the paper is by no means alone in his ideas as to Euclid's treatment of parallel lines, his definition of a plane angle to the exclusion of straight angles and other such matters being unsatisfactory. As he contemplates writing a book on the subject, we only hope that he will first have studied the considerable mass of existing literature upon it ; and if the work is to be properly treated the author should be versed in non-Euclidian as well as Euclidian geometry. The persistent survival of Euclid's "Elements" as a text-book on geometry is mainly due to his sequence of propositions, stereotyped and standardised by constant usage, affording teachers a common starting point. Many have tried to improve on Euclid ; but as long as scarcely two people think alike as to how this is to be done, so long will their proposals fail to take root.

THE January number of the *Philosophical Magazine* contains a paper, by Dr. C. Davison, on earthquake sounds, a somewhat neglected branch of seismology. The sound is described as generally deep and rumbling, like that of a heavy waggon passing ; sometimes it resembles thunder or wind more closely, the fall of heavy stones, or the firing of distant cannon. Near the epicentre of the earthquake, loud crashes are heard by some, but not all, observers at the time when the shock is strongest ; further away, it becomes rougher and more grinding at this moment ; while at a great distance, the sound is throughout smooth and almost monotonous like the low roll of distant thunder. The neighbourhood of the sound to the lower limit of audibility is shown by the fact that it is heard by some observers, as say, like the rumbling of a heavy traction-engine passing, while others equally alert hear no sound at all. To different auditors of the sound, it also varies in character and duration for the same reason. In this country, practically every earthquake is accompanied by sound, which both precedes and follows the shock ; in Japan, the sound is frequently absent even from violent earthquakes, it is seldom heard more than a few miles from the origin, and rarely, if ever, follows the shock. It would therefore appear that the Japanese as a race are inferior to us in their powers of perceiving deep sounds. In strong earthquakes, the sound-area occupies a region surrounding the epicentre ; in weak ones, the sound-area and disturbed area approximately coincide, or the former area overlaps the latter ; while in certain districts the sound is sometimes heard without any shock being felt. Several instances of these earth-sounds are given, and it is urged that they are merely earthquakes too weak to be felt. Dr. Davison believes that earthquakes are caused by fault-slips, and that the sound-vibrations come chiefly from the margins of the area of displacement. He shows that this theory will account for all the known phenomena of earthquake-sounds.

IN the *Proceedings* of the Liverpool Geological Society (Part 3, vol. viii., 1899) we have an address from the ex-President, Mr. J. Lomas, in which he deals with the characteristic lithological characters of the principal geological systems. In another article he describes and figures "some flint implements found in the glacial deposits of Cheshire and North Wales." Concerning the artificial form of some of these, Mr. W. J. Lewis-Abbott speaks with confidence, whereas Sir John Evans remarks "No. 7 may be artificial. Of the others, Nos. 2 and 3 look the most possible ; but the signs are not such as can confidently be relied on. If man existed in pre-glacial times in Britain, it is, I think, probable that his tools would have been of larger proportions." Mr. Mellard Reade describes a great boulder of gypsum which was found at Great Crosby ; he also enumerates the Foraminifera found in samples of Cheshire boulder-clay. Mr. G. H. Morton describes his geological map of Liverpool, and Mr. T. H. Cope deals with the gabbro of Llyn Eigiau, above the valley of the Conwy.

THE *Journal de Physique* for January reprints an article on the Phase rule of Prof. Willard Gibbs, taken from the introduction of the work by Mr. Wilder D. Bancroft. In this article, the rule in question is very simply explained.

THE *Bulletin* of the Cracow Academy (November) contains a continuation of M. P. Rudski's researches on the elastic deformations of the earth. It deals with the deformations produced by glacial deposits or by the formation of coral reefs.

ON account of the comparatively dull light of the English climate, the lenses usually possessed by Kodaks and other hand-cameras have too small an aperture to be used for many purposes. Messrs. Taylor, Taylor and Hobson have, therefore, at the request of many photographers, made arrangements for refitting such cameras with their well-known Cooke lenses. As the lenses can be attached to almost any hand-camera now upon the market, their rapidity will soon be widely known.

AS in previous years, the "Annuaire" of the Brussels Observatory contains particulars of the principal astronomical occurrences for the current year, geographical information, tables of physical and chemical data, and other statistics of frequent service in scientific work. The articles include a discussion of the meteorological observations of 1899, and of the direction of the wind at Brussels, by M Lankaster ; on the use of the kite in meteorology, with a bibliography of the subject, by M. Vincent ; the climate of the Belgian coast, by M. Durieux ; the population of Europe, by M. Lankaster ; reports on various branches of astronomical and meteorological work carried on last year, and an instructive description of the determination of the co-ordinates of sun spots, by M. Niesten.

MANY workers with the microscope have been guided in their early "dabblings" by the late Rev. J. G. Wood's "Common Objects of the Microscope" (Routledge and Sons), and not a few can doubtless recall their failures in the attempt to mount seeds in Canada balsam and their disappointment that the medium refused to set in six to eight hours. A new edition of this deservedly popular book has now appeared, revised and brought up to date by Mr. E. C. Bousfield. The late Mr. Tuffen West's familiar illustrations appear to have been re-engraved, and fly leaves with lists of the figures are now attached to the plates, while Mr. Bousfield has added two plates of his own drawing illustrative of pond life. The new letterpress includes a brief account of the optics of magnification, and the use of the substage condenser (brought into general use since the first edition of "Wood") in the introductory chapters, and

information on fixing, hardening, imbedding, sectioning and staining, also on selecting diatoms, in the chapters on "mounting" now at the end of the book. The number of pages has been increased from 132 to 186.

A NEW method of attacking the problem of determining the degree of ionisation of complex solutions is given by Prof. J. G. Macgregor in the *Transactions* of the Nova Scotian Institute of Science just issued. The number of free ions per unit volume can be studied in the case of the two simple salts separately by means of the conductivity. These numbers are functions of the dilution, and can be expressed graphically in the form of curves. From these two curves, by a neat graphical construction, Prof. Macgregor deduces the concentration of the ions in the solution resulting from the mixture of the two simple solutions, a complicated algebraical process being thus avoided. The method is applied, in a subsequent paper in the same volume by Mr. J. Barnes, to solutions containing a common positive ion, potassium chloride and sulphate. It was found to be possible in this way, given the dissociation theory and data obtainable from simple solutions, to predict the electrical conductivity, specific gravity and surface tension of fairly dilute solutions of potassium chloride and potassium sulphate within the limits of experimental error.

NOTHING can be more striking testimony to the advance of physical chemistry than the manner in which isolated phenomena, long known but previously unexplained, fall into line when attacked by modern methods. An excellent example of this is afforded by the paper of Messrs. Cohen and Van Eijk in the current number of the *Zeitschrift für physikalische Chemie* on physico-chemical studies of tin. As early as 1851 a curious molecular transformation of some tin organ pipes was noticed by Erdmann, and the same fact was rediscovered eighteen years later by Fritzsche at St. Petersburg, the tin crumbling to a grey powder. Since that time this phenomenon has been repeatedly studied by various observers, the causes being variously ascribed to low temperature, effect of shocks upon the crystalline structure, and velocity of cooling of the tin when originally cast. A preliminary dilatometric study of a grey tin showed the existence of a transition temperature at about 30° C., hence a transition element was constructed, having grey tin as one electrode and ordinary white tin as the other. A study of the electromotive force of this cell with varying temperatures showed that the reaction

$$\text{grey tin} \rightleftarrows \text{white tin}$$

was a reversible one with a transition point at 20° C. A careful determination of the same point by the dilatometric method gave the same value. All the observations of early workers are brought into line by this work. The authors point out that, except during a few warm days, all tin is in a metastabile equilibrium, and tends to transform itself slowly into the grey powder modification.

