THURSDAY, DECEMBER 1, 1910.

HISTORY IN BRITISH PLACE-NAMES.

British Place-names in their Historical Setting. By Edmund McClure. Pp. 349. (London: Society for Promoting Christian Knowledge, 1910.) Price 5*s*.

THE loving labour of an average lifetime, "studies in leisure hours extending over some thirty years and more," this work is an eloquent testimony to the value of the science of philology in the elucidation of historical materials. It is both a history and a valuable guide to the philology of British place-names "as they occur chronologically in authentic historical documents from 54 B.C. until A.D. 1154." In his last paragraph, the author explains why he draws a line at Stephen's death.

"The consideration of later records containing place-names is not worth pursuing, as the forms therein presented vary but little from those now in use, and the new terms introduced by the continental monastic orders, such as *Beaulieu, Rievaulx, Jervaulx,* &c., explain themselves" (p. 304).

The phrase "not worth pursuing" surely needs some qualification, and the explanation offered implies that the author is satisfied that later documents contain no material additions to his list of historical place-names.

Very appropriately, "a short summary of the modern methods employed in linguistic research" is given at the beginning, to "illustrate the statement in the text and show the truly scientific character of comparative philology" (p. 13). The text is mainly a history of Britain with the place-names worked in, the latter elaborately discussed in "notes" and footnotes. The thoroughness, as well as the duration, of the author's studies are well attested by the numerous catenæ of name-forms. The best authorities on place-names are cited. Yet the author exhibits throughout a commendable critical independence, as well as personal detachment from pet theories, or theories one would have liked to press from personal conviction. When he discusses rival theories, as in the case of the Picts and their language, he gives a clear idea of the situation.

Considering the great advance made in philology and historical criticism in the last thirty years, such a work as this is must have been periodically revised to a large extent. Specialists in certain lines of inquiry would have expected further revision of some of the information given. The author betrays a suspicion of the genuineness of Gildas's "Destruction of Britain," the spuriousness of which has recently been demonstrated by Mr. Wade Evans and others. In the discussion of sites of battles fought by Arthur, no reference is made to Mr. Anscombe's clever elucidation of the place-names. Sir John Rhys is, of course, the most frequent witness in the author's court, but while the latest edition of the classic "Celtic Britain" has been consulted, no reference is made to that eminent scholar's contributions to the British Academy and the Cymmrodorion Society within the last seven years or so. The author's remark that "the nucleus of the work has already appeared in a serial" sufficiently accounts for the belatedness, in these expeditious days, of some sections of the work. Finality in a work of such a comprehensive design is out of the question, and such omissions as those noted above affect only very slightly the unquestioned usefulness of the work as it is.

The author seems to have a very firm grip of the Scandinavian element in British place-names, a subject which is coming more and more to the fore. In his discussion of the place-names of Shetland and the Orkneys, which are "almost exclusively Scandinavian" (p. 227), the author leaves an impression that he is unwilling to go as far as his evidence goes, and one's attention is arrested by a doubtful deduction.

"As *Orkn* in Norse means a seal, Orkn-eyjar would seem a natural designation for these islands, but the term *Orc* in Orcades goes back to classical times, long before a Northman had put his foot upon them, and its meaning must be sought in the language of the earliest inhabitants" (p. 225).

The facts cited favour a theory of a very early occupation of the Orkneys by Scandinavians, and other evidence may be adduced to the same effect, but all that evidence must be laid aside, because the author is satisfied with some late date for such occupation, and with "classical" spellings of place-names in Britain. On general grounds, alleged dates of the beginnings of great racial migrations are open to a reasonable suspicion, and "classical" references to places in Britain cannot be accepted as final as against overwhelming local evidence.

The perusal of this scholarly, yet readable, book, in which history and philology are made to eludicate each other, opens up a vast field of inquiry, in which archæology, anthropology, and astronomy should also be requisitioned. We have given us an estimate of the value of documentary place-names. A companion volume on the documentary value of place-names in current use, or unrecorded in the documents examined by the author, would be very acceptable. The book is a marvel of compression, and an index of forty-five pages makes it a most welcome work of reference.

JOHN GRIFFITH.

THE CHEMISTRY OF THE ALKALOIDS.

Die Alkaloide. By Prof. E. Winterstein and Dr. G. Trier. Pp. vii+340. (Berlin: Gebrüder Borntraeger, 1910.) Price 11 marks.

SINCE Derosne and Sertürner isolated morphine, the crystalline principle of opium, about a century ago, the separation of the natural bases from plants has always taken a prominent place in chemical research. To-day the number of these substances exceeds two hundred, and the list is probably far from complete. The process of their isolation is usually accompanied by a study of their therapeutic value and by the more difficult and fascinating task of discovering their structure. Of the pioneers in this branch of chemistry, A. W. Hofmann stands in the forefront. Following the earlier discoveries of Gerhardt on the relation of the pyridine bases to the alkaloids, he was able by the aid of new and ingenious methods of dis-

integration, to identify many of the products with derivatives of these bases. But, as the authors of the above monograph state :—

"The constitution of an alkaloid cannot be regarded as definitely ascertained until it has been artificially prepared in accordance with the formula and identified with the natural product."

It is this last synthetic process which calls for the utmost resource and skill of the experimenter. The success which accompanied Hofmann's researches only served to emphasise the difficulties of the final synthetic stage. In spite of the magnitude of the task, Ladenburg accomplished the complete synthesis of coniine (the active principle of hemlock) in 1886. This was followed by Hantzsch's synthesis of trigonelline in the same year, and of piperine by Ladenburg in 1894. Perhaps the most brilliant of recent achievements in this region of research are the syntheses of the tropine alkaloids (atropine, cocaine, tropacocaine) by Willstätter, laudanosine, papaverine, and nicotine, by Pictet, and the purine bases by E. Fischer.

As it is improbable that any known alkaloid exceeds in complexity those the synthesis of which has been accomplished, it may be safely predicted that sooner or later all will be produced artificially. Interesting as this record is of past results and future promise, the real significance of these discoveries is much more far-reaching; for the peculiar physiological properties of the alkaloids has led directly to the study of the relation of atomic grouping to physiological action. The ceaseless activity which has been displayed in this direction, especially in the German laboratories, has thrown so much light on the subject that new drugs are constantly produced the therapeutic action of which closely imitates that of the natural product. This vast and ever-increasing mass of new observations has already been carefully compiled in a treatise by Pictet, and in several monographs by Schmidt.

With the exception of one chapter on the source and significance of the alkaloids in plant-life, to which reference is made below, there is nothing in the present volume which can be said to supersede those named. Like the latter, it is a compilation of the more important facts systematically arranged and brought up to date; but there is no attempt at literary embellishment, which renders Pictet's book so readable, nor are those full references given, which are indispensable in a book of this nature, and form so important a feature in its predecessors. The concluding chapter on the origin of the alkaloids in the plant is the most interesting in the book, not because it throws much new light on the problem, but rather because it reveals the enormous difficulties which surround it. The authors rely on the proteins for their raw material, which, it is well known, contain no pyridine, quinoline, or isoquinoline constituent. For these nuclei they have recourse to such protein products as lysine and arginine, which can conceivably be fused into rings and bring to their aid formaldehyde, and its reduction and oxidation products, methyl alcohol, and formic acid for further elaborating these simpler ring compounds. Theorising is a necessary part of every progressive science, and no fault need be found with the authors if they like to exert their ingenuity on so fascinating a theme. At the same time, it may be pointed out that, if protein materials are to be taken as the starting point, the origin of such compounds as tyrosine and tryptophane affords difficulties quite as great as those which surround the natural synthesis of the alkaloids. J. B. C.

PRACTICAL GARDENING.

Manual of Gardening. A Practical Guide to the Making of Home Grounds, and the Growing of Flowers, Fruits, and Vegetables for Home Use. By L. H. Bailey. Pp. xvi+539. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1910.) Price 8*s.* 6*d.* net.

PROF. BAILEY is already very well known to readers in this country as the author of numerous works upon various branches of scientific horticulture. His greatest work is a "Cyclopædia of American Horticulture," in several large volumes, and containing an immense amount of information on American garden plants, contributed by a large number of specialists. The present work, though far less ambitious, will be found extremely useful to gardeners in the States, even to those with very little experience, for the author, specialist as he is, finds no difficulty in writing upon garden subjects in a manner easily understandable by amateurs.

In a large measure the work is a combination and revision of two former volumes, "Garden Making" and "Practical Garden Book," and it constitutes a guide to the making of home grounds, and the growing of flowers, fruits, and vegetables for home use.

Gardening in the States is not so general or technical as it is in our own country, and most of those who attempt to practise it find a great difficulty at the very outset, for they have few good models available to inspire them with correct ideas. In a large number of instances the formal method of design and planting is given preference, and the ordinary formal garden in America has most of the blemishes such gardens possess at home, but few of the virtues that characterise this system of landscape gardening at its best. There are certain instances of first-rate formal gardening in America, but, as the author of "The American Flower Garden" pointed out recently, the public has seldom the opportunity to inspect them.

Prof. Bailey's advice on the formation of gardens is therefore very opportune, for whilst he does not show himself as a partisan of either of the opposed methods, he explains carefully and in great detail how to make the best use of both by adopting them to the special circumstances of site, aspect, altitude, soil, and climate. Having discussed the "point of view" with regard to laying out the garden and planting it, the author proceeds to relate in detail the treatment of the more important species of plants. The chapter on the protection of plants from things that prey upon them (pests) is unusually valuable, for Prof. Bailey has a rare experience of the subject. Chapters ix. and x. deal respectively with fruit and vegetables, and on these subjects cultural details are supplied on almost every crop. The crops are much the same as

our own; indeed, the fruit crops are identical, whilst all our well-known vegetables are included amongst those cultivated in America, but there are some which are not familiar to us, including such as the sweet-potato, Rutabaga (a kind of turnip), watermelon, pepper, and okra. The okra is a plant belonging to the cotton family, and the green pods are used for making the well-known gumbo soup common in the southern States. The pods are also used for stews, and they are preserved by drying for use in winter.

The book concludes with a chapter containing cultural reminders for every month in the year, both for the northern and southern States, the requirements differing somewhat widely owing to the great differences in the climate.

The volume is freely illustrated, and it contains twenty-five plates which are reproductions from photographs. Beyond these there are numerous illustrations in the text, most of them from sketches, and, taking them generally, they are very inferior, the figures of apples and other fruits being particularly inadequate and disappointing.

A TREATISE ON BRITISH NUDIBRANCHIATE MOLLUSCA.

A Monograph of the British Nudibranchiate Mollusca, with Figures of the Species. Text by Sir Charles Eliot, K.C.M.G. Figures by the late Joshua Alder and the late Albany Hancock and others. Part viii. (Supplementary). Pp. vi+197+8 plates. (London: The Ray Society and Dulau and Co., 1910.) Price 25*s.* net.

THIS "supplement" to a work issued half-a-century ago has been admirably conceived and written by the Vice-Chancellor of Sheffield University. Alder and Hancock's classic monograph is known to every marine zoologist, and fifty years of research and criticism have found scarcely one weak place or error in that accurate and beautiful treatise. The authors, however, had accumulated certain addenda which they would probably have eventually published in the present form of a supplement. They knew that certain of their descriptions were not sufficiently full or were not based on a sufficiently large number of specimens to be final. Moreover, two generations of zoologists could scarcely fail to add new forms to a fauna that was published between 1845 and 1855, or to discover new points in the natural history and anatomy of these attractive mollusca. Hence the need for the present volume, and hence its matter. The illustrations are largely drawn by Alder and Hancock, and have been kept, in the long interval since they were made, in the Hancock Museum at Newcastle-on-Tyne. Sir Charles Eliot has had them reproduced and added to. His long and extensive acquaintance with the subjects and its literature in many lands has qualified him to write a text that shall worthily compare with that of the seven previous parts. The result is one upon which the author and the Ray Society may be warmly congratulated.

Few occurrences make such a pleasurable impression upon a zoologist as one's first encounter with a member of this group of animals. On turning over a stone from the heap that lies covered by laminarian fronds, a grey, slimy object disengages itself from the rich animal undergrowth, and on transference to a vessel of water, straightens out its foot, erects its sensitive "feelers," and waves its serried "cerata." The slimy blob has become a superbly coloured eolis, or an *Aegirus punctilucens*, with coloured light emanating from the sparkles on its mantle. Such a transformation is not readily forgotten, and when the attraction of nudibranchs has once been felt, it is not easy to resist the temptation to investigate so many of these creatures as can be examined in a state of nature. The search for them takes one into the rich pastures of the sea, and here they must be found only by acquaintance with the special haunts of each several kind. The sea, like the land, has its seasons of plenty and of poverty. In winter and early spring few nudibranchs are to be found in the laminarian beds, where later they will abound. A few Doris, perhaps, no two alike in colouring, and an *Eolidia papillosa*, may be found gnawing the base of a sea-anemone or winding that pink gelatinous band of eggs which is to people the water with quaint free-swimming larvæ. But as spring comes, the nudibranchs increase in number, and proceed at once with the great business of procreation. The hydroids, sponges, or alcyonium are the special resorts of Doto, Doris, and Tritonia. Others affect sea-weeds, and are scarcely to be detected in the axils of their food-plant. One kind, a glutton, is found only on the eggs of certain fish. Another eats out the soft parts of a sea-squirt, and then lies buried in the eviscerated tunic. Altogether in the British area there are more than a hundred species, a synopsis of which forms the last portion of this work.

The mode of treatment may be shortly summarised. First comes a chapter on variation and distribution. In colour particularly nudibranchs offer a considerable range of variation, in part due to food, in larger part to light-factors that have as yet not been examined. Age differences between individuals of the same species introduce another source of diversity, and the phenomena of autotomy among Eolids is a further cause of discrepancy. With regard to distribution, Sir Charles Eliot summarises a great mass of evidence in a few pages. The most salient facts are the similarity of the nudibranch faunas in the northern and southern parts of the Atlantic, the similarity of the nudibranchs in the North Atlantic and North Pacific Oceans, and the distinctness of a tropical fauna in the intermediate zone.

"It is interesting to see that the waters of the South Atlantic beyond the tropics contain forms very similar to those found in the north, if not identical with them" (p. 11).

Eolids appear to be preponderant in Arctic and Antarctic waters, Doris in tropical waters. With regard to the vexed question of nomenclature, Sir Charles takes up a position intermediate between the "lumpers," such as Alder and Hancock, and the "splitters," such as Bergh, and he has many valuable remarks on the synonymy of the more difficult species. Two interesting chapters follow on the bionomics and

development of the group and on the anatomy of Doris and of Æolidia; whilst the questions of classification, affinities, and descriptions of species occupy the latter half of the work. On these sections, the author's intimate knowledge of his subject confers a philosophic caution and breadth of treatment. Attention may be directed especially to the discussion of the relations existing between nudibranch and tectibranch mollusca (pp 89–92), and to the descriptions of fifteen species not described in the monograph. Malacologists are under a great debt to Sir Charles for this fine work, which is worthy of the classic that it supplements. F. W. G.

WILD FLOWERS.

Wild Flowers of the British Isles. Illustrated and written by H. Isabel Adams. Revised by James E. Bagnall. Vol. ii., order xlii., Campanulaceæ to order lxxxvi., Araceæ, completing the British Wild Flowers with the exception of Water Plants and Trees. Pp. xi+199. (London: W. Heinemann, 1910.) Price 30*s.* net.

THE talented author of the volume under review has made the fatal mistake of attempting to serve two masters, and with the inevitable result. From the artistic point of view the plates are for the most part very good, and they combine accuracy of detail with beauty of arrangement. No doubt they have suffered somewhat in the process of reproduction by the three-colour process, especially as regards the green tints, but the original drawings must be excellent. An attempt has been made to produce a British flora of an up-to-date character, based on the last edition (10th) of the London catalogue, and also to produce an illustrated flora. The work before us is incomplete from both points of view.

As a flora the omission of trees, referred to on the title-page, is a great mistake, but the complete neglect of Juncaceæ, Cyperaceæ, Gramineæ, and other monocotyledonous natural orders, without a word of explanation, deprives the book of any real scientific value. "Water plants" are also said to be excepted, as well as trees, but the definition of a water plant adopted by the writer must be individual and peculiar since *Hottonia palustris, Nymphoides (Villarsia) peltatum, Lobelia Dortmanna,* and others are not only included but illustrated. It is not easy to suggest any reason for the omission of other natural orders not specifically referred to, such as Elæagnaceæ and Loranthaceæ. There can be no question that both sea buckthorn and mistletoe are "wild flowers of the British Isles"; the former might be ruled out of court as a tree, but its claim to inclusion is a strong one when the non-British *Lycium chinense* forms the subject of a well-executed drawing. The common privet, too, is scarcely a tree. Plantains also, wild flowers *par excellence* and decorative also, fail to find a place in the volume, and one is tempted to conclude that certain plants do not find favour with the writer. It is not a case apparently of the weakest going to the wall or of suffering minorities, since other natural orders with only one or two genera are to be found in their proper place.

The descriptions of the various species are on the whole well drawn up, and some interesting general information is given under each natural order. An attempt is made in some orders to make a slight key to the genera and species, but unfortunately for the unlearned student the keys are not very helpful. In the Labiatæ, for instance, the contrasted heads of the key have no logical sequence. They run as follows:—

Corolla, 2-lipped, and usually 5-lobed.
Stamens 4, 2 outer longer.
Stamens 4; calyx-tube with 10–13 ribs.
Calyx 2-lipped, closed in fruit; stamens included in upper corolla-lip.
Corolla bell-shaped, with 4 nearly equal lobes; calyx with 5 equal teeth.

There appears to be no reason from such a key why one genus should be placed under one heading rather than under another.

Enough has been said to show that this book cannot rank as a valuable contribution to the science of botany, and it is all the more to be regretted when the excellence of the drawings is considered. Although in some of the plates there is unnecessary crowding, yet the draughtsmanship throughout is of a high order, and the plates of Convolvulus and *Tamus communis,* to mention two only, are beautiful works of art. A complete series of plant pictures of our British flora by Mrs. Adams would be of considerable value, and it is a matter for regret that so much skill and labour should have been expended on a book so pretentious and incomplete, which, with all its accuracy of drawing, unfortunately can only be regarded as a work for the drawing-room table.

SHALLOW-WATER STARFISHES.

Echinoderma of the Indian Museum. By Prof. René Koehler. Part vi., Asteroidea (ii). An Account of the Shallow-water Asteroidea. Pp. 191+xx plates. (Calcutta: Printed by order of the Trustees of the Indian Museum.) Price 20 rupees.

IN this carefully executed and copiously illustrated memoir the starfishes of the Indian littoral are for the first time regimented, from material collected, between the Persian Gulf and the Malay Peninsula, during thirty years of steady work, by the Royal Indian marine survey-ship *Investigator,* supplemented by local contributions from the recently commissioned Bengal Government Fisheries' steamer, *Golden Crown.*

Sixty-seven species are enumerated, of which twenty-eight are described as new. Among the novelties, though there is nothing very surprising, the species of Astropecten, Anthenea, Goniodiscus, Nardoa, Luidia, and Ophidiaster predominate.

Of old-established species several that were insufficiently characterised by their authors, or that have never been figured, are here re-described with infinite care, or interpreted by wonderfully lucid photographs, according to the requirements of each case, the author having taken the trouble to rivet attention on nothing less authentic than the very "types." This method of work, together with the fact that certain genera—

particularly the by no means easy genus Pentaceros—are practically revised, within set geographical limits, adds enormously to the value of this conscientious monograph.

Though the work is for the most part descriptive—almost commendably so in an age of easy speculation—the author takes pains to set all his species in their due relations. Of *Palmipes sarasini* he observes that its differences from its congeners are almost of generic value, and of Valvaster that its peculiarities are almost sufficiently exclusive to give it rank as an independent family. He also discusses the position of the irreconcilable genus Metrodira, which he has no hesitation in establishing among the Linckiidæ. Nor has he forgotten to notice the small parasitic mollusca found on species of Stellaster and Palmipes.

This is Prof. Koehler's sixth memoir of the fine collection of Echinoderms of the Indian Museum, and, as India is still *meta incognita* so far as the Echinoidea are concerned, we trust that it is not the last.

One criticism, however, may be offered of this memoir, as of its precursors of the series, namely, that it is too exclusively addressed to the specialist. Species are examined and described with acumen, but there are none of those synoptical tables, of educational value, which the student has almost a right to expect in a museum publication that treats in its entirety one large component of a fauna. If the author would crown his labours in this field by publishing synopses of the families, genera, and species of Indian Echinoderma, he would "thereby highly oblige" many to whom, though they are not experts, whatsoever passeth through the paths of the seas is of interest.

EXPERIMENTAL ELECTRICITY AND MAGNETISM.

(1) *Practical Electrical Engineering for Elementary Students: An Elementary Laboratory Course for Students of Electrical Engineering in Trade and Technical Schools.* By W. S. Ibbetson. Pp. xii+155. (London: E. and F. N. Spon, Ltd.; New York: Spon and Chamberlain, 1910.) Price 3*s.* 6*d.* net.

(2) *Practical Electricity and Magnetism: A First Year's Course.* By R. Elliott Steel. Pp. viii+175. (London: G. Bell and Sons, Ltd., 1910.) Price 2*s.*

(3) *Elementary Experimental Electricity and Magnetism.* By W. T. Clough. Pp. viii+255. (London: Methuen and Co., Ltd., 1910.) Price 2*s.* 6*d.*

THE first two books are intended to cover first-year laboratory courses, in the one case for technical students, in the other for beginners in science at a school or college. The usual differences are to be noted between them, the second being far more theoretical than the first, and also containing sections on magnetism and electrostatics, which the other does not touch.

(1) The system employed by Mr. Ibbetson is excellent, and could with advantage be adopted in any technical schools in which a similar scheme is not already in operation. It is perhaps to be regretted that no experiments with magnets are included, unless the student is intended to have taken a preliminary course in electricity and magnetism under the heading of physics.

Slight alterations in the experiments will have to be introduced in different laboratories to suit diverse conditions, as the book has evidently been written to fit the apparatus employed in one particular school. This defect shows itself most prominently in the too narrow specification of the instruments to be used in the experiments, instead of general advice to enable students to select instruments and resistances suitable in their range and capacity.

The connection diagrams are, on the whole, very good, the boldness of their drawing being a valuable feature. They could be improved, however, especially in the cases of more complicated experiments, by simplification of the drawings of instruments and switches and the avoidance of cross-overs wherever possible.

In experiment xxxv. the use of a standard resistance in connection with the calibration of a voltmeter seems quite unnecessary, and confuses the experiment with the calibration of an amperemeter.

"Shunt dynamo, separately excited," is a very contradictory term, which appears on p. 144; moreover, the experiment can be performed just as well with a generator with a low-resistance field winding.

The complete lack of any reference to the error due to the voltmeter current when measuring resistance by the ammeter-voltmeter method is a serious defect. When measuring efficiency in the photometry experiment, the connections are made so as to avoid this error, but no reason is given. On the whole, however, the experiments are detailed with the care and exactness so essential when dealing with elementary classes.

(2) Mr. Steel's book contains instructions for carrying out a great many experiments, but the language is hardly concise enough for scientific work. The use of supply mains and accumulators is avoided, which renders the book suitable for some few laboratories but unsuitable for many others. The comparative absence of diagrams of connections is a great drawback, and the few which appear are not good examples for students to copy from.

(3) Mr. Clough's book is intended to act as a theoretical text-book, as well as a practical guide in the laboratory, for students preparing for the elementary examinations in the subject.

Magnetism and statical electricity together occupy the first one hundred and fifty pages of the book, and voltaic electricity the remaining one hundred. Voltaic work is explained from a statical point of view in a method somewhat unusual at the present day.

