THURSDAY, FEBRUARY 27, 1890.

THE NEW CODES, ENGLISH AND SCOTCH.

THE country is once more within a month of a new Education Code. Once more the Lord President and the Vice-President of the Council are being besieged by representatives of all interests and opinions, anxious to impress them with the exclusive importance of their particular views. Last year, it will be remembered, the Code—great advance as it was on its predecessors—fell a victim to the fears of one party and the lukewarmness of the other. The extreme School Board partisans gave but scant support to any scheme which did not practically embody the recommendations of the minority of the late Royal Commission, while the champions of voluntary schools shrank from any changes which, by raising the standard of efficiency, seemed likely to accentuate the difference between the Board school, which has the ratepayers' pocket to draw on, and the voluntary school, which depends on a fast-shrinking fund of private subscriptions. And so the Code was sacrificed, and the friends of education were condemned to wait another year.

This is what is constantly happening, and what will continue to happen, so long as there are ten experts forthcoming on all matters relating to educational machinery for one who knows and cares about education itself. Whether elementary schools should be free; whether they should be under representative control; whether they should all receive rate-aid—these and the like disputes are always sure to gain the ear of the public, while the problem of making the education provided worth disputing about is passed by almost unnoticed.

How few among our so-called "educationists" (a newly-introduced word with an ominous ring about it) ever sit down deliberately to face the central problem of elementary education—the only problem of fundamental importance: Given a child between the ages of 5 and 13, with the limitations imposed by its age, by its home surroundings, by the pressing necessity that it should begin to earn a living as soon as possible, and by the fact (most neglected of all by theorists) that there are only a certain number of school hours in the day—what is the best kind of training through which it shall pass? How can those few precious years be best utilized?

Theories, indeed, there are, enough and to spare, till we could wish sometimes that all those in high places who talk of education were made to go through an apprenticeship as school managers, in order to gain some practical acquaintance with the limits imposed on the range of instruction by the nature of the child-material with which they have to deal. For no designer trained to make "designs-in-the-abstract"—who produces patterns for carpets which cannot be woven, for wall-papers which cannot be printed, for copper that cannot be beaten, and for wood that cannot be carved—could be more out of touch with the material in which his designs have to be executed than the educational "reformer-in-the-abstract," who sketches fabulous plans for Universal National Systems of Education which have only one defect—that they are impossible to carry out.

And now, having relieved our feelings, we may turn to the question of immediate importance—namely, the prospects of educational advance under the new Code which is so eagerly expected.

It is rumoured that the authorities at the Education Department are earnestly engaged in the attempt to make the Code a real advance on former efforts. They have many difficulties. If they can successfully run the gauntlet of the Treasury, they have to reckon with the factious criticism of political partisans. We hope, however, that we may assume that the draft Code as it issues from the Department will embody at least all the purely *educational* reforms which appeared in its unlucky predecessor. The clause requiring English as a class subject will go, the curriculum and regulations for evening schools will be made more elastic, an attempt will be made to spread the teaching of drawing, and further facilities will be afforded for science instruction at central schools and classes. It will be the task of outside critics to see that these proposals, already made in last year's Code, are not whittled down, and that they are supplemented by other changes on which al educational reformers are practically agreed. What these changes are may be gathered from the discussion on elementary education, especially in its relation to scientific and technical instruction, which followed Dr. Gladstone's paper at the Society of Arts last November. The programme has been since embodied in a more definite and concrete form in the suggestions which have just been submitted to the Education Department by the Committee of the National Association for the Promotion of Technical and Secondary Education. Among other suggestions they propose that drawing should be made compulsory in boys' schools, of course being allowed a due interval before the regulation comes into operation, during which schools may adapt their staff for the purpose. Elementary drawing should be introduced into infant schools for boys to correspond to needlework for girls, as proposed in last year's Code. The absurd minute of the Science and Art Department—forced on them, it is only fair to say, by the Treasury—confining grants on drawing in girls' schools to departments where cookery is taught, ought of course to be repealed; not so much in the interests of the girls, as of the boys in mixed schools, for whom under the existing regulations provision for drawing cannot well be made. Drawing is not only the basis of all technical instruction, but is a subject of very high educational value, and on both grounds its spread is much to be desired. A further change which is to be hoped for is the extension of the Kindergarten methods from the infant school into the lower standards, and their continuation by means of graduated object-lessons so as to lead up to more distinctive scientific and manual instruction for the more advanced scholars of the school. Manual instruction of some kind ought to be introduced throughout boys' schools to balance needlework instruction for girls.