THE additions to the Zoological Society's Gardens during the past week include a Geoffroy's Cat (*Felis geoffroii*) from Paraguay, presented by Mr. W. A. Gillett; a Woodcock (*Scolopax rusticula*), British, presented by Mr. C. E. Lambert; a Common Snake (*Tropidonotus natrix*), British; a Tesselated Snake (*Tropidonotus tessellatus*), a Dark Green Snake (*Zamenis gemonensis*), European, presented by Miss Ash; a Black-headed Lemur (*Lemur brunneus*) from Madagascar, a Blue-tongued Lizard (*Tiliqua scincoides*) from Moluccas, a Bare-eyed Cockatoo (*Cacatua gymnopis*) from South Australia, two Undulated Grass Parrakeets (*Melopsittacus undulatus*, var.) from Australia, two Common Teguexins (*Tupinambis teguexin*) from South America, an Eyed Lizard (*Lacerta ocellata*), European, deposited; a Black-headed Bunting (*Emberiza melanocephala*), bred in the Gardens.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN FEBRUARY.

February 2.	6h. 56m. to 7h. 43m.	Occultation of κ Piscium (mag. 5·0) by the moon.
2.	11h. 44m.	Minimum of Algol (β Persei).
2.	18h. 5m.	Transit (Ingress) of Jupiter's Sat. III.
5.	8h. 33m.	Minimum of Algol (β Persei).
6.	8h. 36m. to 9h. 24m.	Occultation of δ Arietis (mag. 4·5) by the moon.
7.	14h. 3m. to 14h. 49m.	Occultation of 56 Tauri (mag. 5·4) by the moon.
8.	15h. 50m. to 16h. 29m.	Occultation of n Tauri (mag. 5·2) by the moon.
14.	Venus.	Illuminated portion of disc = 0·801.
15.	13h. 20m. to 14h. 40m.	Occultation of 55 Leonis (mag. 6·0) by the moon.
19.	Saturn.	Outer minor axis of outer ring = 16″·13.
22.	16h.	Jupiter in conjunction with moon. ♃ 1° 31′ N.
25.	10h. 15m.	Minimum of Algol (β Persei).
28.	7h. 4m.	Minimum of Algol (β Persei).

UNITED STATES NAVAL OBSERVATORY.

CAPTAIN C. H. DAVIS, Superintendent of the United States Naval Observatory at Washington, has forwarded a copy of his report for the fiscal year ending June 30, 1899.

The great equatorial, 26 inches aperture, has been devoted to work beyond the reach of smaller instruments, and in particular to the spectroscopic determination of the motions of stars in the line of sight. Many measures were made of the diameters of Mercury and Venus, to determine the irradiation error, and it was established that this was a function of the magnifying power employed.

The spectroscopic observations were almost all made by the photographic method, the wave-lengths being obtained from measures taken with the large Harkness comparator made for eclipse reduction in 1869. The probable error in the velocity, as determined from a single plate, was about ± 0·71 mile per second. Good plates with well exposed comparison spectra have been obtained of α Tauri, α Aurigæ, α Canis Majoris, α Canis Minoris, α Cygni and ϵ Cygni, but many others have been failures, owing to the difficulties involved in the use of a lens only visually corrected. This has recently been remedied by the purchase of a correcting lens of 2·09 inches aperture, which alters the minimum focus from λ 5270 to λ 4341 without materially disturbing the total focal length from the object-glass. Extensive alterations have been made in the endeavour to remedy the air currents produced in the equatorial building on account of its connection with other rooms. The 12-inch equatorial has been employed in the systematic observation of minor planets, comets, occultations of stars and eclipses of Jupiter's satellites, the whole of which have been reduced and published. This telescope has also been used for the exhibition of celestial objects to the public on Thursday evenings. Including those admitted during day working hours, the number of visitors during the year has been 1623.

Transit observations have been continuously made throughout the year. The 9·14-inch instrument was dismounted on June 5, 1899, the whole observing staff being immediately transferred to the new 6-inch transit circle. The temporary fittings supplied at the installation of the 9·14-inch transit in 1893 are being replaced by permanent ones of new design. A meridian mark has been provided for the 6-inch instrument, and the performance of both this and the new steel altazimuth have given every satisfaction.

The new 5-inch altazimuth and the prime vertical instrument have been employed for determining variations of latitude and the constants of aberration and nutation.

The 40-foot photoheliograph was installed, for obtaining sun pictures, on October 11, 1898, and from this date to June 30, 1899, negatives were taken on 122 days. The sun's disc on these plates is 4·3 inches in diameter. The publications of the Observatory are well in hand. Volumes of observations for 1891 and 1892 are almost ready for distribution, and these will complete the record of work done at the old Naval Observatory. The American ephemeris for 1902 is issued, and it is hoped that the volume for 1903 will be issued in February 1900. In this, the adopted value of the apparent diameter of the sun will

be changed from 960″·78 to 961″·50, this alteration being based on the discussion of 35,842 meridian observations made at the principal observatories of the world.

A new departure in the administration of the Observatory was the appointment, in June 1899, of a Board of Visitors by the Secretary of the Navy, whose duty will be to examine and report upon the condition and requirements of the institution.

ON THE BLUE COLOUR IN WOAD.

THE old East Anglian proverb, "As blue as wad," occurs to one visiting the Woad Mill described by Mr. Darwin in NATURE, in 1896 (vol. lv. p. 36), as evidence that woad once yielded a blue dye. As a natural sequence one wonders what sort of blue it was and how it was obtained. A somewhat extended series of inquiries amongst those engaged in the woad industry, amongst those who have written on woad, and amongst botanical, archæological and chemical friends, failed for a long time to elicit the desired information. Curious as it may appear, an appeal to botanical and chemical works, to dictionaries and encyclopædias was equally unsuccessful. The last-named were pretty uniform in their statements about woad, in that it "was formerly used for dyeing blue, but is now superseded by indigo." Many of the books give an account of the woad-vat in which the manufactured woad is used with bran and lime as a ferment to change the insoluble indigo-blue into the soluble indigo-white; but they give no clue as to how woad may be used as a blue dye alone. It has been said that the blueness of woad was more or less a myth, and even if it ever possessed this quality it has long since been lost by continued cultivation.

As some of the facts elucidated in the attempt to find the blue colour may be of interest to others, they are herewith detailed:—

At the present time woad is grown and is manufactured in four places in the Fen country, viz. at Algarkirk, Wyberton, Skirkbeck, and Parson Drove; its use being as above stated, as a ferment in the indigo-vat to dissolve the indigo-blue. This process of dyeing by woad is difficult, cumbersome and expensive, but it yields the most permanent results. A genuine woad-dyed cloth resists sunshine, rain, and sea-air better than any other, but it is so expensive that only the very best articles are dyed in this way. The fastness of woad-dyed cloth is so proverbial that Prof. Hummel, of the Yorkshire College, Leeds, tells me the adjective "woaded" is now applied in the trade to any fast or permanent indigo dye: a woaded black meaning a black that has an indigo ground colour. The wool is dyed before it is woven, and the cloth may be distinguished by having pale blue or yellow threads in the selvedge.