The diagrams and illustrations are plentiful, and the type is varied so as to call into prominence the most important passages. Numerous exercises are given, chiefly drawn from recent examination papers, which should be very helpful for intending candidates.

A few omissions are noticeable, *e.g.* no reference is made to the moving-coil type of galvanometer, which is more frequently used than the suspended-magnet type.

OUR BOOK SHELF.

The Calculus for Beginners. By J. W. Mercer. Pp. xiv+440. (Cambridge: University Press.) Price 6*s*.

STUDENTS of ordinary endowment form the habit of observing things before words. The author of this work has therefore wisely begun with the notions of velocity and gradient of a curve before introducing dy/dx as the instrument for measuring them. The purely mathematical aspect of a limit is not omitted, but it is subordinated; the need for it precedes its introduction. For many purposes, and at any rate for initial study, this course is quite satisfactory; and the author will find most teachers in agreement with him in thinking it is also wise even for those who are to proceed to the more severe and formal study of the calculus. While he doubtless recognises that physicists, engineers, and chemists would benefit by finally surmounting the difficulties of the notion of a limit, he does not make it his business in this book to give the first importance to the difficulties of analysis presented by his subject.

The ground is covered slowly at first; some 250 pages are devoted to the case of x^n in all its bearings before $\sin x$, $\cos x$, a^x, $\log x$, &c., are discussed, even the rules for the differentiation of a product and quotient being postponed until the student is well on with the subject. Those who think that this is a large allowance of pages to the earlier part of the calculus should remember that the shortest account of a mathematical doctrine is not necessarily the one which occupies the fewest pages. An excellent feature of the treatment is the introduction of integration under the heading, "Given dy/dx, find y." The student cannot have it impressed upon him too soon that the determination of a function is often most easily carried out by first finding the rate of variation of the function. In his graphical work he has probably often observed this rate of variation, so that the notion has more chance of appearing *exact* than that of the limit of a sum, and he has at the same time the advantage of getting the most out of the newer ideas with which he has become acquainted. The introduction of e^x graphically is the necessary outcome of the author's whole method, and will give a conviction that seldom if ever results at first from the complete algebraic treatment.

The work, which is well supplied with diagrams, is certain to be used by many teachers, who will find it well adapted to meet the requirements of those for whom it is written.

A Text-Book of Organic Chemistry. By Prof. A. F. Holleman. Edited by Dr. A. Jamieson Walker, assisted by Owen E. Mott. Third English edition, partly rewritten. Pp. xx+599. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1910.) Price 2.50 dollars.

THE first edition of this book was reviewed in the columns of NATURE in 1903, and we were impressed with it as being a most useful addition to the books in English on organic chemistry. Since then we have recommended it to students, who have found its study both interesting and useful. Evidently the book has filled a want in the country, as a second edition was published in 1907, and now we have before us the third edition.

Considerable additions have been made in this issue owing to the advances in organic chemistry which have taken place. The chapter on proteins has, for example, been rewritten, and is now incorporated with the general scheme of the book, whereas in the first two editions the proteins were placed in the appendix. Furthermore, the translator has introduced the protein classification adopted by the Chemical Society, which, of course, is a great advantage to English readers. Another chapter which has been enlarged and completely rewritten is that on pyrrole.

In reading through the book one continually comes across small alterations, sometimes considerable alterations, where recent advances have shown the necessity for revision or additions. For the purpose of review, it is not necessary to direct attention to each alteration or addition; it is more to the point to remark that the book has been carefully revised and brought up-to-date, and that the high standard of the work has been maintained in the third edition. It is to be thoroughly recommended as putting in a succinct and readable manner the salient facts of organic chemistry. The book is not exhaustive, but the student who has carefully studied it will be in a position to read with understanding and discrimination larger works on the subject, which, without the previous knowledge obtained from this work would be beyond him. F. M. P.

A Popular Guide to the Heavens. By Sir Robert S. Ball, F.R.S. Pp. xii+96+83 plates. (London: G. Philip and Son, Ltd., 1910.) Price 15*s*. net.

THERE appears to be little difference between the present book and the second edition, issued in 1905, and reviewed in NATURE of March 9 of that year (vol. lxxi., p. 437). The number of plates and descriptive text is the same, but a frontispiece has been added, giving reproductions of drawings of the miner's comet (1910*a*) and Halley's comet.

We must express astonishment that this "Popular Guide to the Heavens" should contain no reproductions of the remarkable photographs of solar faculæ and flocculi taken by Hale, Deslandres, and others in recent years. These pictures are among the most striking illustrations of celestial phenomena ever produced; yet no notice is taken of them in plate or text. The sun is represented by two plates, one showing a large sun-spot and the other some great prominences. We suggest that it would be far better not to illustrate solar phenomena at all than to let these two plates be considered to represent the most interesting pictures of modern solar physics.

The book contains many beautiful pictures and valuable maps, and is altogether an attractive volume, but there is no reason why people who possess the second edition should purchase the new issue with the view of finding further illustrations of astronomical progress.

Catalogue of Hardy Trees and Shrubs Growing in the Grounds of Syon House, Brentford. By A. B. Jackson. Pp. x+38. (London: West Newman and Co., 1910.)

THE unique collection of trees and shrubs in the grounds of Syon House, Brentford, the Middlesex seat of the Duke of Northumberland, has not been catalogued within the last sixty years, during which time there have been many changes, as specimens have died off and new species have been introduced. The chief interest lies in the fine old trees, some of which are the best representatives of their kind in the kingdom. Two black poplars, estimated to be 128 feet high, are the tallest, and an elm is about 9 feet shorter. More unique are a specimen of *Liquidambar styraciflua* that exceeds 91 feet, and a *Catalpa kaempferi* approximating to 58 feet in height. The collection of deciduous cypresses, *Taxodium distichum*, showing the so-called knees, are famous, and have been frequently described; some fine specimens of *Zelkova crenata* (Urticaceæ) are remarkable. The items of information consist, so far as is possible, of popular

name, family, situation in the garden, country of origin, and date of introduction; interleaved blank pages are provided for notes and additions. The author is to be complimented on the accuracy of his work.

The Essentials of Histology, Descriptive and Practical, for the Use of Students. By Prof. E. A. Schäfer, F.R.S. Eighth edition. Pp. xi+571. (London: Longsmans, Green and Co., 1910.) Price 10*s.* 6*d.* net.

WHEN Prof. Schäfer's "Essentials" made its first appearance some years ago it was at once recognised that here was the book which had long been wanted, and it has since then continued to occupy the foremost place in the estimation of both teachers and students. Every successive edition has kept the work fully up to date in regard to practical methods, descriptive letterpress, and last, but not least, illustrations. Any extended notice of such a well-known text-book is quite unnecessary; all one need say of the eighth edition is that it fully maintains the high standard of previous editions, and the author is to be congratulated on the continued and well-deserved popularity which it has obtained. W. D. H.

The Charm of the Road. England and Wales. By James J. Hissey. Pp. xviii+426. (London: Macmillan and Co., Ltd., 1910.) Price 10*s.* net.

IN his latest book, Mr. Hissey is as successful as ever in painting the charms of travel in one's own country. The journey described in the present volume was begun without a premeditated plan; the author says:—"To us the destination was a trivial detail, left to settle itself each day; the joy of the journey was the thing, therein our pleasure lay." Certainly Mr. Hissey's gossipy description of the places and scenes they met with, and the quaint experiences they were fortunate enough to have, is more than sufficient to convince the reader that the fortunate possessor of a motor-car, a pleasant companion, and plenty of leisure, can have an excellent holiday indeed in straying from one shire to another, as fancy dictates.

The excellent photographs which illustrate this interesting travel book are good testimony to Mr. Hissey's keen eye for the beautiful and picturesque.

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.*]

Marine Microthermograms and the Influence of Icebergs on the Temperature of the Sea.

THE application of precise temperature measurements to the determination of the formation and disintegration of ice in the St. Lawrence River suggested to me the possibility of using very delicate electrical thermometers on shipboard to determine the proximity of icebergs. On account of the difficulty of the experiments, and the fact that well-known authorities on navigation (including Lord Kelvin) had reported that temperature measurements were likely to be uncertain, except when very close to a berg, it was some time before I could arrange for the necessary trials.

In the meantime I had devised a practical form of electrical microthermometer, which was given a thorough test on board the Canadian Government ice-breakers during the experiments made last winter to keep the river clear of ice above Quebec. So sensitive and precise did this instrument prove, that a uniform temperature gradient in the water of one-tenth of a degree per mile could be determined from the ship, approaching an ice field from open water, to an accuracy of a thousandth of a degree.

The interesting experiments of Prof. Otto Pettersson on the influence of ice on oceanic circulation, described in the *Geographical Journal* for 1904 and 1907, made it appear highly probable that the experiments I wished to try would prove successful. Dr. Pettersson showed that ice melting in salt water produced two cold currents, one of fresh water which flowed out on all sides over the surface of the sea, and one of salt water which sank down by the ordinary laws of convection. A third current of warmer sea water flowed in towards the ice, under the surface, and produced the melting of the ice.

Through the kindness of the Hon. L. P. Brodeur, Canadian Minister of Marine, passage was secured on the C.G.S. *Stanley* for the trip to Hudsons Bay last July. As other duties prevented me from being absent from Montreal for so long a time, I was fortunate in being able to send Mr. L. V. King, who had so ably assisted me during the previous winter in ice studies, and who had gained great facility in using the microthermometer.

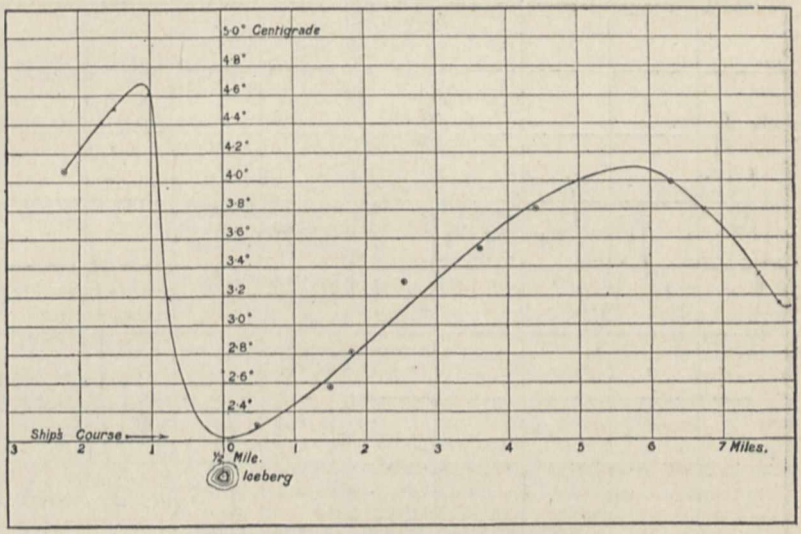

FIG. 1.—Temperature Gradient near an Iceberg.

In addition to the ordinary wire bridge which we used in our river experiments, having a scale nearly 2 feet long for one degree, we adapted a Callendar recording mechanism to our needs, which gave us a scale of 1° C., equal to 8 inches. The automatic recorder could be switched on to the microthermometer at any time, and records accurate to one-hundredth of a degree obtained at any part of the temperature scale. They were obtained while the ship steamed at full speed through heavy seas, and were unaffected by the motion.

I venture to show two diagrams from the many Mr. King obtained, which illustrate the disturbing effect of ice on the temperature of the sea in summer. Fig. 1 shows the temperature gradient approaching and receding from a large iceberg passed within a half-mile from the ship in the open sea off the Labrador coast. The ship's course is shown relative to the iceberg. Fig. 2 shows a microthermogram of sea temperature traced directly from the charts. The proximity of ice is at once shown by a movement of the pen of the recorder off the scale, to return again to approximately the same position after the

iceberg is passed. In nearly every record we have there is a small rise of temperature above the surrounding sea temperature before the fall occurs, which seems characteristic of an iceberg effect.

In the light of the microthermograms we have obtained, the usual method of taking temperatures at sea seems decidedly inadequate. Thus, even if temperatures are taken over the side of a moving ship every fifteen minutes, readings are obtained at about two- to three-mile intervals, which obviously cannot be of much value in determining the temperature gradient characteristic of an iceberg. They might easily, as some of our charts show, indicate a rising rather than a falling temperature. The ordinary marine thermometer, with a degree one-eighth of an inch long, would miss entirely temperature effects made perfectly plain by the microthermometer. The persistence of a temperature gradient in the direction of a ship's course is one thing which I think can be relied on to give iceberg warnings, but when the whole temperature drop is

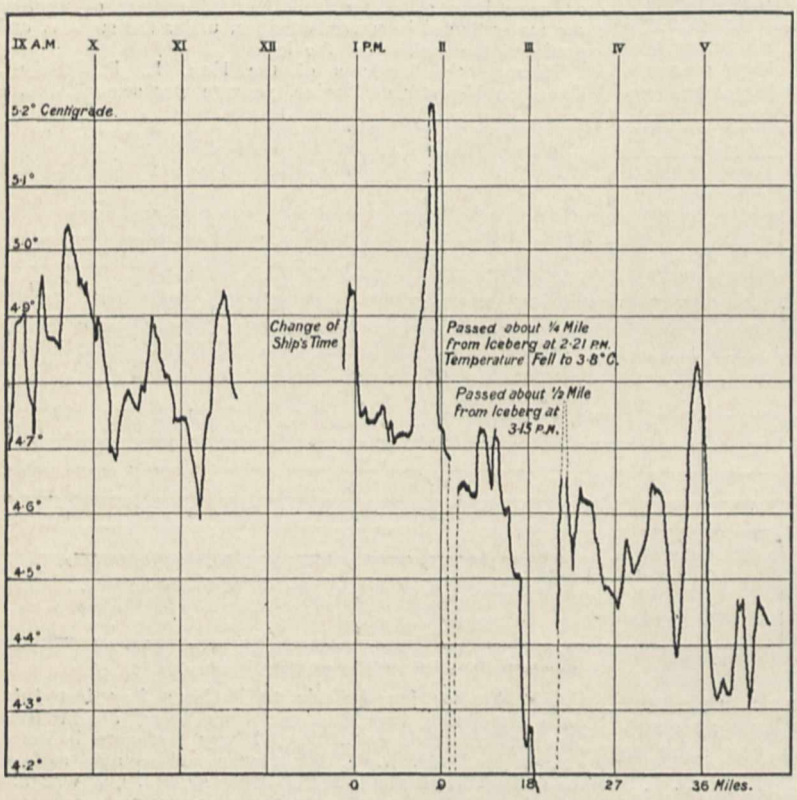

FIG. 2.—Microthermogram of the Temperature of the Sea.

fewer than two degrees in six miles it is evident that very sensitive thermometers must be used to detect it.

Besides the disturbing influence of ice, the proximity of land within a few miles produces effects of great magnitude as compared with the remarkably small variations of temperature in the open sea. In our case this was, no doubt, caused by the cold under-currents being turned up by the shoals and shore line of the Labrador coast.

For hydrographic work, the determination of current boundaries could be made with great exactness from a comparison of the temperature traces and the determination of ship's position.

The small inequalities in the temperature of the sea stand out in strong contrast to the uniform temperature of the St. Lawrence River just after the ice has moved out in the spring. These inequalities of temperature suggest at once the possibility of a vertical circulation set up by convection currents, which must be an important factor in the retention of the solar energy absorbed by the sea. It explains why our records of air and sea temperatures show no diurnal variation, except in the former case when near land. It seems to be well known to biologists that small temperature variations in the sea may be set up by the existence of marine life, and it is difficult to think of any other cause for what we have observed. It is interesting as indicating how important a part marine life probably plays in the conservation of solar energy.

H. T. BARNES.

McGill University, October 27.

Dun Coat Colour in the Horse.

My attention has been directed to a letter in NATURE of November 24 over the signature of Prof. J. Wilson. He disputes the accuracy of certain extractions from "The General Stud Book," which originally appeared in *The Veterinary Record*, in my paper on the inheritance of dun coat-colour. Prof. Wilson also states that in the Stud Book entries there is a considerable element of doubt. This would appear to be the usual attitude of his mind in relation to data which do not exactly fall in with his own theories.

Let me first take the case of the mare Silverlocks (foaled 1725). I most emphatically deny that "the Stud Book assumes" that this mare, which is described as a chestnut on p. 1, vol. i., is identical with a mythical chestnut mare which Prof. Wilson says was foaled exactly a hundred years later. The animal to which he probably alludes was foaled in 1824, and is entered in the third volume as a "*bay colt Silverlock*," by Blacklock out of Sheba's Queen. I would direct Prof. Wilson's attention to the fact that the chestnut mare Silverlocks (1725) is the only *mare* of that name in the first four volumes of the Stud Book, and that the Stud Book entry is perfectly authentic, since it was extracted from an early Racing Calendar which describes Silverlocks as a chestnut mare by The Bald Galloway, out of a sister to Chaunter. This mare was raced for some years, and there is no room for doubt that she was the dam of the dun colt Buffcoat, foaled 1742, and of his two dun sisters, foaled in 1738 and 1739 respectively, all three being by The Godolphin Arabian (brown or bay). Does Prof. Wilson mean to imply that Lord Godolphin was so dishonourable as to run Buffcoat under a false pedigree, for that in effect is what he would have us believe? I have already directed his attention in a private letter to the circumstance that I have a portrait of Silverlocks (1725) which shows her an unmistakable chestnut, and not a dun.

In regard to the dun filly Sarah Curran (1892), by Robert Emmett (bay or brown), out of Cellulites (black), Prof. Wilson is certainly misleading, for he fails to disclose the fact that Messrs. Weatherby distinctly state in vol. xviii., p. 727, that "this mare erroneously appeared in the last volume as dead." Now, whether Prof. Wilson likes it or not, the breeder of Sarah Curran, Mr. J. T. Hartigan, returned this mare as a dun. I judge he was in a better position to form an opinion concerning her pedigree and colour than my critic, who never saw her.

Prof. Wilson says that the filly (1886) by Lord Gough (bay) out of Danseuse (brown) is described as a bay. Here again he does not state the whole truth. As a matter of fact, this filly was returned as bay when a foal, but her breeder specially altered the colour to *light dun* in vol. xix. She had then reached maturity, and was a brood mare.

I do not wish to take up your space in quibbling as

to whether *bay-dun* or *bay or dun* better describes the filly (1907) by Ash (chestnut) out of Unexpected (bay). Here, however, is another instance of reversion to dun which has come under my personal notice, viz. bay-dun hackney filly (foaled 1898), bred by the late Dr. W. Wingate Saul. She was by General Gordon, brown (gametic composition brown-chestnut); her dam, Fanny Gordon, a light yellow bay with black dorsal band. Fanny Gordon was by General Gordon out of Lancaster Fanny, dark liver-chestnut.

J. B. ROBERTSON.

Lancaster.

Lower Cretaceous Angiosperms.

IN the course of my work at the British Museum on Cretaceous plants, I have examined a number of more or less perfectly petrified "woods." Such specimens have generally been classed together as "Gymnosperms," so that they have received little attention from palæobotanists. As I am undertaking an exhaustive study of the Cretaceous plants, the keeper of geology has had sections made of all the likely specimens of woods.

Among those sectioned are Nos. V. 11517, V. 5654, and V. 5452. These are of exceptional interest, because they prove to be, not Gymnosperms, but Angiosperms. One of them is further notable in having its phlœm and cortex petrified, as well as the wood; the majority of silicified woods having lost these soft tissues. The specimens were collected at different times, which minimises the chances of error in referring them to the Lower Greensand; and from geological and petrological evidence there is no reason to doubt that they are, as labelled, of Lower Greensand age (*i.e.* the Aptian of the Continent).

I hope shortly to publish a complete and illustrated account of these specimens, but I make the discovery public now in the hope of obtaining further evidence. Hitherto the floras between the Wealden and Tertiary ages in Britain have not received much attention, owing to the very scanty and imperfect nature of the fossils representing them. Nevertheless, many collectors may have laid aside "wood" from the Greensands, Gault, or Chalk, and, if so, might be willing to lend them to me for examination.

So far as I am aware, the specimens, the nature of which I have recently determined, are not only the oldest Angiosperms from the north of Europe, but are the oldest from any locality with *petrified* structure. From the succeeding Albian, Fliche described an angiospermic wood —*Laurinoxylon albiense*—which he remarked was then (1905) the earliest known petrified Angiosperm. The numerous Angiosperms described from the United States and elsewhere from the Potomac and succeeding formations are leaf impressions only.

The existence of Angiosperms in northern Europe at so early a horizon as the Aptian is a fact which will necessitate revision in some current views as to the early distribution of the most important group of plants.

Manchester University. M. C. STOPES.

The Cocos-Keeling Atoll.

As a contribution from a frank supporter of Sir John Murray's theory of the formation of the lagoons of atolls by solution, I welcome the criticism of Miss Drummond (NATURE, November 24).

I must, however, point out that the discussion does not concern the question of the power of sea water to dissolve calcium carbonate, a fact which, so far as I know, is not doubted, but deals with the more special problem of whether this power for solution is the factor which has caused the development of atoll lagoons.

She has asked me a question, and I think that she has herself given the answer to it.

Taking the case which Miss Drummond presents, and accepting all her figures, we have the following facts. Normal sea water contains 0·12 gram of calcium carbonate per litre, and will form no precipitate on standing for any length of time. Sea water that contains more than this quantity (*i.e.* 0·649 gram per litre) will deposit calcium carbonate "in the crystalline form, and the deposition may go on until the solution contains less than is normally present in sea water."

In this last case, the saturation of the solution, in falling from 0·649 gram per litre to less than that of normal sea water, has passed through a stage at which it is represented by the normal 0·12. Therefore, in this case, sea water containing 0·12 gram of calcium carbonate per litre will precipitate calcium carbonate, and go on precipitating it until it contains "less than is normally present in sea water." This fact therefore negatives the first statement that sea water containing 0·12 gram per litre will not precipitate. What is the factor that determines the precipitation from normal (0·12) saturation in this case when, as Miss Drummond says, sea water when allowed to stand will not precipitate? I would suggest that it is the presence in the solution of the already formed crystals of calcium carbonate—a condition which is also present "in the interstices of the massive corals in the lagoons."

F. WOOD-JONES.

Conflicting Dates of International Congresses.

AT the request of the Swedish geologists, the International Geological Congress took place this year instead of in 1909. This year was also that in which the International Zoological Congress naturally fell to be held. Since, for the convenience of university workers, these congresses are usually held at the same time of year, and since they, with their excursions, now extend over a considerable period, especially in the case of the Geological Congress, it was almost inevitable that the times of the meetings should clash. This may not affect a large number of participants, but it is rather hard on palæontologists, whose interests lie in both camps, and who, even with the aid of the aëroplane, cannot be in two places at once.

I should not trouble you with a complaint about what appeared to be inevitable this year were there not signs of the same difficulty recurring in perpetuity unless protest is at once raised. As a matter of fact, the committee of "Palæontologia Universalis," when it met at Stockholm, forwarded to the council of the congress a request that this interference should be avoided in future. That protest seems to have been without result. If so, in 1913 the palæontologist will again find himself summoned either by duty or desire to opposite quarters of the globe.

F. A. BATHER.

The Megalospheric Form of *Ammodiscus incertus*.