By manual instruction we do not merely mean instruction in woodwork (called, rather unhappily, the "use of tools" in the recent Act), which is evidently only suitable for the higher standards, say the sixth and seventh. We doubt if it can be profitably given to children below the age of 11, and even in the case of these it can of course only take the form of the "hand and eye" training—not of specific instruction in carpentry. For younger children, however, much might be done in the way of modelling (or, as it has been called, "applied drawing"), designed to carry on the training of the fingers which are often made so nimble by the paper-cutting and the Kindergarten exercises of the infant school, only at present to lose their pliancy and dexterity by want of practice as soon as the child emerges from the fairy-land of the Kindergarten into the dull, prosaic atmosphere of Standard I.

To introduce this change it will doubtless be necessary to abolish individual examination in the lower standards at least, and assimilate them in this respect to the infant school. Another change will also be necessary, in the mode of interpreting the Education Acts which has hitherto been customary at Whitehall. Up to the present time there has been a tendency in the Government Departments to decline to recognize manual training as a form of instruction contemplated by the Acts, and in the well-known case of the Beethoven Street Board School, the London School Board were surcharged by the auditor with the cost of tools. The School Board failed to carry the question to the law courts, and so for a time the matter rested. Since then, however, the question has entered on a new phase. The Liverpool School Board, wishing to provide manual instruction in its schools, has obtained the opinion of Sir Horace Davey, Q.C., to the effect that such provision clearly comes within the power of School Boards. The Board has consequently taken steps to make the necessary provision, has appointed an instructor, and now only waits to be surcharged in order to carry the whole question to the Queen's Bench. Other School Boards are following suit, so that we must very shortly see the matter settled in one way or another. The legal question is interesting, not only in its bearing on manual training, but on the general powers of School Boards to give *any* extra instruction they please, provided they comply with all the regulations and requirements of the Education Department for the time being. If Sir Horace Davey's opinion is sustained, it carries with it the right of School Boards to provide any form of technical or manual instruction that can be given consistently with the regulations of Whitehall. Up to the present year, as we stated above, the Education Department was not altogether favourable to the views of Sir Horace Davey. But it is rumoured that of late the views of the authorities on the subject have undergone a change, and that it is probable that manual instruction may not only be recognized as legal, but actually incorporated as a grant-earning subject in the forthcoming Code. The rumour, which we sincerely hope is true, is confirmed by the fact that in the Scotch Code just issued a clause is inserted for the first time inviting school managers to submit as a class subject (earning a grant of 2*s*. or 1*s*. a head) "a course of manual instruction on a graduated system." The Scotch Education Department, therefore, has conceded the whole principle, and though of course Scotland has a separate Act, the admission is full of significance. It would be a trifle too absurd for the English Education Department to refuse to "recognize as educational" a subject which the Scotch Office thinks important enough to be encouraged by a grant.

In other respects the new Code just issued from Mr. Craik's office is a valuable index, if not of what we shall get, yet of what we may justly press for, in the coming English Code. It is, indeed, an enormous advance. Scotch members of Parliament sometimes complain that Scotch business attracts no attention at Westminster. The evil, however, has at least some compensating advantages. Unchallenged—almost unnoticed—the officials at the Scotch Education Office can quietly introduce by a stroke of the pen the reforms in the Code for which we in England have to wait year after year. It may serve a useful purpose if we recount a few of the reforms which Mr. Craik has been able to carry out this year in Scotch education. Of the abolition of fees we say nothing, for that was the result of legislation last session.

In the first place, individual examination in the elementary subjects, which had already been abolished in the first three standards, is now replaced by collective examination throughout the school. This change gives much greater elasticity and liberty of classification to the teacher, and to a great extent modifies the pressure of the system of payment by results.

In the next place, the system of class subjects is entirely revised. Several alternative courses in elementary science are suggested, including courses of "nature knowledge" in "animals," "vegetables," and "matter," for each of which simple and suitable suggestive syllabuses are laid down. Any other progressive scheme of teaching may be submitted to the inspector for approval. "In elementary science this scheme may be so framed as to lead up to the teaching of scientific specific subjects. It may include the subjects of navigation or the elementary principles of agriculture; and a course of manual instruction on a graduated system may also be submitted."