But to return to the plant, many methods have been suggested by which the indigo in it may be extracted. In the earlier years of the present century, when we were at war with France, so great was the difficulty experienced by that nation in obtaining indigo that the Government offered a substantial prize for an efficient substitute. Attention was consequently re-directed to woad, and more than one method was suggested for the separation of indigo from it. However effective these may have proved in France and Italy, with me they failed, and failed so uniformly as to render the very numerous experiments extending over a period of five months unworthy of further notice. Suffice it to say that the experimental material was obtained from Parson Drove, Boston, Cambridge Botanic Gardens, and wild plants from Gloucestershire. Eventually the presence of indigo was demonstrated in these plants by the simple method of Dr. Hans Molisch,[1] who kindly further advised me, in a letter, to examine particularly the younger and expanding leaves. The method consists in keeping the fresh leaves for twenty-four hours in an atmosphere of ammonia, and then for a similar period in absolute alcohol. The ammonia precipitates the indigo in the leaves, while the alcohol dissolves out the chlorophyll: so that by cutting sections one can see the exact tissues in which the indigo occurs. These are those containing chlorophyll. The fibro-vascular tissue, the hairs, the epidermis, excepting the guard cells of the stomata, are free from it.

The quantity of indigo varies very much in different leaves; some turn a beautiful blue, while others come out of the absolute alcohol showing only a faint trace towards the base of the leaves. As a rule, the younger the leaf the more indigo it contains; some young leaves, however, hardly contain any. Old leaves have practically none in them, and become yellowish-green or greenish-white brittle objects after the above treatment.

The process of separating the indigo is more delicate—perhaps it would be more correct to say it is a process simple enough in itself, but one in which certain precautions must be observed. Prof. Beijerinck, whose paper "On the formation of indigo from woad"[1] is summarised in NATURE, November 16, 1899 (p. 71), gives the following method: The woad leaves are put into a stoppered bottle, which is then filled with hot water, in such a way that all the air is expelled and the stopper put in so that no air bubble is allowed to remain between the top of the water and the lower part of the stopper. The water assumes a pale yellowish tint—the colour of sherry—with a green fluorescence. On the addition of a caustic alkali it darkens and becomes greenish. If a dilute acid be now added the indigo falls as a blue precipitate. The first time this method was tried with Parson Drove woad its success was complete; the long sought-for blue colour fell in abundance. Prof. Beijerinck tells me that in the month of September he obtained ·09 per cent. of pure indigo-blue from plants grown in Holland.

A considerable number of experiments have been made with the Parson Drove woad, the outcome of which may thus be summarised. The elaborate precautions for excluding the air are not absolutely necessary—simply pouring boiling or nearly boiling water on fresh woad leaves, so that they are completely covered, answers well enough. If to the infusion thus obtained caustic potash, caustic soda, strong ammonia or lime-water be added, the colour changes from yellowish to greenish. Any woollen fabric now dipped into this alkalised infusion will, on exposure to the air, pass from greenish to blue—not the dark blue one had expected, but a beautiful pale azure blue. This change takes place at once if the fabric be immersed in any of the dilute mineral acids. The blue colour thus obtained cannot be called fast, as it will not withstand the action of alkalis or even of soap. It is very subject to variation, being often greenish-blue, grey, or even dove colour. This depends on the age and quality of the woad leaves, as well as on the details of manipulation. In brief, the process consists in simply making an infusion and treating it first with a caustic alkali, then with an acid. The following points have, however, to be attended to: the leaves must be young, they must be fresh, the water must be boiling or nearly so, the infusion must not be left too long before the alkali is added, nor must the addition of the acid be too long delayed. The infusion must be cold before it is treated. If these precautions be not observed, instead of the indigo-blue, that peculiar brownish-black compound is formed which is the *bête noir* of the woad experimenter.

In order to determine the quantity of indigo in Parson Drove woad in plants of various ages: half a kilogramme of leaves, 28, 30, 34 and 66 days old, was found to yield respectively 1·5, 2·4, 2·1, and 0·6 grammes of impure indigo.

The indigo obtained from different experiments varied much in colour; one specimen was an exceedingly beautiful light blue; mostly, however, it was dark blue, which became when dry more or less green. When this, however, was powdered and dissolved by the aid of slaked lime and ferrous sulphate, it dyed cotton articles bright indigo-blue. With regard to the time the leaves should be allowed to infuse, a series of experiments in which 30 c.c. of an infusion were examined at the end of 30 minutes, 1½, 2, 3, 6, 9, 12, 24 and 48 hours, showed that the first 30 c.c., *i.e.* at the end of 30 minutes infusion, contained as much indigo as any of the others; while after the 6th hour the indigo-blue was replaced by the black-brown precipitate. It is probable that the agitation of the vessel in pouring off the successive quantities was the cause of this, for I have obtained indigo-blue from infusions at the end of 10 or 12 hours when they have not been disturbed.

May I ask if any of your readers can help me by suggesting the process by which the mediæval dyers got a blue dye from the prepared woad? Indigo was not introduced into Europe as a commercial article till the middle of the sixteenth century, and even then its employment was for some considerable time more or less prohibited by legal enactments. That woad was used in this country long prior to this is shown by the indenture which still exists between the woad merchants of Amiens and

[1] "Ueber das Vorkommen von Indican im Chlorophyllkorn der Indicanpflanzen." ("Berichten der Deutsch Botan. Gesell.," 1899. Bd. xvii. Hf. 6, p. 228, t. xviii.)

[1] "Koninklijke Akademie van Wetenshappen te Amsterdam," October 25, 1899.

the citizens of Norwich, dated June 29, 1286. That the culture and preparation of woad was practically the same in the time of Ruellius (1536), Crolachius (1575), Wedelius (1675), and Ray (1686) as it is now their writings show. It is probable some very simple process was used by the dyers in these olden times, as simple as that by which the blue colour can be obtained from the fresh plant—at any rate, less complicated than the woad-vat Helliot describes in 1750 for dyeing with woad and indigo, and which is given, with variations, in encyclopædias down to the present time. CHARLES B. PLOWRIGHT.

CONTACT ELECTRICITY.

AT the meeting of the Physical Society, a few weeks ago, when the subject of Contact Electricity was under discussion, the President was asked by his friendly opponents to commit himself to a definite interpretation of the fundamental equation, and to a precise statement as to what quantity he recognised as "contact potential difference." Prof Lodge did not then comply with the request, but he promised to address the Society upon "Contact Electricity" at their annual general meeting on February 9. It is rather a matter for regret that this ancient feud is so near to amicable settlement. The controversy has held its own for a little more than a century, and throughout that time it has acted as a never-failing stimulus to research in the laboratory. Physicists are now retracing the steps of their arguments, revising their definitions, amending their phrases, and trying hard to understand one another's parlance. No scientific dispute can outlive such precautions.