THE interesting discovery of the megalospheric form of the above species in some abundance in the North Pacific Ocean, as described by Mr. J. A. Cushman in Bulletin No. 71, U.S. National Museum, 1910, pp. 73–5, and noticed in NATURE of September 1, brings to mind the remarkable occurrence of the megalospheric form only (*A. tenuis*, Brady) in some dredgings off Great Barrier Island, New Zealand, which I described in the Transactions of the New Zealand Institute in 1905 (1906). Curiously, the microspheric form was there entirely absent, although Dr. H. B. Brady had previously recorded it from a neighbouring *Challenger* station, No. 169. The latter author regarded *A. tenuis* as perhaps a local variety of the better known *A. incertus*. Rhumbler suggested that the form was possibly the megalospheric stage of the species, whilst the present writer, noting a large amount of variation in the initial chamber, suggested that a microsphere might be present in forms otherwise to be regarded as *A. tenuis*, giving the diameter of the initial chamber in the New Zealand specimens as 100 μ to 50 μ. Mr. Cushman's published figure shows an approximate internal diameter of the proloculum as 250 μ, which is nearer to Brady's published figures than to the examples from the Great Barrier Island. I am now convinced that the specimens from the latter locality had abnormally small megalospheres, giving the minima of measurements so far as known.

A question here arises how to account for the remarkable abundance of *Ammodiscus incertus*, clearly of microspheric relationship, in fossiliferous strata from the Upper Silurian to the late Tertiary. With that problem as a suggestion for observant rhizopodists I conclude this note.

F. CHAPMAN.

National Museum, Melbourne, October 20.

THE PHOTOGRAPHY OF NEBULÆ.

SINCE the year 1880, when Henry Draper, of New York, achieved the first success in photographing nebulæ, namely, the great nebula in the constellation of Orion, the progress made in this branch of astronomy has been both rapid and secure. In this country Common and Isaac Roberts, in France Janssen and the brothers Henry, in Germany Max Wolf, and in the United States W. H. Pickering, Barnard, and Keeler, all have helped to obtain the high standard of excellence which prevails to-day.

Both refracting and reflecting telescopes have been rivalling each other to obtain the mastery in this particular branch, and I think that it is generally conceded to-day that the latter have won the day. The great success achieved is no doubt partly due to the important progress made in the preparation of the photographic dry plate, but a closer scrutiny of the whole situation brings into the light the peculiar skill of the man at the telescope. Isaac Roberts, for instance, had not a very large reflector to work with, one of only 20 inches aperture, yet his skill in tuning up his instrument and his very careful "following" were rewarded by the magnificent set of wonderful photographs which he was able to secure.

Again, Keeler, with the Crossley three-foot reflector, an instrument made in 1879 by Dr. Common, which only reached the United States in 1895, achieved his success only by making a very careful study of and alterations in the telescope and its accessories. While the changes he made were small, they had, as he said, "greatly increased the practical efficiency of the instrument, and therefore, small as they are, they are important." Unfortunately, Keeler died soon after he had commenced his photographic study of the nebulæ, but the handsome volume published as a tribute to his memory ("Publications of the Lick Observatory, vol. iii., 1908"), and containing splendid reproductions from his negatives, will give the reader some impression of the fineness of his work.

Beautiful as the photographs which up to the present time have been secured are, there was inherent in them some defects which it might have seemed impossible to eliminate. There is little doubt but that all these photographs must now be consigned to the second position, to be replaced by those that are the work of Prof. G. W. Ritchey, of the Mount Wilson Observatory.

Prof. Ritchey is one of the band of valuable men which Prof. George E. Hale was fortunate enough to surround himself with in the establishment of the Mount Wilson Solar Observatory. Prof. Ritchey was previously one of the staff of the Yerkes Observatory, and was in charge of the instrument shop at that observatory, and this shop was regarded of very great importance, since it alone rendered possible the construction and frequent improvement of instruments of new type or special design; provision was also made for optical work on a large scale. At the Mount Wilson Observatory the instrument shop was naturally of fundamental importance, and it was not long before the figuring and mounting of a 5-foot reflector was undertaken. This instrument was first tested visually in December of the year 1908, and the first celestial photograph was secured in the same month of that year. The instrument, mounting, dome, building, and accessories were all carried out from the plans of Prof. Ritchey, and it is with this powerful instrument of research and close attention to refinements that he has been able to make this progress in the photography of nebulæ.

In the efficient working of a reflecting telescope it is of great importance to secure as far as possible equal temperature conditions for the telescope, dome, and inside and outside air. Thus the telescope and mirror must not be allowed to be heated up during the daytime because change of temperature causes a deformation of the reflecting surface of the mirror and an alteration in the length of the telescope itself. Again, bright sunshine on the dome causes the building to become heated, and this in turn affects the telescope and mirror and produces temperature errors.

It is chiefly the elimination or practically the almost complete elimination of such temperature changes that has allowed Prof. Ritchey to secure his admirable photographs, and a brief account of the way he has achieved success will be of interest. In the first place, tests were carried on in the optical shop to determine how large a *daily* variation of temperature was permissible without seriously affecting the figure of so large and thick (19·4 cm. at edge, 17·5 cm. at centre) a mirror. By allowing the air temperature about the mirror to rise and fall uniformly for twelve hours

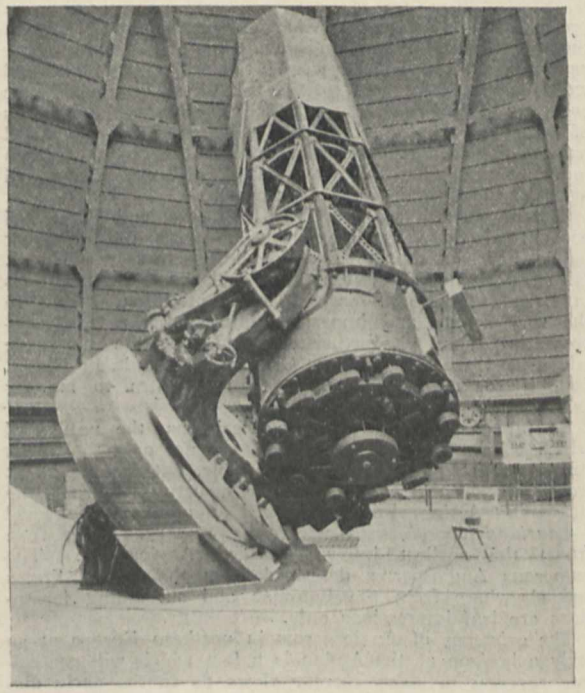

FIG. 1.—The 60-inch reflector mounting in dome.

respectively through 0° F. to 10° F., the most marked effect on the mirror was a decided disturbance of the figure on the outer zones of the surface for a distance of 3·5 or 4 inches in from the edge, these zones becoming too high as the temperature rose, and receding and even becoming too low when the temperature fell. The remaining zones were only slightly affected and the change of focal length of the mirror was small. It was finally decided that a daily variation of the large mirror of 2° F. was the maximum variation that could be permitted without perceptible injury to the sharpness of photographic star-images. When it is mentioned that the daily variation of the temperature in the unprotected dome in clear weather in the latter half of June, 1909, at Mount Wilson averaged 20° F., it will be gathered that the mirror must have altered its figure very considerably. The contraction of the steel skeleton tube was also very noticeable, for the apparent change of focal length found during the night frequently amounted to 0·04 inch.

To maintain a nearly constant temperature, Prof. Ritchey now encloses the greater part of the telescope during the daytime in a light, removable room or chamber, with insulating walls, which he calls the "canopy." The walls of this consist of four thicknesses of fine woollen blankets quilted between covers of white canvas, while the floor is of mats two inches thick, made of cheap woven hair, sewed between covers of heavy canvas. At the upper south portion of the canopy the head end of the skeleton tube projects, and this opening is closed airtight by a folding wooden cover lined with wool felt. In addition to these precautions the large mirror is protected by a short cast-iron tube, and by the airtight covers which protect its surface. Arrangements are made for moving the canopy easily and entirely out of the way of the telescope when in use, and replacing it when observing is completed. While the telescope was protected in the above manner, a sun shield was used to reduce the daily variation of the dome. This consists of gores of heavy white canvas laced to a

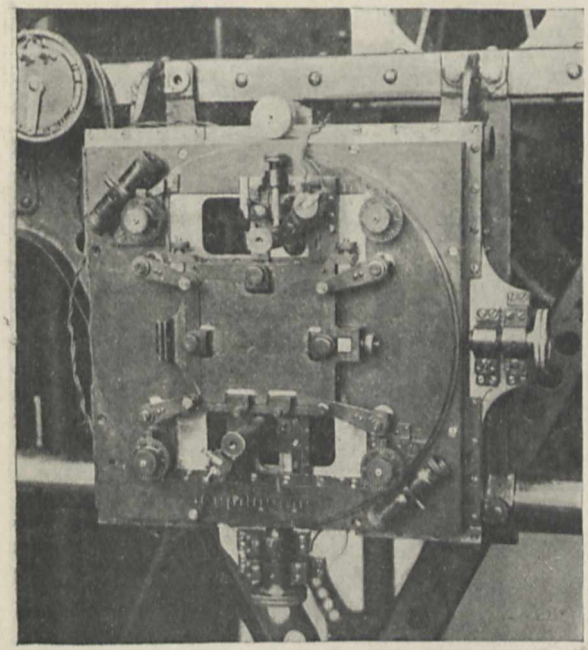

FIG. 2.—The new photographic plate carrier on the 60-inch reflector.

strong framework of steel pipe. The canvas was thus retained two feet from the steel covering of the dome, due provision being made for the free circulation of the air beneath the canvas. In this way the daily variation in the dome was decreased to 10° F. in July, while the change in focus of the mirror was reduced to 0·02 inch.

By the combination of shield and canopy, the inside daily variation of temperature in the latter was only 3·8° F. in August and September, and the apparent alteration of focus reduced to 0·005 inch. Prof. Ritchey proposes, in future, two improvements when he still further hopes to reduce this daily amplitude of variation, first to place in the canopy a small refrigerating apparatus with a controlling thermostat, and, second, to enclose the complete telescope in the canopy.

With these refinements in controlling temperature changes, he adopts the knife-edge method of focussing the stellar images, a most important consideration in stellar or nebular photography. By this means he is able to locate the focal plane to within 0·001 inch. With the help of his new plate-carrier, the focal plane and the plane of the film of the photographic plate can with certainty be made to agree within 0·0003 inch. While making an exposure he has occasionally to remove the plate to check the position of the focal plane of the mirror. Since the adoption of the canopy and shield he has found that re-focussing about every half-hour in the early part of the night, and about every three-quarters of an hour after 11 p.m., is sufficient for accurate working.

The efficiency of the whole instrument is such that Prof. Ritchey states :—

"All of the uncertainties which usually occur in making long exposures with very large instruments are eliminated. A plate can be exposed night after night, if desired, with the assurance that no error in focus greater than one or two-thousandths of an inch can occur, and that no rotation of field can take place without immediately being detected and corrected. Both of these conditions are absolutely necessary for the finest results with an instrument so powerful and sensitive as the 60-inch. . . . On the best of these negatives, with exposures of eleven hours, the smallest star-images are 1·03 seconds in diameter."

To ensure the finest of final products, Prof. Ritchey lastly abandons the use of rapid plates, which, as is well known, are always associated with coarseness of grain, and employs Seed "23" plates almost exclusively.

A close examination of the reproductions of some of the nebulæ which he publishes with his latest communication indicates in a striking manner the wonderful sharpness and richness in detail of his photographs. It is interesting in this respect to compare Ritchey's photograph of the spiral nebula Messier 51 Canum Venaticorum, with that of Keeler, reproduced in vol. viii. of the "Publications of the Lick Observatory" (plate 47), those of Isaac Roberts in vols. i. and ii. of his "Photographs of Stars, Star Clusters, and Nebulæ" (plates 30 and 15 respectively), and, lastly, that by Ritchey himself, taken with the 2-foot reflector of the Yerkes Observatory, and published in vol. ii. of the "Publication of the Yerkes Observatory" (plate 29).

Bearing in mind the differences in quality of the reproductions to which references above are given, the superiority of Ritchey's latest achievement is well marked.

In a more recent announcement (*Monthly Notices*, R.A.S., vol. lxx., Supplementary Number, No. 9), and dated September 17, Prof. Ritchey directs attention to very important conclusions which he is able to arrive at from his recent photographs. These are that the spiral nebulæ are not only distinguished by many sharply-marked characteristics from all other classes of nebulæ, but that the spirals themselves exhibit marked differences from each other in regard to the distribution of the nebulous stars, differences which, as he states, possibly correspond to successive stages of development.

It is in the presence of such photographs as these, and more especially those where the nebulæ are of a spiral nature, that one's attention is directed to the question of the origin of stars themselves.

"All self-luminous bodies," as Sir Norman Lockyer states in the first of his General Conclusions at the end of his work 'The Meteoritic Hypothesis,' "in the celestial spaces are composed either of swarms of meteorites or of masses of meteoritic vapour produced by heat. The heat is brought about by the condensation of meteor swarms due to gravity, the vapour being finally condensed into a solid globe."

Such a photograph as that of Messier 51 seems to represent the above words in picture form. Prof. Ritchey, in commenting on these spirals, which he has most recently photographed, says, that they all "contain great numbers of soft star-like condensations which I shall call *nebulous stars*. They are possibly stars

in process of formation. In general they lie in streams which follow the curvature of the convolutions. Together with the smooth nebulous material in which they are apparently floating, and out of which they are apparently forming, they constitute the convolutions."

While a detailed study of individual nebulæ endorses the meteoritic hypothesis regarding the formation of stars, the hypothesis itself requires the presence of a considerable quantity of self-luminous or non-luminous matter scattered throughout space. The recent advances in the photography of nebulæ have, however, very considerably altered the generally conceived notions regarding the amount of nebulous matter distributed in the heavens. After Keeler turned his attention towards photographing nebulæ, he soon found that he was able considerably to increase the number of known nebulæ with the aid of the Crossley reflector. In this research he reached two important conclusions:—

(1) "Many thousands of unrecorded nebulæ exist in the sky. A conservative estimate places the number within reach of the Crossley reflector at about 120,000. The number of nebulæ in our catalogues is but a small fraction of this." (2) "Most of these nebulæ have a spiral structure."

In the preface to the volume containing Keeler's photographs it is stated:—

"The number already discovered and catalogued did not exceed 13,000. Later observations with the Crossley reflector, with longer exposure-times and more sensitive plates, render it probable that the number of nebulæ discoverable with this powerful instrument is of the order of half a million."

While the above estimate relates to the capacity of the Crossley reflector, what number of additional nebulæ should be added when the very much greater efficiency and aperture of the Mount Wilson Observatory's reflector is taken into account? Prof. Ritchey, as has been shown above, has demonstrated the far-reaching capacity of this instrument and its enormously improved efficiency for nebular photography. Further, when the 100-inch reflector of the same observatory is brought into use, what will then be the approximate number of known nebulæ?

Again, while all these instruments can only record the existence of self-luminous matter in space, what estimate should be made for the number of regions in the sky in which matter which is not luminous is present? The only conclusion that can at present be drawn is that amount of matter distributed in space is really enormous compared to that which is generally conceded to be the case. If, as very probably is the case, this non-luminous matter is as frequently distributed as that which is luminous, then any hypothesis to explain inorganic evolution must be founded on a meteoritic basis.

The work of modern large reflecting telescopes in adding to our knowledge of the probable amount of nebulous matter in space is of very great importance, and the magnificent success of Prof. Ritchey in his latest achievement forms another opportunity for the hearty congratulations of all astronomers to be extended to him. Prof. Ritchey is to be envied, not only for working in a country where astronomy in all its branches is so well fostered, but for being one of the members of the staff of the Solar Observatory on Mount Wilson, an observatory which is so magnificently endowed. On that mountain, when it is decided that a spectroheliograph, which we in this country would consider of very large dimensions, would be capable of accomplishing better research if another of double its size were instituted, then promptly the necessary funds are forthcoming, and the instrument is taken in hand, built, and brought into use. Again, no sooner is a 60-inch mirror found to be a very great advance in celestial photography than one of 100 inches in diameter is immediately projected, and all necessary arrangements for its completion and erection are made. With such facilities for research, so incentive to those who are employed in the investigations, no wonder that work of the highest quality and importance can be turned out; for this reason this country, like many others, is being left far behind.

FIG. 3.—Spiral Nebula Messier 51 Canum Venaticorum. Photographed with the 60-inch reflector and the new plate carrier. Exposure 3h. 55m., February 7 and 8, 1910. Notice the roundness of the star images.

WILLIAM J. S. LOCKYER.

ANNIVERSARY MEETING OF THE ROYAL SOCIETY.

THE anniversary meeting of the Royal Society was held as usual on St. Andrew's Day, November 30, when the report of the council was presented, and the president, Sir Archibald Geikie, K.C.B., delivered an address. Most of the matters mentioned in the council's report have been referred to already in the columns of NATURE, and others are of domestic, rather than of general scientific, interest. The council has decided "that the surplus annual income of the Darwin Fund, after providing for the silver medal and money gift prescribed by existing regulations, be devoted, not to the provision of scholarships or medals, but to the furtherance of biological research in the Darwinian field."

Upon the recommendation of the president and council of the society, the Government has agreed to continue its subscription to the International Association of Seismology for six years more, up to the end of March, 1916. In alluding to this decision in his address, the president took the opportunity to refer to Dr. John Milne's extensive work in modern observational seismology. "The valuable service which he has thus rendered to the study of earthquakes has been universally recognised, and there is a widespread conviction that the system of observing stations which he has created is worthy of being made a national undertaking."

It is proposed to publish a collected edition of the works of Sir William Herschel, under the editorial supervision of Dr. J. L. E. Dreyer. The cost will be shared with the Royal Astronomical Society.

A number of facts of importance relating to sleeping sickness in Uganda have been described by Sir David Bruce and his colleagues in papers presented to the society. The council reports as follows:—

Research on Tropical Diseases.

The work of the commission in Uganda has confirmed the conclusions, mentioned in the council's report of last year, that the *Glossina palpalis* is capable of conveying the infection of sleeping sickness for a much longer period than was thought to be the case at first, and that this fly may act as a carrier of other trypanosome diseases, such as those animal diseases that are produced by *Trypanosoma dimorphon*, *T. vivax*, and *T. nanum*.

One of the most important results of the last year's work of the commission is the discovery that the flies of the lake shore are still capable of transmitting the infection of sleeping sickness, although two years have now elapsed since the population was removed. The cause of this has not yet been ascertained with certainty, but further work is being done to determine, if possible, whether there is an animal reservoir for the *T. gambiense*, and especially whether cattle and antelope harbour the parasite of the disease, as laboratory experiments made at Mpumu suggest. This is a question of great importance with regard to the means to be adopted to control the malady.

The commission has not only done a great deal of work on sleeping sickness, but a number of researches on other maladies, human and animal, have also been carried out. Thus a disease affecting the natives in the province of Ankole, and known as "muhinyo," was investigated by Sir David Bruce and his colleagues, and the very interesting discovery was made that this malady was really Malta fever, and affected both men and goats in Central Africa.

In his presidential address, Sir Archibald Geikie referred to the losses by death sustained by the society during the year. These include the patron, King Edward VII.; foreign members: Alexander Agassiz, Stanislao Cannizzaro, Giovanni Schiaparelli, Robert Koch, Friedrich Wilhelm Kohlrausch, and Melchior Treub; and fellows, Sir William Huggins, Dr. Ludwig Mond, Dr. Shelford Bidwell, Sir Robert Giffen, Rev. Robert Harley, Mr. J. B. N. Hennessey, Mr. Edward Saunders, Sir Charles Todd, and Mr. C. Greville Williams.

The work of the medallists for this year was described by the president in the following words:—

COPLEY MEDAL.

The award of the Copley medal has this year been made to one of our own countrymen, who has been more than fifty years a Fellow of the Royal Society. Sir Francis Galton's life has been one of ceaseless activity in many varied departments of intellectual effort. Few of us can remember how he began as an enthusiastic explorer and geographer, "urged," as he confessed, "by an excessive fondness for a wild life," and with "the love of adventure" as his chief motive. He chose south-western Africa as the theatre of his exploration, penetrated into regions where no European foot had preceded him, and brought back with him a vivid impression of the scenery, physical geography, natural history, and ethnology of Damaraland and South Ovampoland. He embodied his observations in an interesting volume of travel published in 1853. That work showed that he was no mere hunter after game or seeker of adventure, but a shrewd and observant traveller, with his eyes open to every distinctive natural feature in the countries and their inhabitants. His experience in these African journeys led him to plan and to publish in 1854 his well-known and admirable handbook, "The Art of Travel," which, as a pioneering treatise in the practical methods of scientific exploration, has proved of inestimable service to the travellers of the last half-century.

Sir Francis at an early period of his career was led to interest himself in meteorology, which, as a science of observation, was then in its earliest infancy. With much labour and skill he constructed weather charts, and discussed meteorological statistics. His zeal and success in these studies led to his being chosen a member of the Meteorological Council at its origin, and he remained in that position until the council was superseded in 1901 by the Meteorological Office. He likewise acted as chairman of the Royal Society's Committee of Management of Kew Observatory from 1888 until 1900, when the work of this committee became merged in that of the National Physical Laboratory.

But it was not only in geography and meteorology that Sir Francis Galton manifested his versatile energies. He was much interested likewise in biological studies, especially in regard to questions of relationship and heredity. So far back as 1871 he began what has proved to be a voluminous and important series of contributions to these subjects. From his first paper, "Experiments in Pangenesis," down to his last volume on "Eugenics," his successive papers have shown a continuous development of ideas and conclusions. He was led from his early ethnological inquiries into the mental peculiarities of different races to discuss the problems of heredity genius from the fundamental postulate that "a man's natural abilities are derived by inheritance under exactly the same limitations as are the form and physical features of the whole organic world." To obtain further data for the discussion of this subject he carried out the elaborate statistical inquiries embodied in his "English Men of Science." Confident in the results of these researches, he proceeded after the manner of "the surveyor of a new country who endeavours to fix, in the first instance, as truly as he can, the position of several cardinal points." His results in this quest were given in his "Inquiries into Human Faculty and its Development," published in 1883. A further contribution was made by him in 1889, when his work on "Natural Inheritance" appeared. His subsequent papers and essays on "Eugenics" have still further stimulated inquiry into a subject of such deep interest and transcendant importance in all efforts to improve the physical and mental condition of the human race. It has seemed to the council fitting that a man who has devoted his life with unwearied enthusiasm to

the study and improvement of many departments of natural knowledge, whose career has been distinguished by the singleness and breadth of its aims and by the generosity with which he has sought to further them, should receive from the Royal Society its highest award in the Copley medal.

RUMFORD MEDAL.

The Rumford medal has been awarded to Prof. Heinrich Rubens, in recognition of the value of his researches in radiation. For many years he has been engaged in the experimental investigation of optical radiations of very long wave-length. In the course of this work he elaborated, in conjunction with Prof. E. F. Nichols, a method of isolating pencils of nearly homogeneous rays, using the fact that a non-metallic substance reflects very copiously waves of the same length as those to which it is opaque. If, then, a pencil of rays of mixed wave-lengths is reflected several times to and fro between mirrors of the same kind of substance, the rays finally emerging (the "Reststrahlen") have the wave-lengths of the kinds of light which the substance refuses to transmit. The light of other wave-lengths has been transmitted freely at each incidence, and by a sufficient number of reflections is ultimately removed from the pencil. By using different substances as reflectors, Prof. Rubens has isolated infra-red light of various wave-lengths up to as much as 96 μ, or about 0·1 of a millimetre; while, on the other hand, purely electric waves have been produced of wave-lengths as small as 2 millimetres. He has thus enormously extended our knowledge of the infra-red spectrum. Moreover, in conjunction with colleagues, he has investigated the absorbing and reflecting powers of substances for these long wave-length rays. He has shown that, for radiation of wave-length even fewer than ten times the wave-lengths in the visible spectrum, the reflecting and absorbing powers of metals and alloys are determined by their electric conductivities alone, in accordance with Maxwell's theory. It followed from Maxwell's own observations on the absorption of gold-leaf for visible light that agencies more complex than conductivity must be involved for these shorter wave-lengths.