At the same time the regulation requiring either English or elementary science to be taken as one of the class subjects is rescinded. It is to be noticed that in Scotland an attempt was made in the previous Code to encourage science teaching by making it alternative to English as a compulsory class subject. It is somewhat disappointing to be told, as we are in the last Scotch Report, that the change has as yet produced but little increase in science teaching. This fact seems to support the suggestion of the Technical Association that science instruction (which gives more trouble and requires more appliances) should be encouraged by a slightly higher scale of grant than that allotted to other class subjects. But it also tends to suggest the possibility that part of the price which Scotland has to pay for the ease with which it can get educational changes carried out is a certain popular indifference to those changes which may go far to make them nugatory. Thus it is quite possible that the Departmental invitation to submit courses of manual instruction may produce far less effect on schools in Scotland than would be produced in England by a favourable decision of the law courts on a hotly disputed case such as that which may come before them in connection with the Liverpool School Board. The steam which has to be got up on this side of the Tweed in order to get a reform permitted will often supply the motive force which will get that reform carried out. The different fate which has attended the Scotch and the English Technical Instruction Acts hitherto is a case in point. The Scotch Act, passed with ease through an apathetic House, has fallen flat, while the English Act, badly drawn as it is, is arousing a great and increasing amount of interest in the country, and within the first six months is already in full swing in several districts.

But this is a digression. The recasting and improvement of the system of class subjects in Scotland is interesting not only in itself but as indicating a probable change of a similar kind in the English Code. Under these circumstances we must not fail to note the parallel change carried out in the schedule of "specific subjects." Almost the whole of the schedule which relates to science subjects—chemistry, mechanics, electricity, light and heat, physiology, botany, and physical geography—is entirely cancelled, and for the detailed syllabuses of these subjects is substituted a simple invitation to school managers to submit graduated courses in subjects not mentioned in the schedule. At first sight this seems a loss—as though the Department were moving in the direction of paying less instead of more attention to science. The alteration, however, must be read in conjunction with the reforms in class schedules and the observations on class and specific subjects in the last Report of the Scotch Education Department. Commenting on the fact that "the general development of class subjects tends to restrict the specific subjects," the Report proceeds: "this is a result not altogether to be regretted, as the influence of the class subjects is general, while that of the specific subjects is restricted to a few selected scholars."

Again, in the instructions to inspectors just issued, Mr. Craik explains one of the objects of the Department to be "to spread the beneficial results of any such higher teaching as may be given, to the whole school, instead of confining it to a few selected scholars."

It is clear, therefore, that the changes in the fourth and fifth schedules (which are probably the precursor of similar changes in the English Code) are dictated by a desire to extend class instruction in science, even if at the expense of specific subjects; in other words, to transfer natural science from its former position, as a smattering of a few special branches of physics imparted to a few pupils, to its proper place as a course of general stimulating instruction in the elements of "nature knowledge," given as an integral part of the school course to the school as a whole. More specialized science teaching can still be provided if desired in the form of specific instruction framed to suit local wants by the various school managers, or it may be given, as is already the case in many elementary schools, by means of science classes in connection with the Science and Art Department.

We cannot doubt that the Scotch Department is right in its policy, but the probable extension of class teaching under the new and more elastic *régime* suggests a doubt whether the proper way of introducing manual instruction is by means of including it among the class subjects, so long at least as the possible number of class subjects is restricted. Drawing—the only form of manual training previously recognized for boys—has already been put outside the range of class subjects. Needlework—the only other manual subject in the Code—may be taught either as a class subject or as part of the ordinary curriculum of the school. Is there not a chance that in including manual instruction among the class subjects an unnatural rivalry may be set up between this subject and elementary science, which may restrict the spread of both? All this, however, is a matter for the future. Meanwhile we have only to congratulate the Scotch on the improvement of the conditions under which in the future their schools will be carried on, and to express the hope that England will not lag behind.

One word in conclusion. It may be wondered why in this article, dealing with scientific and technical instruction in elementary schools, so little reference is made to the Technical Instruction Act of last session, either in respect of the powers which it confers on elementary school managers, or of those which, much to the regret of many politicians, it appears to withhold.