The case for both sides has frequently been stated. Perhaps the best account consistent with brevity is that given in Prof. A. Gray's "Magnetism and Electricity," Chap. xii. This, in common with all modern summaries of the subject, is admittedly derived from Prof. Lodge's British Association Report of 1884. Those who desire to bring themselves into closer acquaintance with the latest developments of the argument should read the article on "Contact Electricity," by Mr. W. A. Price, in the *Electrical Review* of December 29, 1899. Mr. Price seeks to locate the dispute to the meaning of words, and chiefly to the word "potential." He explains that "potential" is essentially a property of a position in space, and that it implies neither the existence nor the absence of matter near or at a point of which potential is predicated. The expression "potential at a point" has *per se* no ambiguity. But when measurements of the potential at a point are required, the methods employed, from their indirect character, necessitate certain assumptions; and the quantity is no longer free from ambiguity. Potential is generally measured indirectly, as the result of an investigation of the electrical force in the neighbourhood of the given point. The value, so obtained, involves therefore the physical qualities of the fluid medium or media associated with the point, and these have no place in the primary definition of potential. There is, in fact, no experimental foundation for the statement that within a conducting body, not conveying electricity, potential has the same value at all points. Hence no conclusions can properly be drawn until physicists agree amongst themselves as to their cardinal definitions; and when this is accomplished, the controversy will have ceased.

AGRICULTURAL EDUCATION.

WE are slowly realising that success in farming depends quite as much upon scientific knowledge as upon practical training. In other countries this fact has been fully appreciated for many years, and elaborate provision for the interests of agriculture forms a prominent feature of their educational systems. Similar provision has become a necessity for England, if we are to compete with them upon anything like equal terms. In furtherance of this object the Agricultural Education Committee, of which some of the most eminent men of science and agriculturists of the day are members, has recently issued certain definite proposals. Foremost amongst these is a recommendation that all the educational work of the Board of Agriculture should, like that of the Science and Art Department, be transferred to the new Board of Education. If the confusion, overlapping and wasteful expenditure of public money, which have resulted from the multiplication of central authorities, are to be avoided, it is essential that one authority alone should be responsible for the agricultural education of the country. It would be the function of this authority, aided by inspectors thoroughly familiar with the needs of the agricultural classes, and with the conditions of rural life, to secure an adequate provision of the various forms and degrees of instruction required by all those who are in any way concerned with the cultivation of the soil.

Such instruction must commence with the elementary school, for that is the foundation upon which the whole superstructure has to be built, and the Committee emphasises the importance of differentiating the curriculum of the rural from that of the urban school. This change is not advocated under the impression that it will stem the tide of migration from the country districts. A variety of social and economic causes combine to drive men from the villages into the towns. At the same time, on the principle that "as a twig is bent, so will the tree incline," it is hoped that if children were familiarised from their earliest years with the simple facts of nature, and encouraged to take an intelligent interest in them, a love of the country might be awakened, and the desire to remain in it certainly be strengthened. No suggestion of teaching agriculture or science as such is put forward: years ago, Prof. Huxley pointed out the futility of attempting to teach either one or the other in an elementary school. A rural curriculum should include elementary science lessons upon the life, growth and structure of plants, the habits of birds, animals and insects, the nature of the soil, and air and water, and the utility of the simpler methods of cultivation. These lessons should be illustrated by experiments, and be accompanied by practical work, appropriate to the agricultural character of the locality, done by the pupils themselves in gardens or on plots of ground attached to the school. They should be supplemented further by occasional visits to well-managed farms, and valuable assistance might be given by circulating amongst the teachers and pupils leaflets, similar to the admirable "Nature-Study Leaflets" issued by the agricultural college in Cornell University. In like manner girls should receive elementary instruction in cooking, domestic economy and hygiene. In either case the child will be developing those faculties, and forming those habits, which enable a boy to become a skilled labourer or a successful farmer, and a girl to become a competent servant or a capable housewife. To meet the difficulties of small schools, several parishes must combine to engage the services of a peripatetic teacher. There can be no doubt that in the grouping of villages and schools for educational purposes the solution of many of the problems of rural education will ultimately be found to lie.

As yet it is not easy to find properly qualified teachers, but the Committee suggests various ways in which they may be trained. At the normal colleges in France theoretical and practical instruction in agriculture is provided for the students by the departmental professors, and there does not appear to be any reason why students at some of the training colleges in England should not be similarly taught by the lecturers of the County Councils. It should be remembered that the rural school does not require an agricultural expert; such a teacher would inevitably give undue prominence to one aspect of elementary education, and it might reasonably be objected that an attempt was being made to capture the schools in the interest of one section of the community only. The rural teacher should have a general knowledge of the principles underlying the science of agriculture, and some practical knowledge of agricultural operations. Men so qualified will be rapidly forthcoming as the demand for them becomes more general. In the meantime existing teachers should be assisted to acquire the necessary experience by County Council lectures, practical demonstrations on farms and in gardens, and courses of instruction at agricultural colleges; special facilities by means of scholarships or bursaries should be offered to rural pupil teachers for a course of some duration at any institution where theoretical and practical instruction might be had.

It is necessary to insist upon the importance of the lower branches of agricultural education in view of the small attention which has hitherto been paid to them. The hope of the future lies in our having a constant relay of pupils from the elementary schools fitted to attend and profit by the more advanced classes and colleges. For the majority of rural children evening continuation schools afford the only opportunity for further instruction, and the Committee recommends that it should be made part of the duty of every county organisation (outside London and the county boroughs) recognised under Clause VII.

of the Directory to organise such schools throughout their county, to receive and supplement the grants made by the Board of Education, and to supply and pay qualified teachers. The instruction should be in such subjects as natural history, botany, and other sciences bearing upon agriculture and horticulture, bee and poultry keeping, land measuring, farm accounts, &c., rather than in such subjects as typewriting, commercial arithmetic and shorthand. Between these classes and the highest agricultural colleges, schools should be established in every county, where lads from the age of thirteen to eighteen might obtain two years' thorough theoretical and practical training. Each of these schools should be developed by its managers upon the lines most suitable to the agriculture of the district. Thus it may be possible to organise a satisfactory system of agricultural education, but, as was well observed by M. Tisserand, Director of Agriculture in France in 1896, in his memorandum for the Recess Committee: "the agriculturists must be made to understand that the improvement they desire depends as much upon themselves as upon the Ministry, if not more so; that the latter must be powerless without their help; that they will receive succour from the State in proportion as they themselves put forth energy and labour; and that it is only by the united effort of all concerned that progress can be brought about."

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—The practical teaching of physical chemistry is being introduced this term at the Daubeny (Magdalen College) Laboratory. The course of instruction will be given by Mr. Duncan Wilson, who was recently appointed Lecturer in Chemistry to the College, and has studied with Prof. Ostwald.

CAMBRIDGE.—The Allen Scholarship for research, worth 250*l.* for one year, will this term be given for work in medicine, mathematics, physics and chemistry, biology and geology, or moral science. Candidates are to be graduates of the University of not more than twenty-eight years of age. Applications should be sent to the Vice-Chancellor by February 20.

The Faculty of Medicine of the University College of South Wales and Monmouthshire has been recognised for the purpose of medical study outside the University.