Prof. Rubens has recently applied to the measurement of the long infra-red wave-lengths a quartz interferometer, and among other results he has found that the refractive index of water, for waves of length about 82 μ, is of the same order as for waves in the visible spectrum, while for the shortest Hertzian waves yet examined, about 2000 μ, it is as high as 9.

These examples will serve to illustrate how much Prof. Rubens has already done to bridge the gap between optical radiations and electric waves produced by direct electric agency, and how much more is to be expected from him in the investigation of the interval still remaining in which such fundamental changes of properties take place.

ROYAL MEDALS.

The awards of the two Royal medals given annually by our Patron the King have received his Majesty's approval.

One of these medals has been assigned to Prof. Frederick Orpen Bower, in recognition of the great merit of his contributions to morphological botany, of which department of science he is the acknowledged leader in Great Britain. Prof. Bower's early studies in this field (1880–2), on the genera Welwitschia and Gnetum, were marked by the discovery of the true nature of the two persistent leaves in Welwitschia. The next period of his work was given to a study of the morphology of the leaf. He developed in 1884 the idea of the phyllopodium or leaf-axis, and discussed in 1885 the apex of the leaf in Osmunda and Todea. This latter study was cognate to subsequent researches, the results of which were given in 1886 in a review of "Apospory and Allied Phenomena." This work, of much intrinsic interest, is important as having led its author to formulate the views advanced in 1890 in a memoir on "Antithetic as distinguished from Homologous Alternation [of Generation] in Plants." Another memoir, published in 1889, on "The Comparative Examination of the Meristems of Ferns as a Phylogenetic Study," prepared in the light of the then received belief that the leptosporangiate ferns are the more primitive, was followed in 1891 by a discussion of this question, in which Prof. Bower advanced morphological reasons for reversing the hitherto accepted phylogenetic order. The new conclusion has proved to be in accord with palæobotanical results, and marked another distinct step in the advancement of botanical science. During the third period of his work, 1892–1903, Prof. Bower's papers, including an important series on the spore-producing members, have resourcefully maintained the antithetic doctrine, and have afforded a striking instance of the advantage of a well-considered working hypothesis as a guide to investigation. The career of morphological research here outlined has been recently crowned by the publication (1908) of a book on "The Origin of a Land Flora," which is one of the "most important contributions to the advancement of natural knowledge, published originally in his Majesty's dominions," within the period prescribed in respect of the award of Royal medals.

The other Royal medal has been adjudged to Prof. John Joly, who is eminent in two branches of science, geology and physics. This combination of studies has proved to be reciprocally fruitful to both departments. It was from his mineralogical interests that he was led to devise the steam calorimeter, which has enriched physics with an apparatus of high refinement. The use of this method was extended by him to the direct determination of the specific heats of gases at constant volume, a measurement dealing with minute quantities of heat in circumstances quite beyond the capabilities of the usual forms of calorimeter. Among many contributions to standard physical data, which are accepted and in use, may be instanced his determination of the density of saturation of steam. His meldometer, primarily intended for determining the melting points of mineralogical and geological specimens, has been the means of providing data for use in thermometry. He has devised and applied a method of determining the change of volume of rocks and other substances on fusion, which is a datum of primary importance for cosmical theories. He has carried out a refined research, with negative results, on the possibility of minute change of mass (as distinguished from weight) accompanying chemical combination. His recent extended investigations of the occurrence of radio-active substances in materials from various strata have been utilised for fundamental geological discussions. Of other useful inventions which he has introduced, one of the best known is the translucent block photometer.

Prof. Joly has made important contributions to the subject of colour photography, and devised some years ago a three-colour system in which all three colours are present on the same plate in the form of fine parallel lines or small dots.

He has also contributed substantially to the theory of biological processes, such as the ascent of sap in vegetation. Reference may likewise be made to his suggestive memoir on the age of the earth, based upon a discussion of the chemical constitution of the ocean.

DAVY MEDAL.

The Davy medal has been assigned this year to Prof. Theodore W. Richards, as a mark of appreciation of the value of his work in the determination of the atomic weights of the elements. His researches on this subject have not been surpassed in comprehensiveness by those of any other chemist. He has himself determined the atomic weights of no fewer than fourteen elements, and many other atomic weight determinations have been made under his direction and superintendence. The accuracy of the numbers obtained is certainly much higher than that which has been attained by any previous series of researches, and it is impossible to speak in too high terms of the ingenuity, the unremitting labour, and the masterly manipulation which Prof. Richards has brought to bear on his investigations.

In addition to this work on atomic weights, Prof. Richards has made many important contributions to physical chemistry, and it is probably no exaggeration to say that he has done more to raise the standard of accuracy in physico-chemical work than any other living

chemist. Theoretical contributions to this branch of science are comprised in a series of papers on "The Possible Significance of Changing Atomic Volume," in which he suggests a relation between the energy of the atoms and their compressibilities. In order to test his hypothesis, he has made a long series of investigations on the compressibility of elements and compounds. He has determined this constant for nearly all the solid and liquid elements, and he has shown that the compressibility is a periodic function of the atomic weights. In electrochemistry Prof. Richards has made important determinations of the electro-chemical equivalent of silver, and he has supplied some of the most rigorous proofs of the universality of Faraday's law.

DARWIN MEDAL.

To Mr. Roland Trimen, who was for many years curator of the South African Museum in Cape Town, the Darwin medal has been awarded. His official position, and the duties it involved, enabled him to do admirable work in African zoology. His name will always stand with those of Bates and Wallace in the establishment and illustration of the theory of mimicry. In addition to his researches on that subject, he has done admirable systematic work, his descriptions of insects, especially the *Lepidoptera rhopalocera*, being models of accuracy and literary style. He, furthermore, rendered the greatest assistance to Charles Darwin, especially in his work on orchids—assistance the high value of which is acknowledged in a long series of that great naturalist's published letters.

SYLVESTER MEDAL.

The medal which perpetuates the name and mathematical prowess of James Joseph Sylvester has this year been assigned to Dr. Henry Frederick Baker, in recognition of his work in the theory of functions, wherein he has shown himself to be a profound analyst. His book on the Abelian functions, published in 1897, is a classic, and probably no better guide to the analytical development of pure mathematics has appeared during the last three-quarters of a century. While basing the argument of the work on the methods of Riemann, he never loses sight of the arithmetical ideas which we owe to Kronecker, Dedekind, and Weber, or of the geometrical notions brought to light by the labours of Clebsch, Gordan, Noether, and Klein. The critical insight which was thus in evidence marked him out a few years ago as the editor of "Sylvester's Collected Papers." This work, which, with the approaching issue of the fourth and last volume, may be said to be complete, has been necessarily a difficult task, which, besides making demands upon the resources of an accomplished mathematician, has entailed no little editorial labour. Dr. Baker, by explanatory and critical observations, and by frequent ameliorations of the text, has done much to assist mathematical students. His scholarly work has resulted in a faithful record of the course of Sylvester's thought. It seems eminently fitting that the Sylvester medal should be given to one who has erected so lasting a memorial to the great mathematician.

HUGHES MEDAL.

To Prof. John Ambrose Fleming the Hughes medal has been awarded. For thirty years he has been actively engaged in researches in experimental physics, chiefly in the technical applications of electricity. He was an early investigator of the properties of the glow lamp, and elucidated the unilateral conductivity presented in its partial vacuum between glowing carbon and adjacent metal, a phenomenon which has been linked up recently with the important subject of the specific discharges of electrons by different materials. He has published in the scientific and technical Press, and in technical text-books, many admirable experimental investigations and valuable expositions in the applications of electricity, as, for example, to electric transformers and wireless telegraphy. Of special interest and value for theory were the important results concerning the alterations in the physical properties of matter, such as the remarkable increase in the electric conductivity of metals when subjected to very low temperatures, which flowed from his early collaboration with Sir James Dewar in investigating this domain. In recent years he has taken a prominent part in the scientific development of telegraphy by free electric waves.

In the evening the fellows and their guests dined together at the Whitehall Rooms, Hotel Metropole.

ENTERIC FEVER CARRIERS.[1]

THE frequent difficulty in accounting for the source of infection of enteric fever once led to the theory that this disease could arise *de novo*, that is to say, that certain organisms in human dejecta were capable of developing, in favourable circumstances, into enteric fever organisms. It has also been maintained more recently that the specific organism of this disease was capable of living and multiplying in water and soil, for considerable periods. But the bacteriological work of the past few years has discredited both these hypotheses; and the "carrier" case of enteric fever or the mild, unrecognised case of infection generally, explain the transmission of the disease in those cases in which the disease crops up in the absence of any recognised sufferer from the disease.

A "carrier" of enteric fever is a person who, although he may be in good health, carries the infectious material in his body, from which it may pass out. He is not merely a passive transmitter of infection; he is also a breeding-ground and storehouse of these specific organisms; and it appears that not only those sick with the fever, but also healthy persons who happen to be "carriers" of the infection, offer the best explanation for the maintenance of the infection in communities.

The subject has naturally attracted much attention and led to many investigations, the results of which are to be found in numerous recent publications, and Dr. Ledingham has done a great service in preparing for publication a summary of the more important investigations that have hitherto been made of this subject. He gives the history of a large number of occurrences of enteric fever in domestic life, in institutions, and in military populations, in which the source of infection has been traced more or less convincingly to a "carrier." In many of these cases the evidence is conclusive that the infection was conveyed by food or milk. The recorded instances go to prove that the female sex is more liable to carry the infection than the male, and that of both sexes some 2 to 4 per cent. of previous sufferers may continue to harbour the germ, and become "carriers," who intermittently discharge the germ, for periods extending maybe for many years.

As Dr. Theodore Thomson, who writes an introduction to this report, states, the difficulty of dealing with "carriers" is very great indeed, having regard more particularly to the long periods during which people may harbour the infection and to the fact that it has hitherto proved very difficult to free them from the infection. The chief available measures include: all possible efforts to detect "carriers" in the community, and to endeavour to secure on the part of a "carrier" those precautions of strict personal cleanliness and of disposal of dejecta that will minimise the risk of infecting others; an endeavour must also be made to prevent such "carriers" from taking any part in the milk trade or in the preparation or handling of food.

In this interesting report, Dr. Ledingham also discusses the diagnostic methods employed in the search for "carriers" and the immunity question in "carriers." A useful bibliography is appended.

[1] Dr. J. C. G. Ledingham's Report to the Local Government Board on the Enteric Fever "Carrier"; being a Review of current knowledge on this subject. Pp. 138. (London: Wyman and Sons, 1910.) Price 1s.

NOTES.

LORD AVEBURY has been elected a corresponding member for the section of anatomy and zoology of the Paris Academy of Sciences.

WE regret to see the announcement of the death, on November 24, at sixty-four years of age, of Prof. Angelo Mosso, professor of physiology in the University of Turin.

WE learn from the *Revue scientifique* that the new astronomical observatory in the gardens of the Vatican was opened on November 17.

THE *Terra Nova*, with the members of Captain Scott's Antarctic expedition on board, left Port Chalmers on November 29 on her way south.

PROF. R. A. SAMPSON, F.R.S., professor of mathematics and astronomy in the University of Durham, has been appointed Astronomer Royal for Scotland and professor of practical astronomy in the University of Edinburgh, in succession to Mr. F. W. Dyson, F.R.S.

ON account of the General Election, the annual dinner of the Institution of Electrical Engineers (originally fixed for December 6) has been postponed to Thursday, February 2, 1911.

THE French Society of Biology has, says the *Revue scientifique*, awarded the Godard prize to Mlle. Anna Drzewina. The prize is awarded every other year for the best biological work.

THE Emperor Francis Joseph has conferred the Austrian great gold medal of science and literature upon Mr. E. Torday, the leader of the scientific expedition sent out by the British Museum to study the native tribes in the Kasai basin of the Congo.

THE *Scientific American* announces that Prof. Frank H. Bigelow, who recently resigned from the United States Weather Bureau, has joined the staff of the Argentine Meteorological Office.

WE learn from the *Times* that, owing to ill-health, Mr. Goodfellow, the leader of the British expedition to Dutch New Guinea, has been compelled to return home, and that the committee of the British Ornithologists' Union has appointed in his place Captain C. G. Rawling, who represents the Royal Geographical Society on the expedition.

THE death is announced, at fifty-three years of age, of Mr. F. Howard Collins, the author of "An Epitome of the Synthetic Philosophy of Herbert Spencer" and 'Author and Printer: a Guide to Authors, Editors, Printers, Correctors of the Press, Compositors, and Typists." Mr. Collins was awarded a medal at the Franco-British Exhibition of 1908 for his "Simplified Mariner's Compass Card."

DR. HENRY WURTZ died recently at Brooklyn in his eighty-third year. At the beginning of the Civil War he was chemical examiner in the U.S. Patent Office, as well as professor of chemistry in the National Medical College at Washington. He was the author of numerous scientific treatises, and for some time editor of the New York *Gas Light Journal*. The mineral wurtzilite was named after him, and he was also the discoverer of the minerals huntilite and animikite.

A RECENT issue of *Science* gives an interesting account of the development of the Rockefeller Institute for Medical Research. The establishment of the institute is the culmination of a series of gifts, each one based on a demonstration of actual needs and on evidence of a wise use of previously available funds. The initial gift was made in 1901, when 40,000*l*. was provided to be used in a limited number of years in the form of grants to support research. In 1902 a donation of 200,000*l*. was received to cover the erection of a laboratory and the cost of current expenses for a few years. When the plans were being prepared for the future organisation of the institute, the necessity for having a hospital under the control of the institute was felt very much. Mr. Rockefeller decided to erect a hospital, and provided a further 124,000*l*. for the purpose. In 1907, while the plans of the hospital were being prepared, Mr. Rockefeller gave 520,000*l*. to be used solely for the endowment of the institute. This year the trustees of the institute assumed possession of 764,000*l*., the generous patron's latest gift. Up to the present time the work of the institute has been confined to laboratory studies of physiological and chemical aspects of diseases and to surgical and other problems that could be studied on animals. The need for the direct study of diseases under conditions that would permit accurate observations with the aid of comprehensive equipment led to the foundation of the hospital. Instead of being compelled to treat almost every kind of disease, as in a general hospital, the physicians will concentrate on a few ailments. The hospital will have physiological, chemical and biological laboratories to supplement those in the institute. The laboratories of the hospital will be devoted to investigations bearing on the diseases under treatment, while the laboratories of the institute will continue their investigations as conducted at present.

AT the last meeting of the Cotteswold Field Club Mr. L. Richardson pointed out that the so-called "stone circle" on Shurdington Hill, near Cheltenham, was really of natural origin. A slipping forward of the Upper Lias Clay was accompanied by undermining of the basal Inferior Oolite limestone, and some blocks rolling down the slope had assumed the appearance of a stone circle, which is so recorded in the Ordnance Survey. The site being under the cold shadow of a northward-facing cliff is not the position likely to have been selected for an interment.

AN interesting part of the work of the Brooklyn Institute of Arts and Sciences is the arrangement of a special museum and library for the use of children, of which an account is given in the report for 1909. The institution contains rooms devoted to exhibits of historical interest, geography, birds, insects, and similar objects. The library is provided with special literature on these subjects suitable to the needs of its students, and interest in the study of nature is excited by the issue of picture bulletins and the exhibit throughout the year of specimens of trees in bud, flowers, and fruits. The museum is said to be widely used by children in elementary schools, and it offers facilities for training of teachers, who are thus enabled to collect materials for study by their pupils. The practical system thus organised deserves the attention of school authorities in this country.

CAPTAIN A. J. N. TREMEARNE is busily engaged in unloading the stores of ethnological material which he has brought from Hausaland. He contributes to a recent number of the Journal of the Royal Society of Arts a series of folk-tales dealing with the relations of Hausa parents and children, which from these specimens seem to be far from satisfactory, these tales being devoted to the themes of unnatural parents and disobedient children. One is some-

what of the Sampson-Delilah type, in which a strong man loses his power through love of a woman. She, however, atones for this by allowing herself to be buried with his corpse, by which means she and her lover revive, and the grave becomes an iron house in which they live happily ever after.

So much discussion has arisen on the subject of eoliths that it is refreshing to find the case reviewed with good sense, knowledge of the conditions under which natural cleavage of flint may simulate the work of primitive man, and the provision of such a complete series of illustrations in the paper contributed to vol. xxi. of *L'Anthropologie* by L'Abbé H. Breuil, entitled "Sur la présence d'éolithes à la base de l'Eocene Parisien." We can only direct attention to this admirable essay, a study of which may be commended to certain enthusiasts on this side of the Channel. The same remarks apply to another contribution to the same magazine by M. G. H. Luquet, entitled "Sur les caractères des figures humaines dans l'art paléolithique," where the styles of this primitive art are illustrated by numerous well-selected sketches. The author is, on the whole, inclined to question the theory that a magical intention underlies the treatment of the sexual characteristics which are so prominent in the cave drawings.

DR. FRIEDERICI, in describing the distribution of the sling in America (*Globus*, xcviii., p. 287), finds that it occurs practically everywhere if stones can be found. He seems to have misrepresented Peschel, who does not state (at all events in the English edition) that "slings cannot be used in tropical virgin forest," but that they "could not be used in the forest country of the Amazon," because, as he had previously stated, "no shingle is to be found." Slings could only be employed on the narrow paths, in clearings, or by rivers, but in such a country the bow is better than the sling; the spear-thrower is impracticable, as it requires so much elbow-room. He comes to the fairly obvious conclusion that the sling has been independently invented in various parts of the world.

IN the Bulletin of the Johns Hopkins Hospital for November (xxi., No. 236) Dr. Harvey Cushing surveys the present status of neurological surgery, and shows how much has been accomplished during the last few years. Incidentally, Dr. Cushing deals with the value of experimentation on the lower animals. He says:—"There is no question but that a training for neurological surgery must come through laboratory experiences, and just as we are indebted to experimentation on the lower animals for almost every fact of importance which has made for the advance of this particular department, so also must we call upon them for the mere practice of hand essential to success in their clinical applications. Those who oppose the employment of animals for such purposes would leave us the only alternative of subjecting our fellow-man, as a lesser creature, to our first crude manipulations."

EVER since it was first discovered that sleeping sickness in Uganda was disseminated by the dusky tsetse-fly, *Glossina palpalis*, it has been a moot point whether or not other species of tsetse-flies are capable of transmitting *Trypanosoma gambiense*. The question is one of the greatest practical importance, since upon the answer it depends whether sleeping sickness is confined necessarily to those regions where *G. palpalis* is found, or whether it may spread over a vastly wider extent of the African continent into regions in which other species of tsetses occur. Prof. Kleine in German East Africa carried out some experiments with *G. morsitans* which led him to the conclusion that *T. gambiense* was unable to go through its development in, or be transmitted by, this species of tsetse (*vide* Sleeping Sickness Bureau Bulletin, No. 11, Appendix, and No. 18, p. 197). Recently, however, several cases of sleeping sickness have been reported from north-eastern Rhodesia and Nyasaland, from regions far south of the most southerly point at which *G. palpalis* is known to occur. It is believed that in these cases the transmitting agent is *G. morsitans*, and, if so, it is an extremely serious matter. It is to be hoped that the question will be thoroughly investigated without delay.

THE seventy-fourth Bulletin of the United States National Museum consists of an account of some West Indian Echinoids, by Mr. Theodor Mortensen, of the Zoological Museum, University of Copenhagen. The memoir is a short one, extending only to thirty-one pages, but it contains a revised list of North American, Atlantic, and West Indian Echinoids, amounting to eighty-two species, which should be of great value to the systematist. The work is illustrated by seventeen plates of remarkable beauty.

AS we learn from a recently published guide-book, by the curator, the exhibited series of British birds in the Hull Municipal Museum is of unusual extent and interest. It includes, for instance, a large collection made by the late Sir Henry Boynton, a second formed by the late Mr. H. J. R. Pease, and a third known as the Riley-Fortune collection. Two at least of these collections were found to supplement one another, and all three are rich in Yorkshire specimens. The guide is illustrated by reproductions from photographs of some of the groups.

BIRD-MARKING is being carried on as energetically in the United States as in Europe, and, according to an article by Mr. L. J. Cole in the *Auk* for April, with equally satisfactory results. Open aluminium bands are now employed in place of closed rings, but these, owing to their hardness, are not altogether suitable for the purpose. Up to December 1, 1909, there were recovered 911 banded birds. Special interest attaches to a number of night-herons banded at Barnstable, Mass., of which a considerable proportion was recovered. After leaving the heronries these birds scattered in a northerly direction, this direction being largely due to the circumstance that there is no land to the south. The movement indicates, however, a tendency on the part of all young birds to disperse from the neighbourhood of the nests in which they were reared, owing to food-supplies having been rendered scarce.

THE question whether bees are capable of distinguishing different colours has been much discussed, one observer maintaining that the varied hue of Alpine flowers is for the purpose of enabling bees to remain constant to a particular species of plant, so that pollination is effected to the mutual advantage of the bees and the flowers. On the other hand it has been argued that flowers might be as green as leaves without any hindrance to pollination by insects. To test the question, Mr. J. H. Lovell conducted a series of experiments with glass slides of different colours, rendered attractive by patches of honey, to see which particular kind bees would visit, a blue slide being, for instance, offered first, then a red one placed alongside, and, finally, the positions of the two exchanged. As the result of these experiments the observer states, at the conclusion of a paper in the November number of the *American Naturalist*, that "bees easily distinguish colours, whether they are artificial (paints, dyes, &c.) or natural ('chlorophyl') colours. They are more strongly in-

fluenced by a coloured slide than by one without colour. Bees which have been accustomed to visit a certain colour tend to return to it habitually—they exhibit colour-fidelity. But this habit does not become obsessional, since they quickly learn not to discriminate between colours when this is for their advantage."

IN his report on marine biology, included in the administration reports of Ceylon for 1909, Dr. A. Willey states that hopes have been entertained of rendering the southern division of the Mannar pearl-oyster fishery—more especially the so-called "Chilaw paars," which were the headquarters of the industry during the sixteenth century—once more productive. The results of recent observation tend to confirm Prof. Herdman's suggestion that most of the Mannar oysters are not bred *in situ*, but are carried by currents from the coasts of southern India—a conclusion which is of the most far-reaching importance in regard to the future of the pearl-fisheries. "Many years may elapse before anything like complete knowledge can be acquired concerning the physiology of the pearl banks. The great question which compels attention at the present juncture is that of the forced production and preservation of pearl oysters as against their natural propagation when left to themselves. It is felt that something must be done, and, from the rather misleading analogy of the edible oysters, that something can be done. And this conviction is fortified by the fact that something is being done with the same species in Japan, although it is probably a distinct local race adapted to a different environment. It still remains to be seen whether interference with the natural sequence of events will prove useful or profitable under the very special conditions that prevail in the Gulf of Mannar. It is only within the last few years that any attempt has been made to fathom the mystery by the accumulation of facts."

THE question of utilising wind power in country districts is so important that special interest attaches to the collection of statistics showing the frequency of winds of given velocities. In the *Agricultural Journal of the Cape of Good Hope* (No. 3) Dr. Sutton gives such a table for East London, and compares it with a similar table previously drawn up for Kimberley. It appears that at East London the wind is commonly too strong for the ordinary type of windmill; there is a vast amount of energy in the winds of the south-east coast of South Africa awaiting exploitation, but the mechanical difficulties appear to be great.

A NUMBER of determinations of the amount of arsenic present in soil, plants, fruits, and animals are recorded in a paper by Dr. Headden in the Proceedings of the Colorado Scientific Society, vol. ix. In the virgin soils examined no fewer than 2·5 to 5 parts per million were found, whilst the subsoils contained even more, sometimes as much as 15 parts per million. Orchard soils where arsenical sprays have long been in use may contain 10 to 28 times these quantities, and yield appreciable amounts of arsenic compounds to water. Crops grown on these soils and fruits from the trees all contained arsenic, and it was also readily detected in the urine of three persons who had eaten quantities of these fruits.