Plans and estimates for the new botanical laboratory have been submitted to the Senate. The cost will be over 22,000*l.*

The Mathematical Board have amended in a few details their previous report on the Mathematical Tripos. They now propose that each class in Part I. shall be arranged in two divisions, the names in each being in alphabetical order. They think it important that these divisions should, so far as may be practicable, indicate a uniform standard from year to year. The voting will take place on February 15, at 2 p.m.

Dr. Jackson was on January 26 unanimously elected a member of the Council in the room of Mr. Dale, now Principal of University College, Liverpool.

The present state of war has affected the University in a remarkable manner. Not only have a considerable number of graduates and undergraduates volunteered for active service, but the Vice-Chancellor has summoned a meeting with a view to applying to the Government for an increase of the establishment of the University Rifle Corps. The present strength is 600; it is proposed to increase this to 800, and the recruits are ready. Moreover, it is proposed to place the Senate House at the disposal of the corps for a drill hall, at times when it is not required for University purposes. Colonel Dyke is giving a course of lectures on tactics thrice weekly.

Lord Lister has been appointed an Elector to the Chair of Pathology in the place of the late Sir James Paget.

The State Medicine Syndicate have made a grant of 50*l.* in aid of a course in bacteriology, provided for candidates desiring to obtain the Diploma in Public Health.

THE London County Council have agreed to retain a site in Clare Market, Strand, valued at 14,770*l.*, for the establishment of a school for higher commercial education in connection with the new University of London.

THE Queen's Speech, read at the new session of Parliament, which opened on Tuesday, announced that a measure would be introduced in regard to education in Scotland, and that proposals would be made for better enabling local authorities to aid secondary and technical education in England and Wales.

THE following officers were elected at the annual meeting of the Association of Technical Institutions, held in the Mercers' Hall, London, on Wednesday, January 24:—President, Sir Swire Smith; vice-presidents, Lord Spencer, Sir Bernard Samuelson, Bart., Mr. H. Hobhouse, M.P., Mr. W. Mather; treasurer, Mr. R. F. Martineau (Birmingham); honorary secretary, Prof. J. Wertheimer (Bristol).

IN order to meet increasing demands for space, and to keep pace with modern requirements, the Council of King's College have been obliged to undertake very extensive additions to and improvements in the departments of physiology, bacteriology, anatomy, botany, geology, public health, architecture, and applied mechanics. For these purposes, and for the resulting equipments and adaptations, an expenditure of not less than 18,000*l.* has to be met immediately. The object in view is specially commended to friends of the college and of science by Lord Salisbury and by Lord Lister. Mr. Balfour, M.P., will preside at a special festival dinner in aid of the fund, to be held at the Hall of Lincoln's Inn on Wednesday, February 14. All contributions promised before or at the dinner will be placed on the chairman's list and announced at the festival. Contributions may be sent to the Hon. W. F. D. Smith, M.P., treasurer, at King's College.

MR. W. P. HARTLEY, of Aintree, Liverpool, has added to his many donations to University College, Liverpool, the munificent gift of a completely furnished Botanical Institute. The building, which has been carefully designed to meet all the requirements of modern teaching and research, will be built of Ruabon brick with sandstone dressings, on land specially purchased for it by Mr. Hartley, and situated close to the new chemical laboratories. The building, the architect of which is Mr. F. W. Dixon, of Manchester, will consist of three main floors containing the Museum, Lecture Theatre and Junior Laboratory. Two mezzanines and top floor will provide space for senior and research laboratories, library, experimental physiology laboratory, herbarium and private rooms. The basement will contain store-rooms, heating chambers, lavatories, &c. It is expected that the new laboratories will be ready for occupation early in 1901.

THE first report of the Liverpool School of Tropical Diseases has been issued. The school was formally opened last April, with Major Ross as the lecturer in tropical diseases, and though much time has had to be devoted to organising courses of study, and arranging the material available for research, an abundance of other work has been done. The most important result, however, achieved by the school, was the despatch of an expedition to West Africa to investigate the prevalence there of tropical malaria and other diseases. The expedition, which started at the end of July and returned in October, chose Sierra Leone as the field of their labours, owing to its proximity to Liverpool, the time at their disposal being short. The results of the expedition have been in the highest degree satisfactory, and a report on its labours is now in course of preparation, and will shortly be issued. The expedition brought back a considerable amount of very valuable material for teaching purposes, more especially a unique collection of malaria infected mosquitoes, which have proved exceedingly useful for demonstration purposes. Full recognition by the Government has not yet been extended to the school, and until that recognition is given, the class of students most desired, namely, medical officers about to enter into the service of the Government in tropical colonies, will not be attracted. It is confidently expected, however, that full recognition will shortly be given, and that the medical officers in question will be allowed the option of undergoing their course of instruction in tropical medicine at Liverpool.

A DEPUTATION of the Agricultural Education Committee waited upon the Duke of Devonshire at the Education Department on Friday last, to urge the adoption of certain educational reforms on the lines of a series of resolutions which were adopted a short time ago by the executive of the Committee. Among other reforms, the resolutions suggested that in view of the importance of concentrating the control of agricultural and rural education in the hands of one Government department, the educational work of the Board of Agriculture should be transferred to the new Board of Education; that the staff of the new board should include an adequate number of inspectors well

acquainted with the needs of the agricultural classes and the conditions of country life, and that the inspectors should be instructed to see that the curricula of rural schools are differentiated from those of urban schools. It was also recommended that in rural elementary schools there should be a continuous course of rural instruction, beginning in the lower standards with object lessons and continued in the upper standards with lessons in natural history and elementary science bearing on agriculture and rural life. With regard to training, it was suggested that provision should be made at certain of the teachers' training colleges for giving practical as well as theoretical instruction in agriculture and horticulture to those students who desired it. With regard to higher agricultural instruction and evening continuation schools it was recommended that the Board of Education should encourage those county authorities which have not yet done so to provide or to contribute to school and experimental farms and should inspect and report annually on such farms; that in rural evening schools instruction should be given in such subjects as natural history, botany, and other sciences bearing on agriculture, horticulture, bee and poultry keeping, land measuring, farm accounts, and so on, rather than in such subjects as typewriting, commercial arithmetic, and shorthand. The Duke of Devonshire expressed himself in sympathy with the desire of the Committee to give a more useful and practical character to elementary education in rural districts, and mentioned certain steps which the Education Department has taken in furtherance of this object. Full consideration was promised to the various suggestions put forward by the Agricultural Education Committee. The subject is dealt with in an article on p. 332.

SOCIETIES AND ACADEMIES.

LONDON.