THE United States Department of Agriculture has of late been carrying out careful investigations on food and nutrition. Bulletin 227 deals with calcium, magnesium, and phosphorus in food and nutrition. It appears that a healthy man accustomed to a full, mixed diet requires for maintenance of phosphorus equilibrium about 1·5 grams of phosphorus, or nearly 3·5 grams of phosphoric acid, per diem, and the organic combinations of phosphorus seem to be best adapted for the purpose. The calcium requirement is equivalent to about 0·7 gram of calcium oxide per diem. Reference is made to the value of milk in supplying these requirements. The work has been carried out by Prof. Sherman and Messrs. Mettler and Sinclair, of the Department of Chemistry, Columbia University, and full details are given of the analytical methods and of the metabolism experiments. Circular 102 gives a list of the bulletins, &c., dealing with the subject issued by the Department.

CAPT. M. PISCICELLI contributes a well-illustrated article on Lake Bangueolo to the October *Bollettino della Società Geografica Italiana*, in the form of a letter to the secretary, dated at Abercorn, May 1, 1910. The hydrographical conditions of this great complicated maze of water, marsh and islands are described, with notes on the natives and on the fauna of the region.

MR. ELLSWORTH HUNTINGTON continues his investigations on the lines of his fascinating "Pulse of Asia." In the September number of the Bulletin of the American Geographical Society he analyses the data collected by Mr. H. J. L. Beadnell respecting the Libyan oasis of Kharga, and claims that they indicate a succession of climatical changes during the last 2500 years that are in close agreement with the hypothetical "pulsations" of climate in eastern and central Asia during the same period.

THE Liverpool Geological Society may be congratulated on the opening number of the eleventh volume of its Proceedings, which contains a spirited address by Prof. J. W. Judd, F.R.S., on "The Triumph of Evolution: a Retrospect of Fifty Years." Prof. Judd has always brought his personal knowledge of the pioneers of geology to aid him in stimulating research in newer generations. He has systematically upheld the claims of Lyell as an original observer, and as one of the masters who paved the way for the general acceptance of evolution in the natural world. In the present address the relations of Lyell and Darwin, and the final "triumph of evolution" resulting from the work of Darwin and Wallace, are pointed out with vigour and characteristic clearness. This part of the Proceedings also contains papers that maintain the high standard set by the society in the explanation of local geological features.

THE scientific investigation of the German colonial possessions in Africa proceeds steadily, and in the *Mitteilungen aus den deutschen Schutzgebieten* results are being regularly published. The last number (Heft. 3, Band 23) contains five articles dealing with German South-West Africa. One deals especially with the Auin, a Bushman tribe of the Middle Kalahari Desert, which occupy a district in the eastern boundary of the territory on the border of Bechuanaland. Their habits and customs, weapons, modes of hunting, games, and other information relating to this small tribe, which are said to number some 3000, are described and illustrated. A map on a large scale attached to the same number shows the position to the south of Kilimanjaro which has been set aside as a reserved territory for those of the Masai tribe who are on the German side of the Anglo-German boundary line. The reserve contains some 2500 square miles, and lies to the west of the Pangani River.

THE results of the magnetic observations made at the Central Meteorological Observatory of Japan during 1907 appear, and are discussed, in part ii. of the annual report now published. The observatory is situated at an altitude

of 21 metres in long. 139° 45′ E., lat. 35° 41′ N., and was rebuilt in July, 1897, great care being taken to exclude magnetic ingredients from the materials employed. The present valuable report gives a brief description of the building and apparatus, and also describes the methods employed in registering the different variations of the magnets. A number of tables give the hourly values, for the whole year, of the three elements, with remarks as to the nature of the variations, indicating storms, &c. A "severe storm" was registered during the morning of February 10, 1907, the magnets having been agitated during the preceding three days. The principal disturbances are shown on fourteen large-scale charts given at the end of the report.

THE first part of vol. ii. of the Transactions of the Royal Society of South Africa includes a paper by Dr. A. W. Roberts on a preliminary determination of the absorption of light by the earth's atmosphere. The paper is a brief statement of a single determination of the coefficient of atmospheric absorption made on the summit of one of the hills of the Winterberg Range, of an altitude of about 4000 feet. More than 500 observations were made, and it was hoped at first that these observations would yield both the coefficient of absorption and the height of the atmosphere, but a variety of solutions confirmed Dr. Roberts in the view that a more refined series of observations would be necessary before any trustworthy value of the height of the atmosphere would emerge from the equations. Dr. Roberts obtained as a final value for the coefficient of atmospheric absorption at sea-level 0·19 m, where m is the apparent magnitude of a star. The mean of the results obtained by Seidel, Langley, Pritchard, Muller, and Pickering is 0·21 m. Taking 0·20 m as a mean result, Dr. Roberts points out that this signifies that 17 per cent. of all rays that strike the atmosphere perpendicularly are absorbed by the atmosphere. On the horizon the brightness of a star is reduced so that it shines with only about one-fortieth of its zenith brightness.

PROF. EDGAR BUCKINGHAM contributes to the Bulletin of the Bureau of Standards, vi., 3, a short note on the definition of an ideal gas, embodying a brief statement of the main principles of thermodynamics associated with the definition in question.

ON February 21, 1911, the well-known firm of publishers founded by Benedikt Gotthelf Teubner will celebrate its centenary. In this connection a catalogue has been issued of recent works published by Messrs. Teubner dealing with scientific subjects, which affords a striking example of the influence which private enterprise can bring into play in the advancement of learning. Moreover, the list only deals with a small portion of the Teubner publications, separate catalogues being issued for literary and other subjects.

IN the *Rendiconto* of the Naples Academy, 5, 6 (May and June), Dr. Paolo Rossi describes observations on the double refraction induced by strain in caoutchouc. The principal conclusions appear to be that the difference of the principal indices of refraction is proportional to the tension, that the results are pretty much the same for vulcanised and unvulcanised caoutchouc, and that when the elongation is maintained constant the double refraction maintains its proportionality to the tension, even though the latter gradually decreases.

THE action of light on plants forms the subject of a note in *La Nature* for October 20 by M. H. Rousset, dealing with some recent experiments by M. Combes. The author points out that the effects of light vary according to the age and nature of the plant, a strong light favouring the development of large stores of reserve material, as in the tubers of the potato and in the beet, while a weaker light favours the growth of vegetative organs. The effect of light on the ova of trout is studied by Prof. Felice Supino in the *Rendiconti del R. Istituto Lombardo*, whose experiences tend to show that blue light is more favourable to the hatching and development of the ova than red.

IN the *Rassegna contemporanea* for October (a journal which, by the way, has during the past few months contained a number of well-written articles dealing with English national movements), Signor Gino Cucchetti publishes an article dealing, as the author claims, with a suggestion by the geologist, Venturino Sabatini, according to which a remedy for the disastrous effects of earthquakes in Messina and southern Italy should be sought in an efficient scheme of afforestation. It is pointed out that the cutting down of trees in such districts may frequently result in a loosening of the subsoil, which is largely argillaceous or sandy in character, thus giving rise to faults and lessening the resistance to the effects of seismic disturbances. The cutting down of woods receives further mention in an article by the deputy Giovanni Posadi dealing with the preservation of natural beauties, while an article by Signor Arnoldo Faustini dealing with changes that have occurred on the earth's surface in recent times, with special reference to the subsidence of the island of Bogoslaw, in Alaska, possesses collateral interest in the same connection.

THE report on the work of the Government Laboratories, Johannesburg, for the year 1908–9, has recently reached us. Whilst pointing to excellent services in the past, it gives evidence of the need for further inquiry into and control over the food and water supply of the district. The total population of the colony is about one and a quarter millions, including 300,000 persons of European descent; but only 158 samples of foodstuffs other than milk were examined during the year. This, as the analyst remarks, is very inadequate surveillance. As regards the water supply, that of Johannesburg was well looked after both chemically and bacteriologically; and that of Pretoria, where excellent water is obtainable, was also examined, though by bacteriological methods alone. But spasmodic attempts only have been made to control the condition of any of the other supplies of the colony by scientific means, and no proper systematic water survey has yet been made. Among other matters, it is noted that out of a total of 8526 samples examined, more than three thousand, mostly rats, were dealt with in connection with plague investigations.

THE contradictory results which have been obtained as to the effect of a magnetic field on the potential difference necessary to cause a discharge to pass between two electrodes in a rarefied gas are explained in a paper by Prof. Righi communicated to the Academy of Science at Bologna in May, and reproduced in the October number of *Le Radium*. The electrodes were about 2 square cm. in area and from 0·5 to 8 mm. apart, the gas having a pressure of a few tenths of a mm. of mercury. The difference of potential was provided by small storage cells, and the current transmitted measured by a galvanometer. The magnetic field in which the discharge tube was placed could be raised to 9000 units. Prof. Righi finds that the effect of the field, for strengths up to about 1000 units, is to diminish the required potential, but for greater strengths to increase it, and in the case of trans-

verse fields of still greater intensities again to diminish it. He considers these results point to the existence in the gas of neutral doublets, each consisting of a positively charged ion with a negative electron as satellite.

In an offprint from the *Atti del Reale Istituto Veneto* for 1909–10 Drs. R. Alpago and G. Silva discuss hourly observations of magnetic declination and dissipation of electric charge which they made at Padua on May 14–21. The magnetic observations agree with the more complete results from magnetographs in various parts of Europe in showing a small disturbance on the morning of May 19 about the time of the supposed passage of the earth through the tail of Halley's comet. But the coincidence might well be accidental, as magnetic conditions were disturbed for several days before and after. Electrical dissipation on May 19 was in no way outstanding. A very unusual feature throughout the observations is the absence of any decided difference between the rates of loss of positive and negative charges. For both the mean percentage loss observed per minute was 3·5, which is exceptionally high for the Elster and Geitel apparatus employed. There was a well-marked diurnal variation, again nearly the same for positive and negative charges. It showed a double oscillation. The two maxima, about 1.30 a.m. and 4 p.m., respectively, were not far from equal, and were more than double the principal minimum, which occurred about 8 a.m.

An illustrated catalogue of optical lanterns and accessory apparatus, and of an extensive series of lantern-slides to illustrate scientific and educational subjects, has been issued by Messrs. Reynolds and Branson, Ltd., of Leeds. Many of the slides may be hired as well as purchased. The catalogue shows that this firm has some 10,000 slides for sale or hire, and a list of 30,000 slides for sale only will be sent on application. In addition to slides illustrating most branches of science, we notice in the catalogue particulars of a very complete series of slides to illustrate school lessons in geography.

Messrs. W. and J. George, Ltd., of Birmingham, are issuing their latest illustrated catalogue of scientific apparatus in sections, each dealing with a specific group of science subjects. We have received sections 1–4 bound in one volume and sections 5–7 in a second. Copies of the catalogue will be sent on application to teachers and lecturers in charge of laboratories, and to other purchasers of apparatus. The lists are profusely illustrated, and so arranged that reference is easy. The information provided is thoroughly practical, and will assist the teacher greatly in the choice of instruments.

Mr. W. H. Harling, Finsbury Pavement, London, is issuing in parts the fourteenth edition of his catalogue of mathematical drawing instruments and materials. Section A, forming the first part of the full list, has reached us, and gives particulars of the drawing pens, half sets of compasses, bow compasses, spring bows, and proportional, beam, and pencil compasses which are manufactured by this firm. We have also received from Mr. Harling a specimen of the set-square guide he has just produced. It is a simple contrivance in pearwood for guiding a set-square from any edge of a drawing board or sketch block. The guide should be convenient for rapid field sketch work and useful for section lining and cross-hatching. The price of the guide is 1*s.* 6*d.*

The report of the council of the Natural History Society of Northumberland, Durham, and Newcastle-upon-Tyne for 1909–10 shows that the membership has suffered a net loss of eighteen during the year, having fallen to 395. The society's work, especially in connection with the maintenance of its museum, has been helped greatly by the Crawhall bequest of 6000*l.*, which has been so invested that it yields an annual income of 200*l.* Without this timely aid the position of the society would be serious, and it is difficult to see how some such exceptional source of income could have been dispensed with, for in some respects the society is not so flourishing as the council wishes to see it. An issue of the Transactions of the society has been published during the year, and the concluding part of the third volume of the new series is nearly ready. The usual series of winter lectures and summer field meetings have been held. The average attendance at the evening lectures was 85, at the children's lectures 164, and at the curator's "talks" 53.

OUR ASTRONOMICAL COLUMN.

Recent Fireballs.—There was a brilliant meteor seen on Sunday, November 20, by Mr. and Mrs. Wilson, of Cheshunt, Herts, and by Mr. C. B. Pennington, of Newark. It passed over the North Sea east of Spurn Head at heights of from 73 to 33 miles. Its motion was exceedingly slow, being about 12 miles per second.

On Friday, November 25, about 7.30, a fine meteor was seen at Weston-super-Mare by Mr. J. Hicks. He was using a telescope at the moment, but a bright light caused him to look upwards, when he saw a fireball travelling in the direction from Saturn to two degrees above Altair. Near the end of its luminous flight it broke up into a string of fragments like first-magnitude stars, and went some distance farther. The same meteor was seen at Bristol travelling from between Saturn and α Arietis through the stars of Pegasus. It threw off a brilliant train of yellow sparks, and the nucleus distributed itself into a stream of particles at the end. The height of the object seems to have been from 88 to 41 miles from Portland Bill to Launceston, and its path about 93 miles at a velocity of 23 miles per second. The radiant was at about 64°+21°. Another but smaller Taurid was observed on November 25 at 6.52 at normal heights above Somerset, and it moved with great slowness, the speed being about 14 miles per second.

During the progress of the eclipse on November 16, at about 12h. 24m., a splendid meteor was observed from Ireland and Scotland. It had a long and rapid flight, and left a bright streak for several minutes. According to an observer near Glasgow, the meteor was apparently as large as the moon. The descriptions prove that this fireball was a late Leonid. It passed from over a point a few miles west of Glasgow to over the sea north of the Irish coast in a direction almost east to west. The heights were about 89 to 48 miles, and the length of path 145 miles.

Saturn's Rings.—Circular No. 129 from the Kiel Centralstelle contains a telegram from M. Jonckheere, of the Hem Observatory, stating that, on several evenings, he has observed a nebulous degradation of the exterior edge of the Saturnian ring A.

Cerulli's Comet (1910*e*) identified with Faye's Short-period Comet.—In a communication to the *Astronomische Nachrichten* (No. 4456) Prof. Pickering gives the elements, and an ephemeris, calculated by Mr. Meyer Lewy, for Cerulli's comet, and points out the probable identity of this object and Faye's periodical comet; such identity was also suggested by Prof. Berberich.

Dr. Ebell, having investigated the subject, finds that the observed place on November 12 differs from the calculated place of Faye's comet by only −4*s.*, −4·1′, whilst the present apparition is the most favourable and brightest since the object was discovered by Faye, at Paris, in November, 1843; he considers the identity is assured. A later telegram Prof. Pickering gives improved elements and ephemeris by Mr. Lewy, and states that the identity with Faye's comet is confirmed.

Faye's comet has a period of 7·44 years, and was re-

discovered in 1850, 1858, 1866, 1873, 1880, 1888, and 1895, although it was missed in 1903. Its orbital eccentricity is exceptionally small, and its perihelion distance (1·7) great. It is also remarkable as being the first comet of which the periodicity was determined, by Goldschmidt, directly, by calculation, without comparison with the elements of earlier comets.

A number of observations are also published, the magnitude being generally estimated as about 10. Dr. Schiller recorded it at Bothkamp on November 10 as diffused, having a suspicion of a tail, in p.a. 300°, and a granulated nucleus of magnitude 9·8. Dr. Ristenpart, on November 11, saw no tail, but an eleventh-magnitude round nebulosity of 1′ diameter with a central condensation. Dr. Cerulli announces that he discovered the comet on a plate taken on November 8.

A SYSTEM OF STANDARD WAVE-LENGTHS.—No. 3, vol. xxxii., of the *Astrophysical Journal* contains a list of forty-nine secondary standard wave-lengths published under the auspices of the International Union for Solar Research. The increased accuracy of modern research necessitated the measurement and adoption of a standard system, and to this end three independent observers were asked to determine the wave-lengths of the forty-nine iron lines now published. From the results secured for each line a mean value has been adopted, and will in future be used in solar work; the wave-lengths range from λ 4282·408 to λ 6494·993, and wave-lengths measured in this system should be designated in future by using the symbol "I.A." The primary standard is the wave-length of the red cadmium line adopted at a previous conference.

In the same journal Prof. Kayser publishes standards of third order of wave-length on the international system, determined from the arc spectrum of iron between λλ 4118 and 6494; he intends extending the measurements to λ 7900. He finds that some of the secondary standards still contain errors of from 0·004 to 0·005 A. A comparison with Rowland's wave-lengths of the solar spectrum gives differences varying irregularly between 0·15 and 0·22 Å., but by subtracting about 0·19 A. from Rowland all measurements can be reduced to the international system with sufficient accuracy. Prof. Kayser tabulates about 370 wave-lengths, and gives the intensity, the probable error, and the respective differences from Rowland and the observers who made the measurements for the secondary standards, viz. Fabry and Buisson, Eversheim, and Pfund.

THE RADIAL VELOCITY OF SIRIUS.—A most exhaustive discussion of the radial velocity of Sirius is published by Herr W. Münch in No. 4455 of the *Astronomische Nachrichten*. Herr Münch measured a large number of plates taken at Potsdam during the period 1901–10, and his thorough discussion takes up the whole of a double number of the journal. It includes, *inter alia*, the errors introduced by the measuring screw, by the different widths of the measured lines, by the possible uncertainty as to the purity and wave-lengths of some of the lines, &c. Besides several lines of yet unknown origin, he finds in the spectrum of Sirius those due to Cr, Fe, H, Mg, Ni, Sc, Ti, V, Y, and Zr, and, possibly, La and Mn.

For the mean velocity of the centre of the Sirian system referred to the sun he tabulates a series of seventeen values ranging from −8·0 (March 17, 1907) to −14·1 (April 4, 1906), the mean value being −10·3 km., with a mean probable error of ±0·4 km. Omitting the observations of 1906 and 1908, which gave abnormally large values, the mean radial velocity becomes −9·8 km., with a mean probable error of ±0·3 km.

"ANNUAIRE DU BUREAU DES LONGITUDES, 1911."—The *Annuaire* for 1911 published by the Bureau des Longitudes contains the usual astronomical tables, ephemerides, &c., and also tables relative to metrology, moneys, geography, meteorology, and statistics; this year the tables of chemical and physical data are omitted, as also are matters referring to the sundial, solar physics, and the minor planets.

The special articles, four in number, are very interesting; the first deals with the sixteenth conference of the International Geodetic Association, which was held in London, and in the second M. Bigourdan publishes a great deal of interesting information concerning the total eclipse of the sun which will take place on April 17, 1912, and will be visible in France for a few seconds.

MAGNITUDE OF NOVA SAGITTARII, No. 2.—A telegram from Dr. Ristenpart, Santiago, announces that on November 7 the magnitude of Nova Sagittarii (96.1910) was 9·9 (*Astronomische Nachrichten*, No. 4456).

AGRICULTURAL RESEARCH IN JAPAN.[1]

THE Japanese have entered the field of agricultural investigation with characteristic energy and thoroughness, and have shown a lively appreciation of the fact, not always realised elsewhere, that the principles underlying an agricultural problem must first be studied before the problem itself can be solved. Some of the special features of Japanese agriculture present highly important problems, the development of which will be awaited with much interest.

The present volume of the Journal of the College of Agriculture contains, in the two parts already published, four papers, of which three deal with silkworm problems. Mr. K. Toyama reports studies on the red worms occasionally appearing among the progeny of the normal black worms, and hitherto regarded in a general way as sports. In 1905 he obtained some red worms, and studied their behaviour on crossing. The results showed that the phenomena are really Mendelian, black being dominant over red; the red worms uniformly yielded red offspring, while the matings of the blacks resulted in the production of one red to three blacks. Prof. C. Sasaki deals with jaundice of the silkworm, a disease prevalent in all silkworm countries, and frequently found in Japan. The worms lose their appetite, weaken, and finally die; the skin loses its firmness and becomes soft and weak, while polyhedral bodies appear in the blood and various tissues. Evidence is adduced that the disease is caused by a streptothrix found in the blood of affected worms. The polyhedral bodies may, however, arise from other causes such as a small dose of formalin, interruption of respiration, or attacks of maggots, and are probably to be ascribed to the degeneration of the contents of the nucleus. The same author has also solved an interesting problem that has hitherto been overlooked. Silk fishing lines, commonly known as "Tegusu," are largely employed by the Japanese fishermen, but no one has up to the present found out any more about their origin than that they are imported from southern China. The Chinese writers say that some wild silkworms found in Yōkō on the leaves of camphor trees and Foushu (*Liquidambar formosana*) are the source. In April, when the worms are mature, they are dipped in vinegar, and then filaments 7 or 8 feet long and golden-yellow in colour are taken from their bodies. Prof. Sasaki made a journey in southern China, found the worm, and determined it as the larva of *Saturnia pyretorum*, Westwood. He has also introduced it into Formosa.

Mr. S. Kusano has a paper on chemotactic and similar reactions of the swarm spores of myxomycetes, Æthalium, Stemonitis and Comatricha being investigated. In general, these organisms feed mostly on rotten wood or leaves, and there is evidence that they can digest bacteria. It appears also that they can themselves be devoured by infusoria. Wood attacked by them was found to be acid. The swarm spores showed marked chemotaxis, being attracted by acids, repelled by alkalis, and unaffected by neutral, non-poisonous substances. A consideration of the phenomena from the dissociation hypothesis indicates that the H- and OH-ions are in all cases the stimulating components, the OH being much the more effective, and active even at a dilution of N/10,000. The attraction of the H-ion reaches a maximum at N/600; in higher concentration the acid repels and injures the organism. H-ions act beneficially in several ways; they promote germination of the spores, and then attract them to the place where food material occurs. An interesting physiological point was noticed. The spores germinate much more readily in contact with moist air than when thrown on to water; in the latter case they do not appear to be wetted very quickly.

[1] Journal of the College of Agriculture, Imperial University of Tokyo, vol. ii., Nos. 1 and 2.

STOCKHOLM TO SPITSBERGEN: THE GEOLOGISTS' PILGRIMAGE.

WE geologists who were privileged to take part in the journey to Spitsbergen before the meeting of the Geological Congress in Stockholm had good reason to count ourselves fortunate. Perfect weather, genial companionship, comfortable surroundings, admirable organisation and guidance, and a route through the strongholds of Thor of the Hammer, in which intense scientific interest was constantly united with entrancing beauty of scene—surely the combination would have roused enthusiasm among much more stolid folk than the impressionable race of hammerers!

We started by special train from Stockholm, about seventy strong, an agglomerate of fifteen nationalities, on the evening of July 25, and at once left behind us the broken weather that has encircled Western Europe this summer, entering a northern region of brightness and calm in which we continued until our return. Those of us who were in Stockholm the previous day had been called together to see a fine exhibition illustrative of Spitsbergen geology, temporarily shown in rooms attached to the museum of the Swedish Geological Survey, and to hear lucid demonstrations on the exhibits by Prof. A. G. Nathorst and by the Director of our excursion, Prof. G. De Geer. Here we had already an opportunity to begin or to renew friendships that were cemented during the journey. Owing to the care and forethought with which every detail of the expedition had been planned, our start was made promptly, and we settled without confusion into our allotted places.

The night's train journey brought us to Ragunda in Ångermanland, where our first halt was made. During four hours of the morning we visited sections splendidly illustrating the evidence from which Prof. De Geer has worked out the chronology of post-Glacial time in Sweden. By a catastrophe in 1795, the great lake of Ragunda was suddenly drained and its bed laid bare; and the ravines subsequently eroded through its sediments now reveal the whole succession deposited since the melting of the Glacial ice-sheet. In these sediments Prof. De Geer recognises and counts the annual bands of the "seasonal clays," much as one may count the annual bands in a tree trunk. By the extension of the same method over various other parts of the country, he has attained results by which the recession of the ice-sheet and all its incidents may be actually dated, as he showed us later in field demonstrations near Stockholm during the sitting of the congress.

Northward again for the rest of the day and through a night of twilight, during which the Arctic circle was crossed, our train brought us to breakfast on July 27 at the bright town of Kiruna, which has newly sprung up in the Lapland wilderness under the famous mountain of iron ore. Here we remained until the afternoon, visiting the great iron quarries under the guidance of Director Hj. Lundbohm, who instructed us by a preliminary address in the geology of the district and the history of its rapid development. After a banquet to which we were invited by the mining company we took train again at 4 p.m., and ran shortly into view of the beautiful Lake Torneträsk, in a region of powerful overthrust faults and of Glacial lake-shores. Making several short halts in this wild country to examine points of especial interest within easy reach of the railway, under the guidance of Dr. O. Sjögren, we reached Abisko in the evening. Here our train remained for the night, affording us opportunity to appreciate the picturesque surroundings of Abiskojokk, now a much visited tourist resort.

On the morning of July 28 the Norwegian frontier was reached at 11 a.m. Thereafter followed a marvellous descent to the coast, along the rim of a great fiord the blue waters of which shone gloriously in the depths below us. At Narvik, our port of embarkation, we were shown the methods of treating the iron ore from Kiruna and the facilities afforded for its shipment, being thereby still further impressed with the enterprise which has been shown in the development of this great Swedish mining industry.

Our ship was the *Æolus*, Captain S. de Klinteberg, a comfortable Stockholm passenger boat of 870 tons register. Sailing from Narvik at 5 p.m., we were held up for a few hours of the night by fog in the narrow passages leading northward from the Ofoten Fiord; but this was our only delay in the charming voyage to Tromsö, which was reached next evening.

There had been rumours of unusual ice conditions in the Spitsbergen seas before we left Stockholm, and at Tromsö these rumours were partly confirmed. Our Director, therefore, learning that a French ship was due to arrive next day from the north, decided to await her coming in order to gain definite information. So we spent a calm, sunny day pleasantly at Tromsö, first visiting the museum with its excellent collection of Arctic animals and birds, and afterwards crossing to the mainland to see the Lapp summer camp or to climb the nearer mountains. Meantime the *Ile de France* had arrived, and reported that while floe-ice from Barents Sea had drifted in quantity round the south and south-west coast of Spitsbergen, the inner fiords of the island were free, so that the only difficulty was to obtain access to them, for which purpose it might be necessary to go far to the westward. With this intelligence we steamed ahead again on the evening of July 30.

As we passed northward in the shadow of the fiords a red glow of wonderful brilliancy shone on all the higher peaks and glaciers, and never faded; until, at midnight, as we passed out into the open ocean under the majestic Fugle Rock, we saw the disc of the sun just cut by the sea-line; from which it rose with seeming effort, like a heavy seabird, as night grew into morning. It was thus that most of us gained the midnight sun for the first time, not to lose it again until our approach to Norway in returning.

During the last day of July we pounded northward under a cloudy sky, with a touch of ice in the air; but in the evening we ran into sunshine again, and there, ahead of us, lay Bear Island miraged on the horizon. This was indeed good fortune, for in his eleven previous voyages past the island our Director had seen it only twice, so frequent are fogs in these seas. Our course was altered that we might run in under its eastern face. The placid sea around us was furrowed by its myriad sea-fowl, and from 11 p.m. until 2 a.m. we coasted its lonely cliffs and sea-stacks closely enough to distinguish the main features of their geological structure, and to catch glimpses of its desolate interior with all features accentuated by the light and shade of the low sun.

In its stratigraphy Bear Island is akin to Spitsbergen, though with a more restricted range of formations. To all geologists these far northern islands are of great interest, but peculiarly so to the geologists of Scandinavia, inasmuch as they contain a great sequence of the later Palæozoic, Mesozoic, and Tertiary sediments which are lacking within the Scandinavian 'shield.' To the Swedish explorers, and especially to Prof. J. G. Andersson, we owe most of our knowledge of the geology of Bear Island. At its southern extremity is a ridge of crushed and altered 'Heklahoek' rocks, which include fossiliferous Lower Silurian limestones. The rest of the land is built up of Devonian, Carboniferous, and marine Triassic strata, all in some parts very fossiliferous, and with coal seams in the Devonian. The sequence is interrupted by strong unconformities and broken by faults, some of which we could see plainly from our steamer.

Now it became difficult to chop up the Arctic day into conventional night and morning, and we counted by events—particularly by meal-times, for we were a hungry crew—rather than by the clock. Not many hours after sinking Bear Island in the southward, on August 1, we began to meet floe-ice; which soon thickened, so that we had to slow down and eventually to turn southward and westward for more open water. Again and again during the day was this experience repeated, a chilly ice-blink always paling the hazy sky to the north and east as we threaded our zigzag course amid the floes, on which inquisitive seals shifted uneasily, doubtful whether to regard us as dangerous or not. Usually at this season the voyage to Spitsbergen lies entirely in open water; but most of us were glad of the chance which gave us this touch of the true Arctic colour. Still, to the anxious captain of our ship the prospect must have been decidedly less enjoyable. Thus we steamed cautiously all day and all night among the floes or along the broad water-lanes between the great white streaks drawn out by the north-flowing

current, until we had been shouldered off 70 or 80 miles to the westward of Spitsbergen. On August 2, however, we got an easterly course, picking our way across the ice-streams where they were thinnest, and by evening the lead showed that we were approaching land. So we lay to, in a light haze, to await clear weather.

Soon, very gently, the haze thinned away; the northern sun shimmered again over the smooth olive sea, burnishing the floes into silver; and then, gradually, an exquisite panorama of peaks and glaciers was unveiled in front of us, lengthening northward and southward into a far perspective, and we knew that this was Spits-bergen, and worthy of its name. Due north of us rose the angular ridges of Prince Charles Foreland, and right ahead lay the gap of our haven, Ice Fiord; so we moved quietly forward, through a scene of dreamy splendour, to our anchorage after midnight in Safe Bay. Surely never was there a more impressive revelation of this silent land!

From this time onward our days were busy days, thronged with scientific interests and impressions that shifted all too rapidly. Within the great Ice Fiord, which runs for 60 miles eastward, crossing the strike of the rocks and almost bisecting the island, we found open water, and our ship was able to pass into all its branches without impediment. During the ensuing week we penetrated most of its recesses, landing at the best points for investigating its several formations, and gaining a clear idea of their structures from the barren craggy outcrops that rose high above all the waterways. (See Fig. 1.)

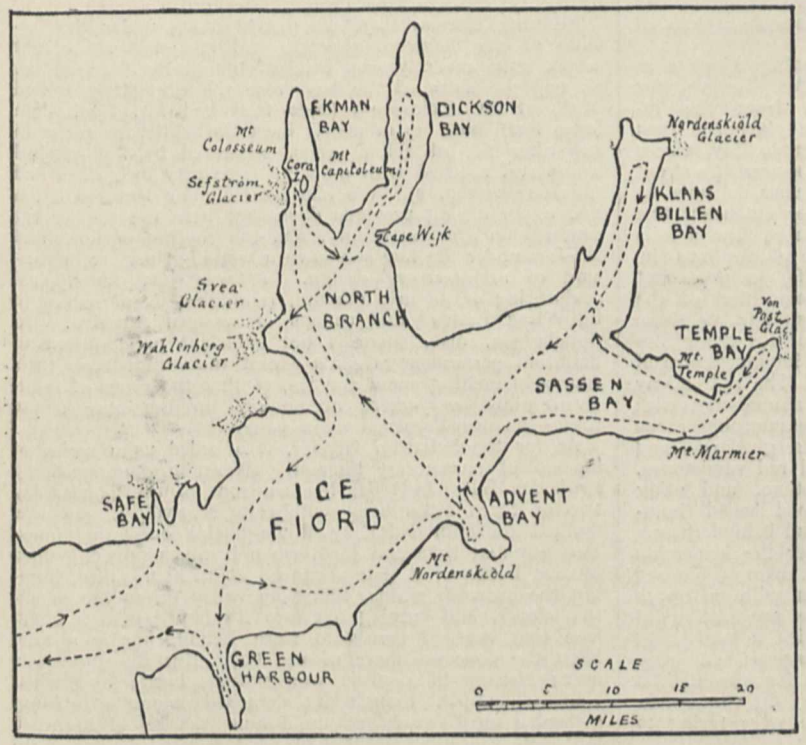

FIG. 1.—Index-map of Ice Fiord, Spitsbergen. The course of the ss. *Æolus* is shown approximate'y by the dotted line.

Though complex in detail, the geology of central Spitsbergen is simple in its main outlines. Earth-movements of intensity, repeated at intervals down to Tertiary times, have ridged up the western margin of the island, bringing to light the oldest rocks and crumpling them along with the newer formations. These earth-waves, with their faults, folds and overthrusts, subside eastward, leaving a high plateau of regular stratigraphy and gentle dips, which is sharply trenched by the branching fiord and its tributary valleys. On the north side of the fiord most of the valleys contain glaciers which reach the sea; but on the south side, owing to difference of aspect and other causes, the land-valleys are often empty nearly to their heads. The high jagged outer ridge, at the entrance to Ice Fiord, consists of crumpled Heklahoek rocks, succeeded eastward in the next ridges by sharply folded and broken Carboniferous strata. But in the interior, the long northern branches of the fiord reveal a great mass of red Devonian rocks, very similar to our British Devonian, upon which the Carboniferous strata rest with strong unconformity and overlap. In upward succession, the Carboniferous limestones and cherts are followed by a belt of sandstones and shales, to which, on the somewhat scanty fossil evidence, a Permian age is assigned; and above these come the Triassic strata, chiefly shales or clays, with thin limestones, sandstones, and phosphate-bands, often rich in well-preserved marine fossils. The outcrops of the three last-mentioned formations are narrowed to strips in the outer folded belt, but expand into wide tracts around the interior fiord. Then follow thick masses of the Jurassic and Tertiary sediments, for the most part gently dipping and in apparent, but unreal, conformity, which build up the high picturesque plateaus on the south side of the inner fiord. These consist mainly of sandstones and shales of fresh-water or estuarine origin, but with occasional bands containing marine fossils. Both formations yield abundant well-developed plant-remains, in striking contrast with the present diminutive Arctic flora; and both include coal-seams, at least one of which, in the Tertiary rocks, is likely to be of economic consequence.

To resume the recital of our doings in this land. We were astir early on the morning of August 3, anxious to take our first steps in Spitsbergen, and before breakfast many of us were ashore among the mixture of rocks, moraines, glaciers and raised beaches that forms the west shore of Safe Bay. Leaving this anchorage at breakfast time, our ship went east across Ice Fiord and ran close in under the bold precipices of Jurassic and Tertiary rocks bounding the plateau around Mount Nordenskiöld, until Advent Bay was reached, before noon. This has recently become a place of permanent habitation—the only one in the ownerless land. Most of us were surprised at the display of engineering activity in such a remote corner, brought about by American enterprise in the development of a mine in the Tertiary coal. A shipping wharf has been erected, to which the coal is brought from the mine high up on the hill-side by skips travelling overhead on a cable. At the mine, which we visited later, a seam of good quality, 4 feet thick, is worked by means of an adit. It was singular to see the walls of the workings all thickly encrusted with a sparkling layer of hoar-frost from the condensation of moisture on rock-surfaces that are permanently below freezing point. A pure white coal-mine!

For the afternoon in Advent Bay we divided into two parties. Those who wished to study the Jurassic plant-beds crossed with the ship to the north-east side of the inlet under the guidance of our Director. The rest of us landed at the wharf and went inland towards Mt. Nordenskiöld, led by Mr. B. Högbom, who had been already for some weeks in the island on geological work under Prof. De Geer's instructions, and who here awaited us. With him we went to the glacier-filled head of the valley south of the coal-mine and ascended the plateau on the westward to an upper moraine where Tertiary plant-fossils occurred in profusion. On this moraine, at an elevation of about 1500 feet, most of us were content to stay, basking in the sunshine and enjoying the glorious view over fiords, plateaus, and snow-fields; but certain of the more energetic elder members of our party continued upward

over the snow to the very summit of Mt. Nordenskiöld (3460 feet), not reaching Advent Bay again until near midnight. The plateau which we traversed in returning to the ship was tesselated in places with fine examples of the singular "gardens" due to soil-creep—round or polygonal patches of clayey soil, up to 15 feet in diameter, bordered by slabs of stone, often on edge—which are remarkable in the Spitsbergen tundras at all levels, as in those of other Arctic lands.

Leaving Advent Bay at noon on August 4, our course was shaped eastward under the cliffs to Sassen Bay, where we made a short landing near Mt. Marmier to collect the abundant Triassic fossils and to examine the diabase which is here intruded conspicuously in sheets among the sediments. It was instructive to see how the shaly Trias, very like our Lias in composition, was creeping down the slopes in big partly frozen mud-flows, mixed with ice and with blocks of diabase, providing a mass ready to be worked up by any advancing glacier into the semblance of our darker boulder-clays. This, indeed, is the particular value of the Spitsbergen phenomena to the English glacialist, that the country rocks are analogous in structure and texture to those of England, and are rarely of the hard type prevalent in nearly all other accessible regions of present-day glaciation.

Crossing Sassen Bay, we landed our palæontologists at Cape Bjona, under the fluted cliffs of Mt. Temple, for the collection of Carboniferous fossils from the inexhaustible stores of the limestones. The glacialists then went on with the ship to the head of Temple Bay, where the Von Post Glacier comes down to the sea with a front of ice-cliffs three miles broad. This glacier is now in retreat, and lateral moraines of its former extension line the fiord on both sides for a distance of more than a mile from the present front. Ice-falls from the glacier into the sea cause waves that have carved out cliffs 30 or 40 feet high in places, clearly revealing the composition of the moraines. These cliffs were strikingly similar to those of some English boulder-clays; indeed, but for the gleam of the neighbouring ice, one might have imagined oneself under a sea-cliff of north-east Yorkshire. The red loamy clay of the sections was studded, not too abundantly, with well-striated boulders of igneous and metamorphic rocks (from some unknown source beneath the glacier) along with others, more numerous, of grey and red sandstones, conglomerate, chert, Carboniferous limestone, and other sedimentary rocks. Both moraines formed broad hummocky ridges, with troughs of lower ground behind them.

A party of five German explorers, under the leadership of Lieut. W. Filchner, who were intent upon a journey into the interior of Spitsbergen, had been with us up to this point, interesting us greatly by the preparation of their outfit during the voyage. Now, with a heartening cheer, we left them to begin their adventures, our ship returning in the quiet evening sunlight for the night's anchorage at Bjona Harbour, where the impatient palæontologists hungrily declared that we were trying to starve them into glacialism!

Next day we coasted eastward to Klaas Billen Bay, and then northward up this deep inlet nearly to its head. A new phase in the stratigraphy of the island was here most instructively displayed in its bare brightly tinted slopes. Red Devonian strata rose up in strong force on its western side until unconformably overlain by the "Culm," which is believed to be of Lower Carboniferous age, while the limestones and cherts of the Upper Carboniferous rested in still bolder unconformity on both. A great fault cuts out the Devonian at the head of the bay; and east of it the Carboniferous rocks are known to rest directly upon bosses of an ancient complex group assigned to the Archæan, which we had not time to reach. Under the instruction of our leader these complicated features were made plain to us from the ship, and we realised how great was our advantage in gaining so comfortably in an hour the knowledge that would have cost many laborious days to gather without such guidance. Most of the day was spent on shore at the western side of the fiord; then, after a late dinner on the ship, we went to land again at 10 p.m. on the eastern arm, for a midnight stroll to the Nordenskiöld Glacier, which breaks off with a sea-front of three miles in water reaching nearly 500 feet in depth. Under an overcast sky, which intensified the cold blueness of the ice, we crossed the tesselated tundra with its shelly terraces of raised beach to the southern moraine of the glacier, and saw how the grey shelly mud had been incorporated with the moraine. This was our coldest night, with no sun; but we were fortified by a camp-fire on the beach, and hot coffee, before returning to the *Æolus* at 2 a.m.

An incident of navigation had rendered it necessary that our ship should return to Advent Bay for a further supply of coal, so now she went southward across Ice Fiord to the coaling wharf, and lay there during August 6. Here, for the day, our party broke up into independent groups, some climbing the high plateaus, others going up the coal-mine valley to the glaciers, and the palæontologists working assiduously along the Jurassic and Tertiary outcrops on the slopes above the bay. Next morning we left Advent Bay again for the North Branch of Ice Fiord, passing from cloud and breeze into bright still sunlight, with that local incidence of weather which appears to be characteristic of Spitsbergen, for all day we could see the cloud-banks pouring in like great glaciers from the ocean and welling up against the southern shore of the fiord.

Entering Ekman Bay, we passed along under the ice-cliffs of the Sefström Glacier, and anchored at a spot which quite recently was beneath the glacier. Above us, on opposite sides of the bay, rose the exquisitely fretted edges of Mt. Colosseum (1960 feet) and Mt. Capitolium (2790 feet), built up of nearly level Carboniferous rocks in tier after tier of belted crags, separated by high-pitched slopes and notched with amazing regularity by gullies and talus-cones (Fig. 2). We had seen similar features again and again during previous days, but here the sculpturing attained its greatest beauty, and the rhythm of light and shadow under the low sun gave a well-nigh perfect impression of architectural design. It was just the typical sculpturing of an arid climate, reminding us of scenes in the 'Bad Lands' and cañons of western America. In Spitsbergen, also, there is not sufficient precipitation to maintain permanent streams except those that have their source in melting snow and ice, so that the cones of frost-riven talus everywhere accumulate on the bare slopes above the over-deepened main valleys.

As for the Sefström Glacier, it afforded us a series of lessons of surpassing interest. When first mapped by Prof. De Geer in 1882, the sea-front of this glacier lay two or three miles back within its side-valley, and was flanked on both sides by fluvio-glacial outwash plains. Between that time and 1896, when it was again examined by our Director, it had advanced about four miles, burying the outwash plains, filling its valley up to the mountain slopes, and bulging out into Ekman Bay in a broad lobe that reached across to Cora Island, hardly a mile from the opposite shore of the bay. But its spurt was over; already in 1896 it was sinking back; and when visited in 1908, though its detached snout still hung grounded on Cora Island amid huge masses of morainic material, the main front had so far receded that there was again a sea-passage between it and the island, and a narrow strait, with ice-cliffs to right and left, between the new front and the detached portion affixed to the island. Since then there has been further recession, so that we found a wider passage; but a remnant of the melting snout still shone up conspicuously amid the red moraine on Cora Island.

We spent most of the day on the island, and I know that there was at least one glacialist of the party who felt that the time of the whole journey would have been well spent for the sake of this day alone! In its original condition Cora Island was a low spit about two miles long and half a mile or more wide, composed of Carboniferous limestone partly covered with raised beach; but it has been increased to more than twice its size by the moraine banked upon its western side during its invasion by the glacier. This moraine, which for the greater part must have been actually under the ice at its maximum, has been thrown in a tumultuous succession of ridges and hollows across the flank of the island, forming a curved belt about three miles long, nearly half a mile wide at its broadest, rising in places to 50 or 60 feet above sea-level, and ending sharply, where it touches the original island,

against the lower bare ground, with hardly any 'outwash' (see Fig. 3). It consists almost entirely of streaky red clay containing a few scratched boulders, and crowded with marine shells, some broken, but mostly perfect and the bivalves united. The clay has evidently been derived in the first place from the red Devonian rocks into which the fiord is cut; but its more immediate origin was the neighbouring sea-bottom, which has undoubtedly been dragged up in some way by the glacier in its advance. The existing remnant of the glacier was seen to be curiously entangled among the clay; and the presence of smaller masses of ice buried under the moraine was indicated by the crater-like hollows of subsidence by which its surface was pitted.

But the story of Cora Island is too long for our space—we must leave it regretfully, in the same mood that we left it on the late evening of August 7, to hasten back to our ship. On August 8 the *Æolus* carefully threaded the different temperament; the Svea, smooth, worn, and retiring; the Wahlenberg, known to have been recently aroused into activity, and jagged, fissured, and tumbling in the rapidity of its advance. On this coast, also, our Director pointed out to us the crumpled structure of the rocky ridges separating the glacier-basins—huge wrinkles on the fringe of the western belt of disturbance. Crossing Ice Fiord once more, we found anchorage for the night in Green Bay, but not too near the malodorous whaling station, where the carcases of a dozen unshapely monsters awaited dismemberment.

On the morning of August 8 we landed on the west shore of Green Bay, and went inland up a transverse valley which cuts the mountainous ridge and very clearly reveals its structure—a steeply dipping succession of Carboniferous, Permian and Trias, with Jurassic on the shores of the bay, and Tertiary, comparatively undisturbed, above the eastern side. Mist, with a splutter of rain, hung around

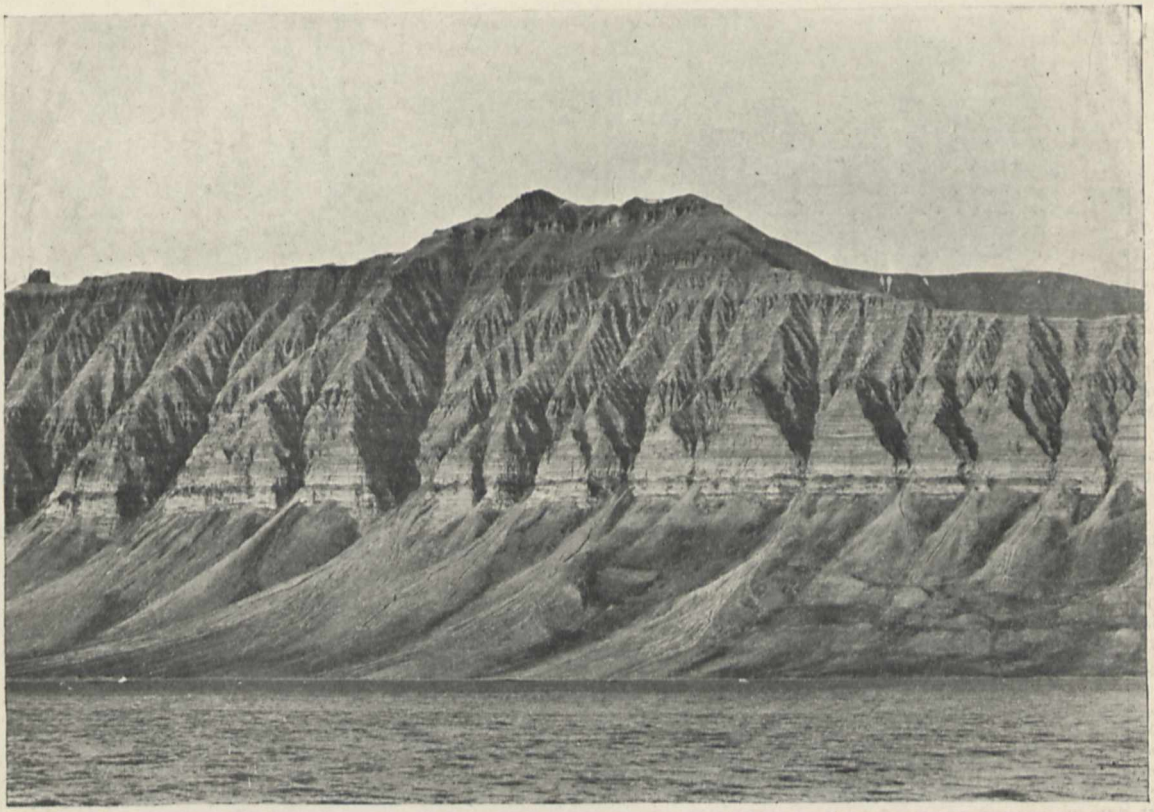

Photo. by Oscar Halldin, Stockholm. [*Reproduced by kind permission of Prof. G. de Geer.*

FIG. 2.—Mount Capitolium (2790 feet), Ekman Bay. Carboniferous rocks (with underlying Devonian concealed by talus), showing fretted form developed by weathering.

inner recesses of Dickson Bay, where her farthest north, 78° 50′, was reached, and where the glowing redness of the Devonian rocks—in the distance like heather in bloom—gave warmth to the Arctic wilderness. Many of us, however, chose the alternative of a landing under Cape Wijk, at the entrance to the fiord, and a long climb up the shaly slopes of Permian and richly fossiliferous Trias to the plateau at about 2000 feet, formed by an intrusive sill of diabase. There, in bright sunshine, we gained a view from which not all the promised reptiles of the Trias could drag us—fiords, glaciers, and valley-trenches everywhere around; away in the north-east, snowfields and peaks above the head of Wijde Bay; and our ship a speck on the blue floor of the nearer recess. Nevertheless, it would be a desolate land to be alone in with no such speck!