Physical Society, January 26.—Prof. Lodge, F.R.S., President, in the chair.—A paper by Prof. Ayrton and Mr. Mather, on some developments in the use of Price's guard wire in insulator tests, was read by Prof. Ayrton. For insulation tests made by the direct deflection method the guard wire properly applied affords complete protection against surface leakage when the ends of the cable tested are near the galvanometer, so that it is possible to have the wire connecting the conductor of the cable with the galvanometer terminal "air insulated." A difficulty, however, arises when the ends of the cable are at a considerable distance from the testing instrument; this may render air insulation impossible. The authors have overcome this difficulty by applying a guard wire along the entire length of the lead. This is done by using a concentric wire to connect the cable and galvanometer, the inner of the concentric being used as the lead and the outer as the guard wire. The principle can also be applied to determine whether a defective piece of cable is bad throughout or bad owing to one or more isolated faults. In this case the cable is placed in two water tanks, one of which is earthed, and the other fairly well insulated. By a suitable arrangement of the guard wire it is then easy to determine the resistance of the wire in the earthed tank, so that by altering the length of this wire the character of the insulation can be determined throughout the whole length of the cable. In referring to some of the earliest experiments with the guard wire made by Mr. Appleyard in 1895, Prof. Ayrton pointed out that the principle had not been applied completely, and that at one point there was a chance of leakage. Mr. Campbell said that the necessity of having a concentric could be obviated by simply hanging the lead from the guard wire by short lengths of material of fair insulation. Mr. Appleyard said that he quite agreed with Prof. Ayrton that the guard wire ought in general to be applied at both ends of all leads, provided that both ends could be got at. The reason it was used at one end only in the experiments on dielectrics made in 1895 was that the far end of the lead was carried into the condenser box, which was submerged in water in the temperature tank. Special precautions were taken to ensure good insulation of the submerged end of the lead, and tests showed that the leakage there was nil. As the end of the wire could not be got at, no guard wire could be applied. Mr. Appleyard congratulated the authors upon the use of a concentric cable for a lead, and pointed out that such a lead was sufficient for all the routine tests on core; the inner and outer conductors could be used for the purpose of taking the "copper" resistance. Mr. Price expressed his interest in the developments of his principle which had been made by the authors.—Mr. Appleyard then read a paper on a fault-test for braided and other cable-core. This method enables the fault to be found without the removal of braiding or tape. The core is wound on two insulated drums or tanks, the intermediate piece of cable being about ten feet long. One end of the core is left free, the other is connected to earth through a galvanometer and a battery. A guard wire is connected from some point between the galvanometer and the battery to some point of the braiding on the wire between the drums. A wet cloth, connected to an earth wire, is laid on one or other of the drums, over the braiding. The galvanometer deflection is noted. The earth-wire is then changed over to the second drum, and the corresponding deflection is observed. A comparison of these deflections at once indicates upon which drum the fault lies. With the galvanometer still deflected, the core may be run through a suitable contact brush or sponge attached to the guard wire. The instant the fault passes under the guard wire contact, the deflection falls and the fault is located. The paper gives the theory of the method, and indicates how to apply it (1) to localising "distributed" faults; (2) to several faults in a single cable; and (3) to the case of a single fault. One advantage of the method is that at the critical moment, when the fault passes under the guard wire, the galvanometer is short circuited through the fault, and thus completely protected.—A paper on reflection and transmission of electric waves along wires, by Dr. E. Barton and Mr. L. Lownds, was read by Dr. Barton. The waves used were produced by means of an induction coil and an oscillator, and travelled along wires ·15 cm. diameter, 8 cms. apart, and 166 metres long. The ends of the wires were connected by graphite markings on ground glass, so that any wave trains which reached the ends were at once absorbed. Three circular parallel-plate condensers were used, of 15, 9 and 5 cms. radius respectively. The plates were in all cases separated by air, and were placed 1 cm. apart. The needle of the electrometer connecting the wires was uncharged, so that it was always attracted by the charged plates. The positions of the condenser and electrometer could be varied so as to study either the reflected or the transmitted waves. The electrometer produced a negligible disturbance, as it reflected only 0·04 per cent. of the energy incident upon it. The authors have attacked the problem mathematically, using the relations of Heaviside, and have obtained expressions for the reflected and transmitted systems. These expressions consist of two terms, one of which is comparatively unimportant. From the other term certain values have been calculated. A superior limit has then been given to the other term, and the values already obtained have been subjected to a correction on this account. By a suitable arrangement of the condenser and electrometer these calculated values have been experimentally determined, and are in close agreement with the theoretical numbers, falling in many cases between the results derived from the approximate and the corrected theories. The authors have also investigated the stationary wave system produced by interference when the electrometer is placed close to the condenser, and between the condenser and the oscillator. The chairman said that the experiments afforded a satisfactory verification of Heaviside's theory.—A paper on the frequency of transverse vibrations of a stretched india-rubber cord, by Mr. T. J. Baker, was taken as read. In this paper Mr. Baker has investigated the frequency of the note given out by an india-rubber cord of square section when subjected to different tensions. The relation between length and tension is linear over a considerable range. The curve connecting length with frequency shows that while the cord was doubling its length the pitch was rising rapidly, but that further extension was practically without effect. Since the relation between length and tension is linear, while the sectional area is decreasing, it follows that the value of Young's modulus must be changing. The author has shown that the value of Young's modulus is proportional to the square of the stretched length of the cord. Using this fact, the frequency of the note given out by a stretched india-rubber cord is shown to be proportional to a quantity which varies very slightly with increase in length of the cord, and hence the variation in elasticity is given as the cause of the constancy of the note.—Mr. Appleyard exhibited some mirrors produced inside incandescent lamps by the application of voltages much above those for which the lamps were designed, and the consequent deflagration of the filaments.—The meeting then adjourned until February 9.

Chemical Society, January 18.—Prof. Thorpe, President, in the chair.—The following papers were read:—Note on nitrogen halogen compounds, by J. Stieglitz and E. E. Slosson.—On the electrolysis of the nitrogen hydrides and of hydroxylamine, by E. C. Szarvasy. The author has made series of experiments on the electrolysis of solutions of ammonia, hydrazine, azoimide, hydroxylamine, and of their salts; attempts to prepare polymeric nitrogen by electrolysing solutions of azoimide and its salts at high current densities are still in progress.—On the relationship between the constitution of some substances and the fluorescence which they exhibit, by J. T. Hewitt.—Action of fuming nitric acid on α-dibromocamphor, by A. Lapworth and E. M. Chapman. The oxidation of α-dibromocamphor yields camphoronic and homocamphoronic acids, nitrobromocamphor, dibromocampholidid, a substance of the composition $C_{10}H_{16}N_2O_6$ and a lactone which yields a crystalline acid, $C_{10}H_{16}O_4$, on hydrolysis with potash.—Note on Volhard's method for the assay of silver bullion, by T. K. Rose. The precautions to be observed in using Volhard's method are described, and the limit of accuracy is put at 0·1 per 1000.—*c*-Substituted hydroxytriazoles, by G. Young and E. Witham. The authors have prepared a number of hydroxytriazoles, using the reactions represented by the following equations:—

$$CHR:N.NH.CO.NH_2+O=CR\begin{matrix}N.NH\\ \diagdown\quad\diagup\\ N\end{matrix}C.OH+H_2O$$

and

$$R.CHO+NH_2.CO.N:N.CO.NH_2=CR\begin{matrix}NH.N\\ \diagup\quad\diagdown\\ N\end{matrix}C.OH$$
$$+NH_3+CO_2.$$

—Note on the use of a mixture of dry silver oxide and alkyl halides as an alkylating agent, by G. D. Lander. Alkylic derivatives of menthol, benzoin, benzamide and ethylic acetoacetate are obtained by the action of dry silver oxide and alkyl iodides.