That same evening, in going southward, we steamed close in under the ice-cliffs of the Svea and Wahlenberg glaciers—contiguous neighbours, but at present of very

the peaks all day, but the valley was dry. Later, a flying visit was made to the whaling station by those who could face the ordeal; and in this manner was our programme for Ice Fiord brought to its appointed end. As our ship swung westward into the floes at the mouth of the fiord the evening sunlight glittered on the land, just as it had done at our approaching; so it chanced that our last view of Spitsbergen was like our first.

It had been planned that we should visit Hornsund next day in returning southward. But the ice-floes drove us westward even farther than before, and there would have been much risk in pushing landward through them again. Our journey to the lonely island was done. So, after a few hours of devious sailing, we emerged from the tangle into the open ocean, and there rolled uncomfortably southward under a cold thick sky for the next two days, gaining the welcome shelter of the Norwegian coast on the morning of August 12. It was on the previous night that we had reached into sunset again.

Being now a few hours ahead of time, our captain took us up the lovely Lyngen Fiord, in glorious weather, with a sprinkle of new snow on all the peaks. Thus were we reconciled to the loss of Hornsund. And at Tromsö in the afternoon we returned to the world of telegrams, letters and newspapers.

Of the after-voyage through the fiords to Trondhjem it is enough to say that the weather remained perfect; and that Dr. Hans Reusch, the Director of the Norwegian Survey, was of our company, so that we missed nothing that could be learnt in passing. At Trondhjem, moreover, on August 14, we had time, under Dr. Reusch's guidance, to visit the high strand-lines near the city and to examine the scientific and artistic collections in its museums, finishing the day with a pleasant reunion at one of the hotels. Here we left our ship, taking train on the morning of August 15 up the fine valley that leads across the Swedish frontier. We reached Åre in Jämtland in the afternoon, went eastward until evening across the ground we had seen from the summit of Areskutan, past the great Lake Storjon, and reached Stockholm, exactly on time, before breakfast on the morning of Wednesday, August 17. The initial reception of the members of the congress was held in Stockholm on the evening of that day.

To those who did not share in the pilgrimage this recital of our itinerary can at the best convey only a feeble idea of its advantages. Not the new country alone and the new experiences, but above all, the constant association and intercourse of men of different nationalities and outlooks, with interests in common which they were ever ready to discuss together—this it was that gave peculiar value to the journey, as to all journeys of the same type. Deeply indeed were we indebted to our leader, Prof. G. De Geer, and to the accomplished lady, his wife, for the whole-hearted enthusiasm which they threw into the difficult task of planning, guiding, and demonstrating in

Photo. by Oscar Halldin, Stockholm.] [*Reproduced by kind permission of Prof. G. de Geer.*

FIG. 3.—North end of Cora Island, Ekman Bay; showing the Sefström moraine of shelly clay, to the left of the inlet, and a portion of the original island to the right.

in time to make the ascent of Mt. Åreskutan (4620 feet) for the sake of the view from its summit over an immense range of lower lake-country to the eastward. The glacial phenomena of this region are like those of Torneträsk on a grander scale; the same evidence for a succession of glacier-dammed lakes, at first discharging westward over the watershed into Norway; the same shrinkage of the ice-sheet from the western mountain-rim to the lower eastern country; the same westward transport of the boulders. On the top of Åreskutan there are boulders which have come from places far away to the eastward at much lower altitudes.

In the evening Prof. C. Wiman joined us at Åre; and next morning, under his leadership, we visited sections near the Åre Lake, which show the fossiliferous Lower Palæozoic succession. We were able also to appreciate the evidence for a gigantic overthrust of the metamorphic rocks from the westward over the unaltered Palæozoics. Leaving Åre by train in the afternoon of August 16, we varied languages so that the time at our disposal should always be profitably spent; and even still more for the happy spirit of friendliness and geniality which they imparted to the whole expedition. Much also we owed to Mr. B. Högbom for his share in the direction of our party in Spitsbergen, and to Dr. Hj. Lundbohm, Prof. C. Wiman, and Dr. O. Sjögren for their aid in Sweden, while Mr. C. Carlzon and Mr. H. Ahlmann were our ever-obliging helpers and interpreters. In our admiration for the extraordinary skill with which every stage of the journey was arranged, we could not fail to recognise the thoughtful solicitude of our physician and treasurer, Dr. J. W. Nordenson, of whose high qualities as an organiser we had daily proof.

Brief must be our reference to the constitution of the party. The British geologists were lamentably few—G. A. J. Cole, A. P. Coleman, A. Strahan, and the writer—but, for the occasion, we will count with us also the U.S. Americans, R. S. Tarr, Miss F. Bascom, Miss Z. Baber, and Miss E. Rice. The German and Austrian

contingent was predominant, including (titles omitted) H. Credner, G. Gürich, K. Keilhack, A. Penck, A. Rothpletz, W. Salomon, K. Sapper, F. Wahnschaffe, and other well-known names. Among those from France were L. Carez, L. de Lamothe, E. de Margerie, and A. Offret; from Italy, S. Cerulli-Irelli and E. Mattirolo; from Portugal, J. Mendez-Guerreiro; from Switzerland, M. Allorge, J. Brunhes, and P. Mercanton. From Denmark, among others, came V. E. Hintze, V. Madsen, and J. P. J. Ravn; from Holland, J. I. J. M. Schmutzer and Mlle. A. Grutterink; from Norway, H. Reusch; from Hungary, E. de Cholnoky and E. de Maros; and Japan was represented by K. Inouye and H. Yabe. Broadcast now is the gathering that went with the good ship *Æolus* on this memorable voyage to Spitsbergen!

G. W. LAMPLUGH.

A FOURTH RECALESCENCE IN STEEL.

IN 1868 the late Dr. George Gore, F.R.S., discovered the recalescence points now known as Ar_3 and Ar_2, and in 1872 Prof. W. F. Barrett, F.R.S., discovered the point Ar_1, which is now known as the carbon change point. Prof. Barrett gave the phenomena the generic title of "recalescence," by which they have been known ever since.

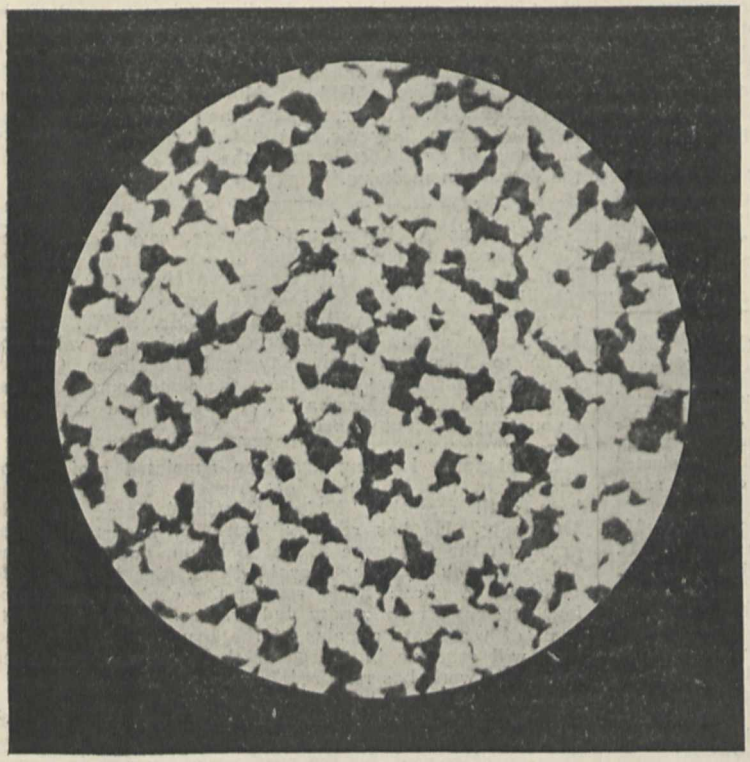

Photo-micrograph of nearly Pure Iron containing 0·21 per cent. Carbon. Rapidly quenched between the two peaks of Ar_2. Magnified 450 diameters.

At the recent meeting of the British Association, Prof. J. O. Arnold described to the section of chemistry the result of accumulated thermal and micrographic observations upon this subject extending over twenty years. He first described the recalescence apparatus used at Sheffield University, in which the tape results can be plotted either as a time-temperature or as an inverse-rate curve. The latter is more delicate, its coordinates being units of temperature and time in seconds, for units rise or fall in temperature.

The Recalescence of Chemically Pure Iron.

From many observations it appears that before even a rough quantitative measurement of recalescence in steel can be made it is very desirable to obtain a standard cooling curve of iron absolutely free from carbon; this was made possible by a gift of chemically pure iron from Dr. Hicks and Prof. O'Shea, of Sheffield University. The recalescence data registered *in vacuo* on placing the thermocouple between two small plates of this iron show that the maximum of Ar_3 appears at 854° C., and the set-back between the two peaks of Ar_2 is registered at 750° C.

The Recalescence of Iron containing about 0·2 per cent. Carbon.

On cooling unsaturated steels containing about 0·2 per cent. carbon it was noticed that there was along the range of temperature between Ar_3 and Ar_1 some thermal evolution which prevented the curve crossing the radiation line after recalescence, and also kept it well to the right of that line. Careful investigation of this phenomena revealed the fact that whilst with iron containing 0·38 per cent. carbon this new and prolonged recalescence was very much augmented, as compared with a 0·2 per cent. carbon steel, that iron containing 0·63 per cent. carbon gives out during this fourth phase of recalescence much less heat than the 0·38 per cent. carbon steel. Therefore it would appear that the maximum of heat of the fourth phase of recalescence is evolved from a semi-saturated steel, namely, an iron containing 0·45 per cent. carbon, and having in the cold a micro-structure consisting of 50 per cent. ferrite and 50 per cent. pearlite. The recalescence data and curves of all these steels were shown on the screen and minutely described.

The Cause of the Fourth Phase of Recalescence.

By micro-thermal investigations Prof. Arnold has satisfied himself that the fourth phase of recalescence is due to constitutional segregation, namely, the falling out between Ar_3 and Ar_1 of the ferrite and hardenite from their state of mutual interpenetration or solid solution into microscopically invisible masses. A method was adopted for rapidly quenching from nitrogen in iced brine 0·2 per cent. carbon steel at various temperatures. The temperatures were:—(1) 995° C. (well above Ar_3); (2) just below Ar_3; (3) just after first peak of Ar_2; (4) just above Ar_1; (5) 15° (normalised or cooled in air).

The micrograph here reproduced is a section quenched between the two peaks of Ar_2. The segregation is obviously proceeding very quickly, and the ferrite is strongly electro-negative to the dark etching areas of hardenite still containing in solution large quantities of iron. The micrographs indicate that the critical range Ar_2 has no influence on the segregation of hardenite and ferrite. In Prof. Arnold's view these five photomicrographs, when correlated with the recalescence curves of the steel experimented upon, prove that the fourth phase of recalescence is due to the heat evolved during the segregation of the ultimate micrographic constituents of steel, which began at Ar_3 and incomplete at Ar_1, during the cooling of unsaturated steels at a moderate rate, say 0·5° per second.

REPORTS ON IMPERIAL FOODSTUFFS.

WE have received No. 63 ("Gums and Resins") and No. 71 ("Foodstuffs") of the "Colonial Reports: Miscellaneous," comprising selected reports from the Scientific and Technical Department of the Imperial Institute. They refer to products, from British possessions, examined at the institute with regard generally to the possibility of their profitable cultivation or preparation in the districts concerned. The first report is a useful little monograph on gums and resins from the commercial and analytical point of view, with particulars of the colonial specimens examined. The chief matter of scientific interest in the paper on foodstuffs, namely, a summary of the

facts relating to cyanogenesis in plants, has already been published elsewhere.

Among points of general interest we note that Yebb (or Yeheb) nuts from Somaliland, which grow in arid districts and have formed the principal food of many destitute refugees, were found to contain about 12 per cent. of albuminoids, 11 per cent. of oil, 24 per cent. of sugars, and 37 per cent. of other carbohydrates. They thus show high nutritive value as a foodstuff; and it is recommended that the cultivation of the plant (*Cordeauxia edulis*) producing the nuts should be tried in other countries, especially where a foodstuff is needed which can be grown in arid places. Tea from the Nyasaland Protectorate was found to be analytically of good quality, though on account of its having been packed with tobacco no opinion could be given on its flavour. Nevertheless, it is considered that the cultivation of tea in the Protectorate might well be extended. Some Natal tea, too, appears to be very satisfactory. Its proportion of caffeine is only slightly less than that of Indian tea examined, and as regards tannin it is intermediate between Indian and China teas. In the opinion of the department the cultivation and preparation of tea in Natal deserves very full study, with a view to the production of tea of characteristic quality.

Cocoa grown experimentally in Uganda gave very promising results. So also did some specimens cultivated by the Botanical Department of the Gold Coast Colony, though it was pointed out that more attention was required in the fermentation of the beans, since it is on this that the aroma and colour largely depend. Small consignments subsequently sent for actual sale realised fair prices, and from the knowledge gained it was possible to indicate the directions in which further improvement of the cocoa could be effected. Some useful memoranda on miscellaneous matters, such as the constituents of food and their functions, and the harvesting and shipment of maize, are also included in this report on foodstuffs.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The special board for medicine has elected Prof. Marsh, Master of Downing College, as its representative on the general board of studies for four years, and the special board for economics and politics has elected Mr. G. L. Dickinson as its representative on the same board for the same period.

Prof. Hughes states that he has received a very valuable gift of fossils, &c., from the widow of the Rev. G. F. Whidborne, who had previously presented to the Sedgwick Memorial Museum the collection of Devonian fossils which he had described in the Transactions of the Palæontographical Society. Mrs. Whidborne has now given to the museum the remainder of his collection, with all his scientific books and manuscripts, together with a valuable series of photographs and other illustrations, and has included in her gift the cabinets in which some of the specimens were kept and were being arranged.

The Vice-Chancellor publishes the following extract from the will of the late John Willis Clark, formerly Registrary of the University:—"I bequeath also to the Chancellor, Masters, and Scholars of the University of Cambridge my Collection of Voyages and Travels as recorded in a special catalogue, forming part of the collection, to be placed under the charge of the Museums and Lecture Rooms Syndicate. And I request the said Syndicate to deposit the same wherever in their judgment it is likely to be most useful."

The board of anthropological studies desires the establishment of a special examination in anthropology for the ordinary B.A. degree. The board reports as follows:—"As anthropology is a subject that is rapidly growing in importance, the board is of opinion that the time has arrived when it is desirable that a special examination in anthropology should be held. Anthropology is a science that demands extensive and precise study, and at the same time bears upon other branches of learning, for example, history, economics, psychology, biology, and geography. It may now be considered as a mental discipline not inferior to other subjects comprised in the various special examinations."

OXFORD.—On November 29 Congregation took into consideration some of the amendments that had been proposed to the statute concerning the faculties and boards of faculties, of which the preamble was approved on November 8. Exception had been taken in some quarters to certain provisions of the statute which appeared to disqualify the college tutors as such for membership of the faculties. An amendment proposed by the Master of Balliol providing that the head of any college or similar society within the University might certify any member of Convocation authorised by his society as a member of the faculty in which his teaching is given was carried without a division. Another amendment, proposed by the Master of University College, to the effect that a number of the members of the general board of the faculties should be elected from and by the whole body of members instead of from and by each faculty acting separately, was opposed by the President of Magdalen, Prof. Gotch, F.R.S., and Prof. Oman, and rejected on a division.

As was generally anticipated, the question of compulsory Greek is not to be allowed to rest in the position to which it was relegated by the division on November 22. A petition to council is being prepared, asking that a short statute may be framed relieving honour students in the schools of natural science and mathematics "from the necessity of taking two ancient languages in Responsions." This movement has the support, amongst others, of Sir W. Anson, Profs. Gilbert Murray, Myres, Poulton, F.R.S., H. H. Turner, F.R.S., and Osler, F.R.S., the latter of whom, however, has stated "that he is strongly in favour of retaining Greek in the case of candidates for the degrees in medicine."

MR. JAMES A. PATTEN, of Chicago, says *Science*, has given 40,000*l.* to endow a chair of experimental pathology in the medical school of Northwestern University. Special attention is to be directed to the study of tuberculosis and pneumonia. By the will of the late Mr. S. W. Bowne, bequests in stocks and bonds of considerable value are made to Wesleyan University and Dickinson College. Radcliffe College, we learn from the same source, has received from Mrs. Martha T. Fiske Collard a bequest amounting to about 20,000*l.*

M. MAURICE LERICHE has been appointed professor of geology at the University of Brussels. M. Leriche has been until recently "Maître de Conférences" at Lille University. He has recently issued an important monograph on the Oligocene fish of Belgium, published in the *Mémoires du Musée Royal d'Historie Naturelle de Belgique*, v. Prof. Dollo retains the chair of palæontology at Brussels University and conservator of the department of vertebrate remains of the Brussels Museum, and thus will continue in charge of the important collections which his work has rendered famous.

PRINCE ARTHUR OF CONNAUGHT has accepted the position of president of the appeal committee appointed to secure the sum of 70,000*l.* for the purchase of the site in Gower Place and for the erection thereon of new chemical laboratories for University College, London. We are glad to notice that the new president in a further appeal through the Press emphasises the national aspect of the appeal committee's object, and asks for a national response. As we have pointed out already, 25,000*l.* must be raised before December 25 next if the new site is to be secured, and towards this amount upwards of 10,000*l.* has been raised. It should not be difficult to secure the remaining 15,000*l.* during the next few weeks.

THE German Emperor opened a new technical university at Breslau on Tuesday, November 29, and delivered an address, in which he referred to the great importance of such institutions for the industrial progress of the Empire. There are now eleven technical universities in Germany, five of which are in Prussia, namely, at Charlottenburg, Aachen, Hanover, Danzig, and Breslau. The Berlin correspondent of the *Morning Post* reports that in the course of his remarks at the dedication of this—the second technical university founded in his reign—the German Emperor said:—"The close connection between

technical science and industry becomes year by year more manifest, and it is not by chance that the immense advance made by our industrial life is contemporaneous with the progressive development of the technical university system in Germany. The times are past in which a school of practice sufficed for the engineer. Whoever wishes to be equal to the demands made by technics in our time must go into the battle of life equipped with a solid scientific and technical education." His Majesty also remarked that Silesia had gained for itself an eminent position through the assiduity and spirit of enterprise which had enabled it to develop its coal and iron and its spinning and weaving industries, and he expressed the opinion that the inhabitants were perfectly justified in desiring to have a technical university in their capital. Dr. von Trott zu Solz, Prussian Minister of Ecclesiastical Affairs, addressing the Emperor, recalled the fact that it was King Frederick the Great who laid the foundation of the greatness of the Silesian industries, in that he encouraged the employment of Silesian coal in other industrial districts and overcame the prejudice against Silesian iron.

A CONFERENCE organised by the Joint Committee for the Abolition of Half-time Labour was held on November 23 at the Church House, Westminster, with the Bishop of Birmingham in the chair. The meeting was called to consider the question of the employment of children in mills and factories, and of securing the passage of a Bill through Parliament raising the age of "half-timers" to thirteen. Prof. Sadler, in a letter expressing inability to attend, said it is a drag upon the economic welfare of the country that more than 200,000 children between twelve and fourteen years of age have left the day school for good, and that more than 40,000 more only attend school half time. There is no reason in the nature of things why the number of boys and girls under fourteen who are wholly or partially exempt from day-school attendance should be proportionately six times as numerous in England and Wales as in Scotland. The chairman insisted that it is a ludicrous waste of energy and money to let education stop at the age of fourteen, thirteen, or twelve. The evil is increased by the system of half-time attendance. Two things, he said, are necessary to stop this wastage of education—to abolish the half-time system, except possibly in some very extreme and exceptional circumstances, and to press forward in the matter of continuation schools. If continuation schools are to be made a real force, the hours of work in shops must be restricted. It is physiologically certain that it is impossible to get real good out of education so long as the bodies and minds of children are in the main occupied in getting a living. Eventually the following resolution, which was proposed by Lord Sheffield, was carried:—"That this meeting approves of the recommendations of the Departmental Committee on partial exemption, and trusts that legislation, as promised by the Board of Education and unanimously approved by resolution by the House of Lords, may be carried into effect in the first session of the coming Parliament."

IN consequence of a suggestion of the Chancellor of the Exchequer made last March to a large deputation from English universities and colleges, a committee of representatives from these educational institutions was appointed to place before the Chancellor suggestions as to the principles of distribution on which, in its opinion, an additional grant to university Colleges might be utilised most effectively. The committee consisted of Mr. A. H. D. Acland, Sir Alfred Hopkinson, F.R.S., Sir Oliver Lodge, F.R.S., Sir Isambard Owen, and the Rev. Dr. A. C. Headlam. Conferences between the Chancellor of the Exchequer and the President of the Board of Education with the committee were held on November 16 and 17. The committee expressed the view that the Treasury Committee, on the advice of which grants are distributed, should take into consideration:—(1) Output.—That is, the extent and character of the work being done, including the number of students, the nature of the instruction given, and research and other work undertaken. (2) Needs in order to carry on the work efficiently: (*a*) staff, and the remuneration of its members; (*b*) accommodation and equipment. (3) Development.—The development of work which the several universities and colleges desire, and would be in a position to undertake effectively with further financial assistance, and having regard to provision already made from private benefactions, or other local support, or which may be obtained for such objects. The committee also pointed out it is essential for the universities and colleges to have freedom as to the mode of expenditure of grants to secure the greatest return from them and to meet constantly varying conditions. Great importance was attached to the grants being certain, and not liable to diminution, so long as the extent and character of the work are maintained. The Chancellor of the Exchequer expressed himself willing to grant an additional sum to the colleges to be allocated on the lines laid down by the committee, but subject to the condition that sufficient additional local support is forthcoming in each case, not only to maintain the existing activities of the college in conjunction with its existing Treasury grant and to place it on a secure footing in regard to its capital liabilities and requirements, but to meet a suitable proportion of the cost of maintenance of the new developments adopted. He was prepared to increase the total grant by 50,000*l*., and promised (subject, of course, to compliance with the minimum conditions as to character, efficiency, &c., which any college is already required to fulfil in order to participate in the grant at all) not to reduce the existing grants to the several colleges.

SOCIETIES AND ACADEMIES.

LONDON.

Geological Society, November 9.—Prof. W. W. Watts, F.R.S., president, in the chair.—L. **Richardson**: The Rhætic and contiguous deposits of west, mid, and part of east Somerset. This paper contains an account of the Rhætic strata of Somerset. The sections at Blue Anchor and Lilstock are described and correlated with those on the Glamorgan coast. The record by Prof. Boyd Dawkins of Rhætic mollusca in the top portion of the Grey Marls is confirmed, and their recognition as Rhætic is substantiated. The deposit between the top of the fossiliferous Grey Marls or "Sully beds" and the main bone-bed at Blue Anchor measures 22 feet, and teems with Rhætic fossils. The beds above the bone-bed agree well with those occupying the same stratigraphical position in Glamorgan. The now obscured sections, that were to be seen in the railway-cuttings at Langport and Charlton Mackrell, noticed by Mr. H. B. Woodward, are described. Huge boulder-like masses of rock were noted at the top of the Black Shales, and the White Lias proper, with a well-marked coral-bed, totalled 25 feet in thickness. The classic sections of Snake Lane, Dunball (Puriton), Sparkford Hill (Queen Camel), Shepton Mallet, and Milton (Wells), have been reinvestigated, and the thin Rhætic deposits in Vallis Vale, at Upper Vobster, and sections in the Radstock district, and on the Nempnett and neighbouring outliers, are described. This investigation has shown that the Microlestes Marls are equivalent to the Sully beds; that the Wedmore Stone occurs well below the bone-bed; that Moore's "flinty bed" at Beer Crowcombe is probably on the horizon of the Pleurophorus bed (No. 13); that the Upper Rhætic is as persistent as usual; that the White Lias proper is of restricted geographical extent; and that on the Bristol Channel littoral are marls, "Watchet beds," above the White Lias. Around Queen Camel, Moore's "insect and crustacean beds" appear to come in at a horizon which lies between the Watchet beds and the Ostrea Limestone. A classification of the Rhætic series is suggested. The fauna of the Rhætian is Swabian in facies, and the conclusion to be derived from the study of the beds is in agreement with Suess's view, that while the dominant movement was one of subsidence and not local but extended, it was, nevertheless, "oscillatory and slow."—Rev. G. J. **Lane**: Jurassic plants from the Marske quarry. The Marske quarry is situated on the northern side of the Upleatham outlier in the Cleveland district of Yorkshire. In the quarry several varieties of rock are

exposed, namely, shales, small coal-seams, sandstones, and a ferruginous bed. The beds are of Lower Oolite age, and belong to the Lower Estuarine series. From this quarry Dictyozamites was recorded for the first time in England. The writer has obtained nearly forty species from the quarry, among which are many characteristic Wealden plants.

Physical Society, November 11.—Prof. H. L. Callendar, F.R.S., president, in the chair.—Dr. C. **Chree**: The supposed propagation of equatorial magnetic disturbances with velocities of the order of 100 miles per second. The question of the simultaneity of magnetic disturbances recorded at different stations has recently been discussed by Dr. Bauer and Mr. Faris. A good many magnetic storms have so-called "sudden commencements." As regards these "sudden" changes, three things are conceivable: they may be absolutely simultaneous at different stations; there may be a very small difference of time corresponding to the rate of propagation of electromagnetic waves; or, finally, there may be, as Dr. Bauer concludes, longer intervals, amounting to several minutes, for stations remote from one another. Dr. Bauer concludes that Mr. Faris's figures demonstrate the truth of his theory that disturbances normally are propagated round the earth, sometimes eastwards, sometimes westward, the time of a complete revolution averaging about 3¾ minutes. The author of the present paper discusses the weaknesses of Dr. Bauer's theory. He points out that the theory could be adequately tested by a careful comparison of curves from selected stations fairly encircling the globe, choosing, if possible, stations the time-measurements of which are specially trustworthy.—Prof. W. B. **Morton**: Cusped waves of light and the theory of the rainbow. Diagrams were shown of the forms assumed by a plane wave of light falling on a spherical raindrop and twice reflected from the interior of the drop, as well as the waves emerging from the drop. The waves in general have cuspidal edges, which run along the caustic surfaces. This relation between the caustic and the cusps on the waves was pointed out by Wood in connection with the similar waves produced by reflection at a spherical surface. It had been noticed earlier by Potter, Jamin, and Macé de Lepinay. The phase over a wave of this type is not constant, the two portions on opposite sides of a cusp differing in general by a quarter period. Attention was directed to the advantage of regarding the distribution of light in the rainbow as the consequence of the interference of the cusped waves which run down to the observer's eye along the direction of minimum deviation. This way of looking at the matter is shown to be equivalent to Mascart's approximate method of explanation of the formation of the supernumerary bows by interference of disturbances coming from the two poles on the special wave-form used by Airy.

Zoological Society, November 15.—Dr. S. F. Harmer, F.R.S., vice-president, in the chair.—J. Lewis **Bonhote**: Experiments on the occurrence of the web-foot character in pigeons. After referring to Mr. R. Staples Browne's paper on the subject in the Proc. Zool. Soc. for 1905, in which the web-foot was shown to be a simple Mendelian recessive, Mr. Bonhote instanced further cases from the lofts of Mr. F. W. Smalley that bore out Mr. Staples Browne's conclusions. Both these gentlemen, however, gave the author birds from their strains, and in the first instance when webbed birds from the different strains were crossed an irregular result—namely, four normal and one webbed—was obtained. Matings from these birds were continued, and the results were, in almost every case, contrary to Mendelian expectations, normals throwing webs and webs throwing normals. After discussing various suggestions, Mr. Bonhote came to the conclusion that no really satisfactory explanation was forthcoming. The Mendelian inheritance was apparently there, but dominated and modified by some other agency.—E. **Degen**: Notes on the little known lizard *Lacerta jacksoni*, Blgr., with special reference to its cranial characters.—G. A. **Boulenger**: *Lacerta peloponnesiaca*, Bibr. A new description of this little known lizard, made from living specimens in the society's gardens, with the view of fixing its correct position in the genus Lacerta.—E. G. **Boulenger**: Remarks on two species of fishes of the genus Gobius, from observations made at Roscoff. The paper dealt with the specific distinction of *Gobius minutus* and *G. microps*.

Linnean Society, November 17.—Dr. D. H. Scott, F.R.S., president, in the chair.—Prof. G. **Henslow**: A theoretical origin of *Plantago maritima*, L., and *P. alpina*, L., from *P. Coronopus*, L. Vars. This suggestion arose from the presence of *P. maritima* around the erection of faggots for condensing the brine of the salt-spring of Bad Nauheim, which is some 240 miles from the nearest coast, for M. Lesage proved that fleshiness of maritime plants was the direct result of the presence of salt. *P. Coronopus* has many varieties, and all the characters upon which they are based are very variable; forms approximating the above species are already named.—Prof. G. **Henslow**: A theoretical origin of Monocotyledons from aquatic Dicotyledons through self-adaptation to an aquatic habit, being supplementary observations to a previous paper (Journ. Linn. Soc., Bot. xxix. [1892], p. 485). The conclusions arrived at are:—(1) Coincidences are innumerable in all parts of monocotyledonous plants with aquatic Dicotyledons. (2) Experimental verification now covers and explains a large proportion of these coincidences. (3) Terrestrial Monocotyledons retain by heredity many of the aquatic characters acquired by their ancestors when living a hydrophytic life, but they are now readapted to a life in air.

MELBOURNE.

Royal Society of Victoria, October.—Prof. E. W. Skeats in the chair.—T. S. **Hall**: The systematic position of the species of Squalodon and Zeuglodon described from Australia and New Zealand. *Squalodon wilkinsoni*, McCoy, *Zeuglodon harwoodi*, Sanger, *Kekenodon onamata*, Hector; and *Prosqualodon australis*, Lydekker, agree in having the molar roots fused, as distinct from the northern hemisphere forms. New genera based on the proportion of crown to fang are proposed, namely, *Parasqualodon* (*wilkinsoni*) and *Metasqualodon* (*harwoodi*).—C. M. **Maplestone**: Further descriptions of the Tertiary polyzoa of Victoria, part xi. A new family, Synapticellidæ, with n.g. Synapticella (6 spp.), is founded. The family is allied to Catenicellidæ and Eucratidæ, but the zoaria are free and rigid, and the zoœcia in single series. In all, 38 new species are described.—F. **Chapman**: A trilobite fauna of Upper Cambrian age (Olenus series) in N.E. Gippsland, Victoria. E. O. Thiele found a limestone near Mt. Wellington which he, Skeats, and Dunn hold to be interbedded in slates which on graptolite evidence are Upper Ordovician. The author records Agnostus, Crepicephalus, and Ptychoparia, besides brachiopods and a few other forms, all of which are held to show Cambrian affinities.—A. J. **Ewart**, Jean **White**, and Bertha **Wood**: Contributions to the flora of Australia, No. 16. The authors described a new grass, Sarga, n.g., from N.W. Australia, a new Linum from Tasmania, and others.

CAMBRIDGE.

Philosophical Society, November 14.—Prof. Wood in the chair.—Prof. **Biffen**: Some crosses with Rivet wheat. Cases of coupling of roughness of the chaff with grey colour were described from several crosses between subspecies of *Triticum sativum*, and also a case where two varieties normally immune to the attacks of *Claviceps purpurea* gave rise to an F_2 generation containing susceptible individuals.—Mrs. D. **Thoday** and D. **Thoday**: The inheritance of the yellow tinge in sweet-pea colouring. The yellow tinge in scarlet, salmon, and deep cream sweet peas is found to be very complex in character. In the deepest tinged flowers examined, Queen Alexandra and St. George, the yellow colouring is produced by at least three coincident recessive factors. The three are all independent of one another; two tinge the sap and affect the whole flower, while the third is a plastid character, especially affecting the standard and pro-

ducing marked bicoloured forms. In the absence of yellow plastids the flowers do not "burn," unlike most known salmon or scarlet varieties.—Dr. R. N. **Salaman**: Demonstration of Mendelian laws of heredity in the potato.—Prof. **Wood**: The feeding value of mangels. Reference was made to a former communication on the composition of the five types of mangels. The present paper describes a series of feeding trials designed to ascertain if the percentage of dry matter is a fair index of feeding value. Nine experiments are discussed, and the result arrived at is that the percentage of dry matter does indicate the feeding value.—F. H. A. **Marshall**: Some causes of sterility in cattle. Sterility in some cases was shown to be probably due to a deposition of lipochrome in the ovarian interstitial tissue, associated with follicular degeneration.—F. H. A. **Marshall** and K. J. J. **Mackenzie**: Caponising. It was shown that in a case of incomplete caponisation, where pieces of testis of varying sizes had become transplanted on to the intestine and in other abnormal positions, spermatozoa were formed in the testicular grafts in spite of the fact that they were virtually ductless glands; also that the development of the secondary male characters and sexual desire were almost normal, as in the cases described by Foges and Shattock and Seligmann.—F. W. **Foreman**: Notes on protein hydrolysis. During the hydrolysis of the protein of Linseed the following points worthy of special mention were noted:—(1) By a modification of the ordinary method it was found possible to separate practically the whole of the glutaminic acid as the hydrochloride in the early stages of the hydrolysis. (2) The very high content of valin compared with leucin. (3) The low percentage of tyrosin. (4) The discovery of a basic lead salt of tyrosin, and the possibility of introducing a trustworthy method for the estimation of tyrosin in a mixture of amino-acids obtained from a protein by hydrolysis by precipitating it as this basic lead salt.—K. R. **Lewin**: Nuclear relations of *Paramecium caudatum* during the asexual period. The micronucleus of *Paramecium caudatum* is not necessary to continued multiplication by fission. By merotomy an amicronucleate race was obtained which maintained itself for seven weeks. This result was not due to fusion of mega- and micronuclei under the stimulus of operation.

DUBLIN.

Royal Dublin Society, November 22.—Prof. T. Johnson in the chair.—Prof. W. **Brown**: Mechanical stress and magnetisation of nickel. The author gave the results of experiments on magnetism and torsion of nickel wires when the wires were of different degrees of magnetic softness and of different lengths and diameters, which show several peculiarities in the behaviour of nickel as compared with iron when tested under the same conditions.—Prof. T. **Johnson**: A seed-bearing Irish pteridosperm—*Lyginodendron Oldhamium*, Willm. The author records the presence in Ireland of the Pteridospermeæ, and gives an account of specimens of *Sphenopteris Hoeninghausi*, Brgt., in the botanical division of the National Museum, Dublin, and especially of one specimen of this in the Geological Survey collection. This specimen shows not not only the connection of *S. Hoeninghausi* with the stem of Lyginodendron, but also the direct continuity of the fossil known as *Calymmatotheca Stangeri* with *Lyginodendron rachis*. In addition the author describes the presence of a Lagenostoma seed in one of the cupular rosettes of Calymmatotheca. The specimen furnishes the evidence of direct continuity in support of the views of Oliver and Scott on the synthetic reconstruction of the Palæozoic pteridosperm *Lyginodendron Oldhamium*.

PARIS.

Academy of Sciences, November 21.—M. Émile Picard in the chair.—M. Francotte was elected a correspondant in the section of anatomy and zoology in the place of the late M. Van Beneden.—J. **Guillaume**: Observations of Cerulli's comet made at the Observatory of Lyons. Data are given for November 12 and 16. The comet is of about the tenth magnitude; a small tail was visible on November 16th.—M. **Luizet**, J. **Guillaume**, and J. **Merlin**: Occultations observed during the total eclipse of the moon of November 16, 1910, at the Observatory of Lyons.—L. **Montangerand**: Observation of the total eclipse of the moon of November 16, 1910, made at the Observatory of Toulouse.—M. **Lebeuf**: The total eclipse of the moon of November 16, 1910, observed at the Observatory of Besançon by MM. Chofardet and Goudey.—M. **Bourget**: Observations of the total eclipse of the moon of November 16, 1910, made at the Observatory of Marseilles.—Robert **Jonckheere**: The total eclipse of the moon of November 16–17, 1910, at the Obervatory of Hem.—E. **Cartan**: Isotropes capable of development and the method of the mobile trihedron. Eugène **Fabry**: Order of the singular points of a Taylor's series.—A. **Chatelet**: The theory of numbers.—T. **Lalesco**: Resolving nuclei.—Marcel **Brillouin**: The discontinuous movement of Helmholtz. Curved obstacles.—M. **Villat**: The resistance of fluids limited by a fixed indefinite wall.—MM. **Claude, Ferrié,** and **Driencourt**: Telephonic and radio-telegraphic comparisons of chronometers by the method of coincidences between Paris and Brest. The difference between the two sets of comparisons by telephone and by wireless telegraphy is less than 0·01 sec.; if necessary, the accuracy could be increased.—G. A. **Hemsalech**: The modifications undergone by the lines of the spark spectrum in a magnetic field. A development of work described in a previous paper. Three classes of phenomena are shown to exist: a general effect independent of the direction of the lines of force of the magnetic field; a longitudinal effect, produced when a spark is parallel to the lines of force; and a transversal effect, produced only with very slow discharges, when the spark is perpendicular to the lines of force. In the present paper observations on the first two of these effects are described and discussed.—G. A. **Andrault**: A rapid graphical method for measuring the slipping of induction motors.—Francisque **Grenet**: Study of the porosity of Chamberland filters. The dry filter, placed vertically, is completely filled with mercury, and a fine steel tube passed through a close-fitting stopper is connected with a calibrated glass capillary tube. On plunging the filter into distilled water, the air in the capillaries of the porous pot is driven inwards, causing a rise of the mercury in the glass capillary. Filter tubes of different makes showed large differences in the pressures thus measured, varying from 18 cm. to 2 metres of mercury. These pressures measure the diameters of the pores of the filter.—J. **de Kowalski** and J. **de Dzierzbicki**: The progressive phosphorescent spectrum of organic compounds at low temperatures. Figures are given for the bands of benzene and nine of its homologues, for phenol, cresols, and xylenols and benzyl alcohol. The results show that progressive phosphorescence is a property which depends essentially on the constitution.—Charles **Moureu** and J. Ch. **Bongrand**: Propiolic compounds. Cyanacetylene. Methyl propiolate, $CH{:}C.CO_2CH_3$, was converted into propiolamide, $CH{:}C.CO.(NH_2)$. By the action of phosphorus pentoxide upon this amide, cyanacetylene, $HC{:}C—CN$, is obtained. This forms a mobile liquid boiling at 42·5° C., solidifying in ice to a mass of crystals melting at 5° C. The physical and chemical properties of this compound are given in detail.—Casimir **Cépède**: An improvement of the binocular microscope, increasing the illumination of the objects under observation.—Marcel **Mirande**: The effects of tarred roads on vegetation. It has been found experimentally that the vapours given off by tar such as is used for treating roads act injuriously on green plants. In the open country the vapours given off by a tarred road would be insufficient to damage vegetation, but in shut-in streets damage to trees planted on the edge of the pavement may be expected.—Jules **Amar**: Respiratory exchanges after work has been done. The amount of oxygen used by a human subject was measured, first, when at rest, then during work, and finally at regular intervals after cessation of the work. The original consumption of oxygen was reached in from six to eight minutes after the work was stopped. The rate of decrease of oxygen absorption varied with each subject.—Ch. **Gravier**: The battle for existence in the

madrepores of coral reefs. The forms which succumb in the struggle are those which are large and globular; the arborescent forms have more resisting power.—E. **Roubaud**: The evolution and history of *Roubandia rufescens*, a parasite of the social African wasps, genera Icaria and Belonogaster.—P. **Fabre-Domergue** and R. **Legendre**: The search for *Bacterium coli* in sea water by the methods employed for fresh water. All the usual tests for coli in fresh water are retarded in their action by the presence of common salt. Certain modifications of technique necessitated by this fact are suggested. The question has arisen in connection with the control of oyster beds.—J. **Couyat** and P. H. **Fritel**: The presence of plant impressions in the Nubian grit in the neighbourhood of Assouan.

CAPE TOWN.

Royal Society of South Africa, October 19.—Mr. S. S. Hough, F.R.S., president, in the chair.—A. G. **Howard**: An investigation into the land and sea breezes conditions at Port Elizabeth. A second contribution to the meteorology of South Africa.—E. T. **Littlewood**: Graphical representation of some of the simpler analytic functions of a complex variable. The modulus of the function corresponding to each point of the (horizontal) xy plane was represented by the length of a vertical line erected at that point, the upper extremities of these lines forming a ("modular") surface, while the argument was represented by a family of curves ("stream lines") drawn in the xy plane. Certain general results were established and methods given. In the models, the surface was suggested by a wire framework, which usually illustrated contour lines and vertical sections, while the stream lines, drawn on the horizontal base of the model, were visible through the framework. The simpler algebraic, circular, exponential, and logarithmic functions were thus treated.

DIARY OF SOCIETIES.

THURSDAY, DECEMBER 1.

LINNEAN SOCIETY, at 8.—Spermatogonesis in Stenobothrus: Capt. C. F. U. Meek.—Reports on the International Botanical Congress at Brussels, 1910: Dr. Otto Stapf and others.

RÖNTGEN SOCIETY, at 8.15.—Osmotic Growths: Dr. Deane Butcher.

FRIDAY, DECEMBER 2.

GEOLOGISTS' ASSOCIATION, at 8.—The Geology of Natal: Dr. F. H. Hatch.

INSTITUTION OF CIVIL ENGINEERS, at 8.—The Scherzer Rolling-lift Bridge over the River Tawe, at Swansea: J. H. Morris.

MONDAY, DECEMBER 5.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Geographical Aspects of the Problem of Empire Cotton Growing: J. Howard Reed.

ROYAL SOCIETY OF ARTS, at 8.—Industrial Pyrometry: C. R. Darling.

ARISTOTELIAN SOCIETY, at 8.—A Defect in the Current Logical Formulation of the Basis of Induction: Bernard Bosanquet.

VICTORIA INSTITUTE, at 4.30.—The Theory of Jurisprudence: Judge G. H. Smith.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Analytical Constants of Shellac, Lac-resin and Lac-wax: Puran Singh.—Theory of Dyeing: Resolution after Treatment with Acids, &c.: W. P. Dreaper and A. Wilson.—Some Indian Oils and Fats: A. Kesava Menon.

TUESDAY, DECEMBER 6.

INSTITUTION OF CIVIL ENGINEERS, at 8.—*Further discussion*: Portland Cement, and the Question of its Aeration: H. K. G. Bamber.

WEDNESDAY, DECEMBER 7.

ROYAL SOCIETY OF ARTS, at 8.—The Panama Canal in 1910: Dr. Vaughan Cornish.

SOCIETY OF PUBLIC ANALYSTS, at 8.—On Fischer's Modification of Volhard's Method for the Estimation of Manganese, and its Comparison with other well known Methods: E. Cahen and H. F. V. Little.—Note on the Composition of British Wines: E. Russell and T. R. Hodgson.—A New Volumetric Process for the Estimation of Tungsten: Dr. E. Knecht and E. Hibbert.—A New Volumetric Process for the Estimation of Molybdenum: Dr. E. Knecht and F. W. Atack.—The Degree of Accuracy with which the Proteins of Milk can be Estimated by the Aldehyde Method: H. D. Richmond.—Note on Gorgonzola Cheese: E. Hinks.—Tests for Cocaine and certain Cocaine Substitutes: Dr. E. H. Hankin.

ENTOMOLOGICAL SOCIETY, at 8.

THURSDAY, DECEMBER 8.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: Colour-blindness and the Trichromatic Theory. Part II. Incomplete Red or Green Blindness: Sir W. de W. Abney, K.C.B., F.R.S.—On the Sensibility of the Eye to Variations of Wave-length in the Yellow Region of the Spectrum: Lord Rayleigh, O.M., F.R.S.—(1) Trypanosome Diseases of Domestic Animals in Uganda. IV. *Trypanosoma uniforme*, sp. nov.; (2) Trypanosome Diseases of Domestic Animals in Uganda. V. *Trypanosoma nanum*. (Laveran): Colonel Sir D. Bruce, C.B., F.R.S., and others.—Some Enumerative Studies on Malarial Fever: Major R. Ross, C.B., F.R.S., and D. Thomson.—On Hæmoglobin Metabolism in Malarial Fever: G. C. E. Simpson.—A Case of Sleeping Sickness studied by precise Enumerative Methods. Further Observations: Major R. Ross, C.B., F.R.S., and D. Thomson.—Enumerative Studies on *Trypanosoma gambiense* and *Trypanosoma rhodiense* in Rats, Guinea-pigs, and Rabbits; Periodic Variations disclosed: Dr. H. B. Fantham and J. G. Thomson.—The Life History of *Trypanosoma gambiense* and *Trypanosoma rhodiense* as seen in Rats and Guinea-pigs: Dr. H. B. Fantham.—Experiments on the Treatment of Animals infected with Trypanosomes, by means of Atoxyl, Vaccines, Cold, X-rays, and Leucocytic Extract; Enumerative Methods employed: Major R. Ross, C.B., F.R.S., and J. G. Thomson.

MATHEMATICAL SOCIETY, at 5.30.—(1) Properties of Logarithmico-exponential Functions; (2) Some Results concerning the Increase of Functions defined by an Algebraic Differential Equation of the First Degree: G. H. Hardy.—Optical Geometry of Motion: A. A. Robb.—(1) Note on the Pellian Equation; (2) A Property of the Number 7: T. C. Lewis.—On the Arithmetical Theory of Binary Cubic Forms: G. B. Mathews.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Magnetic Properties of Iron and its Alloys in Intense Fields: Sir R. Hadfield, F.R.S., and Prof. B. Hopkinson, F.R.S.

FRIDAY, DECEMBER 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.

ILLUMINATING ENGINEERING SOCIETY, at 8.—Recent Progress in Electri Lighting: Prof. E. W. Marchant.

CONTENTS.