Entomological Society, January 17.—Annual meeting.—Mr. G. H. Verrall, President, in the chair.—It was announced that the following had been elected as officers and council for 1900–1901: President, Mr. G. H. Verrall; treasurer, Mr. R. McLachlan, F.R.S.; secretary, Mr. C. J. Gahan; librarian, Mr. G. C. Champion; and as other members of the council: Mr. C. G. Barrett, Dr. T. A. Chapman, Messrs. W. L. Distant, H. St. J. K. Donisthorpe, F. D. Godman, D.C.L., F.R.S., A. H. Jones, R. W. Lloyd, the Hon. Walter Rothschild, and Messrs. E. Saunders and C. O. Waterhouse. The election to fill a vacancy on the council and one in the office of secretary, caused by the resignation of Mr. J. J. Walker, R.N., was adjourned to March 7.—The President delivered an address in which he reviewed the advantages and disadvantages under which entomologists and other men of science now labour as compared with the conditions existing at the beginning of the century. He called attention to certain abuses prevalent, instancing, among others, the hasty and ill-digested nature of much of the work now published, the result, as he believed, of the facilities that are given for publication. Having referred also to the vast increase in the number and variety of the publications which a student must consult in order to be fully acquainted with the work being done in his special branch of study, Mr. Verrall proceeded to suggest that there should be an international agreement for the purpose not only of restricting the number of the publications to be recognised, but of exercising some control over their contents, in order that worthless papers might be excluded. In conclusion, he briefly summarised the reforms which he considered most essential to be effected at the beginning of the new century.

Zoological Society, January 23.—Dr. Albert Günther, F.R.S., Vice-President, in the chair.—Mr. Sclater exhibited a photograph of a young example of the Rocky Mountain goat (*Haploceros montanus*). It was stated that the animal had been captured near Field, British Columbia, in June last, and had lived in captivity ever since. Mr. Sclater also exhibited a collection of birds formed by Mr. Alfred Sharpe, C.B., during an excursion to Fort Jameson in Northern Rhodesia. The collection consisted of 135 specimens, which had been referred to 66 species.—Mr. A. Smith Woodward gave an account of a series of remains of *Grypotherium* and associated mammals from a cavern near Last Hope Inlet, Patagonia, exhibited by Dr. F. P. Moreno. The specimens had been collected for the La Plata Museum by Dr. R. Hauthal, and had already been described in a memoir by Drs. Hauthal, Santiago Roth, and Lehmann-Nitsche. Mr. Woodward recorded some additional observations. He confirmed the reference of the so-called *Neomylodon* to *Grypotherium*, and agreed with the previous authors that the fragments of bones and skin had been left in their present state by man. The associated mammalian remains were in the same condition of preservation, and were referable to *Arctotherium*, a large species of *Felis*, *Onohippidium*, and a large rodent, all of the extinct Pampean fauna. Remains of existing mammals were also found in the same cave, but apparently in another stratum.—Prof. E. B. Poulton, F.R.S., communicated a report, drawn up by various specialists, on the Insects and Arachnids collected in 1895 and 1897 by Mr. C. V. A. Peel in Somaliland. It contained annotated lists of the specimens contained in the collection and descriptions of several new species.—Mr. W. E. de Winton read a paper on an interesting collection of mammals made by Lord Lovat in Southern Abyssinia while accompanying Mr. Weld-Blundell's expedition from Berbera to Khartoum in the beginning of last year. Several of the antelopes were of particular interest: the "Beira" (*Dorcotragus megalotis*), hitherto only known from a few isolated hills in Somaliland, was found to be very plentiful on the banks of the Blue Nile above Roseires.

PARIS.

Academy of Sciences, January 22.—M. Maurice Lévy in the chair.—M. Grandidier announced to the Academy the loss it had sustained by the death of M. Alexis de Tillo, correspondant for the section of geography and navigation.—Presentation of the first publications of the Observatories of Potsdam and Paris relating to the photographic chart of the sky, by M. Lœwy. Two sets of negatives have been taken, one with a long exposure, sufficient to take in stars of the 14th magnitude; the other with shorter exposure, so as to exclude stars of a higher magnitude than the 11th.—M. Zeuthen was elected a correspondant for the section of geometry in the place of the late M. Sophus Lie; and M. Peron, a correspondant for the section of mineralogy, in the place of the late M. Matheron.—Note on the works of Lavoisier, by M. de Vincenzi. A reproduction of a letter of Lavoisier, not previously published, dated January 6, 1793, to Mr. Robert Kerr, the English translator of his *Traité élémentaire de Chimie*.—Observations on the subject of the preceding note, by M. Berthelot. No trace can be found in the archives of the Academy of the new and enlarged edition of the *Traité élémentaire* referred to by Lavoisier in the above letter as being in preparation.—On isothermal surfaces, by M. C. Guichard.—On the degree of generality of any differential system whatever, by M. Riquier.—On the measurement of capacity in a heterogeneous medium, by M. A. A. Petrovsky. An analysis of the method suggested by Borgmann and Petrovsky, in which alternating currents are used. It is shown that a complete compensation can only be obtained in the cases where the compensated system is either a conductor or an insulator. In general, the magnitude of the capacity as measured will be a function of the number of oscillations of the alternating current.—On the liquefaction of gaseous mixtures, by M. F. Caubet. A pressure-temperature diagram is given showing the results of experiments on ten mixtures of carbon dioxide and methyl chloride. The results complete those already published by Prof. Kuenen.—On a phenomenon arising from the use of triphase currents in radiography, by M. Delézinier. The author shows that by the use of the method suggested by him in a previous paper, using triphase currents, the Crookes' tubes will work equally well when the anode of the tube is connected to either pole of the induction coil. The destructive effects upon the bulbs of a changing over of polarity, which occur with direct currents, are avoided if triphase currents are employed.—Transformation of the photographic image of a negative into a lamellar state, and colour phenomena derived from this, by M. A. Frillat. A negative is carefully cleaned and dried and then exposed to the vapours of nitric acid, which dissolves the precipitated silver, and causes the disappearance of the image. The plate is now placed in an atmosphere of moist sulphuretted hydrogen, when the silver is reprecipitated in a lamellar condition, and the image which reappears is vividly coloured. There is, however, no relation between the true colours of the objects and the colours so produced, although by varying the time of exposure to the sulphuretted hydrogen some control is obtainable over the colours.—On

the metallic borates, by M. L. Olivrard. Since the only definite borate of the composition $B(OR)_3$ is the magnesium borate of Ebelmann, attempts were made to prepare other borates of a similar constitution. Cadmium borate, $Cd_3(BO_3)_2$, can be prepared in a pure state by heating together in a platinum crucible potassium and hydrogen fluoride, KHF_2, with boric anhydride, and then adding cadmium oxide.—On a new method for determining aluminium, by M. Alfred Stock. The method proposed depends upon the setting free of iodine and precipitation of alumina from its salts by a mixture of potassium iodide and iodate. The reaction is not complete unless some sodium thiosulphate is added, and the solution heated. The aluminium hydrate thus thrown out is in a much denser form than when precipitated by ammonia, and is easily washed and dried.—On the fauna of the Auvergne, by MM. C. Bruyant and A. Eusébio.—On the seminal teguments of some species of the genus *Impatiens*, by M. Camille Brunotte.—On the geology of Southern China, by M. Leclère. The geological expedition to Southern China occupied from December 1897 to July 1899, and resulted in filling up the gap in the geology of the country between Indo-China and Central Asia.—On some fossil plants of Southern China, by M. R. Zeiller. A study of the carboniferous fossils collected by M. Leclère in the expedition mentioned in the previous paper.—On the structure of the southern portion of the zone of the Briançonnais, by M. W. Kilian.—On a new Miocene rodent, by M. Cl. Goillard. The new rodent, which was found in the Miocene strata of Grive-Saint-Alban, on account of its peculiar dentition cannot be regarded as belonging to any known genus. The molars have some resemblance to those *Brachyuromys Betsileonensis*, now existing in Madagascar, and recall also the dentition of the living species *Tachyoryctes annectens* and *Rhizomys vestitus*. The name proposed for the fossil is *Anomalomys Gaudryi*.—On a crystallised fibrin, by M. L. Maillard. Although admitting the accuracy of the observations of M. Dzerzgowski as to the existence of crystals of calcium palmitate in the deposit from sterile serum, the author still is of opinion that there is also a quasi-crystalline albuminoid material present.—The increase of yeasts, without fermentation, in the presence of a limited quantity of air, by M. A. Rosenstiehl. In the experiments described, the reproduction of the yeast without fermentation would appear to be caused by the presence of tannin, or of some similar substance capable of being coagulated by gelatine.—On the nature of the propagation of a nervous influx, by M. G. Weiss. The experiments made by the author upon the effect of temperature upon the velocity of a nerve impulse are not in agreement with those of Helmholtz, since the velocity would appear to be independent of the temperature, and hence is not so intimately related to a chemical change as is muscular contraction.—New method for measuring the thermal sensibility, by MM. Ed. Toulouse and W. Vaschide. To eliminate the disturbing effects of contact sensations the authors use drops of water heated to known temperatures, and weighing only 0·1 gram, which are allowed to fall on to the skin from a height of 1 cm.—Action of a continuous current upon the respiration of muscle, by M. Th. Guilloz.—On the solar halo of January 11, 1900, by M. l'Abbé Maze.

DIARY OF SOCIETIES.

THURSDAY, FEBRUARY 1.

ROYAL SOCIETY, at 4.30.—A Case of Monochromatic Vision: Sir W. Abney, F.R.S.—Thermal Radiation in Absolute Measure: Dr. Bottomley, F.R.S., and Dr. Beattie.—Electrical Conductivity in Gases traversed by Cathode Rays: Dr. McLennan.—Researches on Modern Explosives: W. Macnab and A. Ristori.—On the Influence of the Temperature of Liquid Air on Bacteria: Dr. A. Macfadyen.

ROYAL INSTITUTION, at 3.—The Senses of Primitive Man: Dr. W. H. R. Rivers.

LINNEAN SOCIETY, at 8.—On Botanic Nomenclature: C. B. Clarke, F.R.S.—On the Zoological Results of an Expedition to Mount Roraima, in British Guiana, undertaken by Messrs. F. V. McConnell and J. J. Quelch: Prof. E. Ray Lankester, F.R.S.

CHEMICAL SOCIETY, at 8.—The Chlorine Derivatives of Pyridine. Part V. Synthesis of αα'-Dichloropyridine. Constitution of Citrazinic Acid: W. J. Sell and F. W. Dootson.—The Formation of Heterocyclic Compounds: S. Ruhemann and H. E. Stapleton.—The Space Configuration of Quadrivalent Sulphur Derivatives: Methyl Ethyl Thetine Dextrocamphorsulphonate, and Dextrobromocamphorsulphonate: W. J. Pope and S. J. Peachey.—Nitrocamphane: M. O. Forster.

RÖNTGEN SOCIETY, at 8.—Röntgen Rays in Diseases of the Chest: Dr. Hugh Walsham.—Mr. A. Hastings Stewart will show a small Egyptian Mummy and Skiagrams of the same.

FRIDAY, FEBRUARY 2.

ROYAL INSTITUTION, at 9.—Wireless Telegraphy: G. Marconi.

GEOLOGISTS' ASSOCIATION, at 7.30.—The President, J. J. H. Teall, F.R.S., will deliver an Address on the Natural History of Phosphatic Deposits.

MONDAY, FEBRUARY 5.

SOCIETY OF ARTS, at 8.—The Nature and Yield of Metalliferous Deposits: Bennett H. Brough.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—A Fragment of the Geography of England: South-West Sussex: Dr. H. R. Mill.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—On Recent Objections urged against the Adoption of the Metric System: Dr. W. S. Squire.—Oil of Carthamus Tinctorius (Safflower Oil): H. R. Le Sueur.

TUESDAY, FEBRUARY 6.

ROYAL INSTITUTION, at 3.—Structure and Classification of Fishes: Prof. E. Ray Lankester, F.R.S.

ZOOLOGICAL SOCIETY, at 8.30.—Notes on the Transformations of some South African Lepidoptera: Colonel J. M. Fawcett.—On Mammals obtained in South-Western Arabia by Messrs. Percival and Dodson: Oldfield Thomas.—On a Small Collection of Decapod Crustaceans from Freshwaters in North Borneo: L. A. Borradaile.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Moving Loads on Railway Underbridges: W. B. Farr.—Note on the Floor System of Girder Bridges: C. F. Findlay.

WEDNESDAY, FEBRUARY 7.

GEOLOGICAL SOCIETY, at 8.—Bala Lake and the River System of North Wales: Philip Lake.—Foraminifera from an Upper Cambrian Horizon in the Malverns: Frederick Chapman.

SOCIETY OF PUBLIC ANALYSTS, at 8.—Note on the Separation of Oleic Acid from other Fatty Acids: Dr. J. Lewkowitsch.—Analysis of a Sample of "Treacle" and of a Sample of So-called "Golden Syrup": C. G. Matthews and A. Hyde Parker.—The Determination of Carbon and Sulphur in Steel: Bertram Blount.—Note on Sour Milk: H. Droop Richmond and J. B. P. Harrison.—Butters from various Countries compared: C. Estcourt.

THURSDAY, FEBRUARY 8.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* The Spectrum of α-Aquilæ: Sir N. Lockyer, K.C.B., F.R.S., and A. Fowler. On Electrical Effects due to Evaporation of Sodium in Air and other Gases: W. C. Henderson.

ROYAL INSTITUTION, at 3.—Modern Astronomy: Prof. H. H. Turner, F.R.S.

CHEMICAL SOCIETY, at 8.30.—Victor Meyer Memorial Lecture: Prof. T. E. Thorpe, F.R.S.

SOCIETY OF ARTS (Imperial Institute), at 4.30.—The Projects of Railway Communication with India: J. M. Maclean.

MATHEMATICAL SOCIETY, at 8.—A Formula in the Theory of the Theta-Functions: Prof. A. C. Dixon.—Some Elementary Distributions of Stress in Three Dimensions: J. H. Michell.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Standardisation of Electrical Engineering Plant: R. P. Sellon.

FRIDAY, FEBRUARY 9.

ROYAL INSTITUTION, at 9.—Symbiosis and Symbiotic Fermentation: Prof. J. Reynolds Green.

ROYAL ASTRONOMICAL SOCIETY, at 3.—Anniversary Meeting.

PHYSICAL SOCIETY, at 5.—Annual General Meeting.—Address by the President, Prof. O. J. Lodge, F.R.S.

INSTITUTION OF CIVIL ENGINEERS, at 8.—Underground Sources of Water-Supply: D. E. Lloyd-Davies.

CONTENTS.