The real fact is that we have our doubts as to the need of any general Technical Instruction Act for elementary schools, and have a suspicion that their exclusion from the late Act was in reality a blessing in disguise. Of course, if the opinion of Sir Horace Davey (and now we are glad to be able to add, of the Scotch Education Department) should be upset in the law courts, it may be necessary to rectify the anomaly by a short Act of a single clause recognizing the legality of manual instruction. But, with this possible exception, no new powers are required by School Boards, and no new rate need be imposed. Mr. Mundella, in complaining of the exclusion of elementary schools from the late Act, compared the scheme to an educational ladder with the lower rungs left out. Let him be reassured—no rung is wanting so far as legislation is concerned. As at present advised, we feel clear that the managers of a public elementary school, so long as they comply with the requirements of the Department, may teach what extra subjects they please. The rating power possessed by a School Board is limited only by the wishes of the ratepayers. What really retards the introduction of technical and manual instruction is the want of imperial grants (which may and ought to be given through changes in the Code), the want of time, the pressure of other subjects, the ignorance of the public, and the parsimony of the ratepayers. But none of these obstacles can be removed by legislation. What legislation could and probably would do, would be to restrict the present powers of School Boards by defining them; and, perhaps, even to confine the rate for technical instruction within the limit of a penny in the pound. But this can hardly be what Mr. Mundella wants.

A DICTIONARY OF APPLIED CHEMISTRY.

A Dictionary of Applied Chemistry. By T. E. Thorpe, B.Sc. (Vict.), Ph.D., F.R.S., &c. Assisted by Eminent Contributors. In Three Volumes. Vol. I. (London: Longmans and Co., 1890.)

THE first volume of the "Dictionary of Applied Chemistry," edited by Prof. Thorpe, is a welcome addition to our scientific books of reference, and forms an admirable companion to the "Dictionary of Theoretical Chemistry," the second volume of which was reviewed some weeks ago.

In the preface Prof. Thorpe points out that, as this work has special reference to the applications of chemistry to the arts and manufactures, it deals but sparingly with the purely scientific aspects of the science, unless these have some direct and immediate bearing on the business of the technologist. How direct and how immediate such a bearing is at the present day, and how difficult, not to say impossible, it is to separate theory from practice, may be judged of by turning over the pages of this most useful volume.

Take, for example, the article on the azines, written by the most competent authority on that subject, Dr. Otto Witt, of Berlin. The untrained technologist will be completely at sea with the honeycomb of benzene rings with which he clearly explains the constitution of such well-known compounds as the safranenes, the splendid yellow dyes so ably investigated by Dr. Witt himself, whereas the manufacturer who has the theory of the subject at command is complete master of the situation. Or, again, let us turn to the next article, on the azo-colouring matters, communicated by another equally trustworthy authority, Prof. Meldola, covering 28 thickly-printed pages, in which the same necessary connection is seen. And no other example, perhaps, indicates more forcibly the enormous advance which applied chemistry has made in the last ten years, and its entire dependence upon abstract research. In proof of this, it needs only to be pointed out that the article concludes with a list of no less than 95 distinct patents on this one group of colouring matters, from March 12, 1878, to June 30, 1888, all of which are the result of original, chiefly German, research.

An examination of other important articles written by specially-qualified contributors indicates that each subject is brought up to the level of the present state of our knowledge. Let us look for a moment at the article on ammonia, contributed by Prof. Lunge, of Zurich. Here we find detailed reference to the newest forms of apparatus for the manufacture of ammonium salts, illustrated by excellent woodcuts of the Feldmann-still. Again, turning to the article on chlorine, we have to note the same completeness and technical grasp of the questions discussed. Thus, on p. 526, we find the method patented so long ago as 1866 by Mr. Brock, of Widnes, and now for the first time coming into general use, which has for its object the treatment of the exit gases from the bleaching-powder chambers by means of a dry lime-sprinkler, this not only removing a serious nuisance in the manufacture, but also recovering chlorine otherwise wasted.

Prof. Hummel, of Leeds, contributes an excellent article on bleaching; and here again we see that the newest processes are fully described, *e.g.* on p. 323 the Mather-Thompson bleaching process is fully noticed, and the electrical bleaching process of Hermite likewise referred to. As regards this latter, the conclusion arrived at is that now generally admitted by practical authorities, viz. that electrolytic bleaching cannot reasonably be expected to replace bleaching-powder at a price of £7 per ton.

One of the most valuable articles in the book is written by Mr. John Heron on brewing, in which he not only describes the most modern forms of brewing plant and processes, but gives a clear statement of the important researches of Pasteur and Hansen on the alcoholic ferments. As we all know, it was Pasteur who first directed attention to those other forms of Saccharomyces known as "wild" yeasts in fermenting yeasts and beer; but it is not so commonly understood that it was Hansen who taught us how to introduce into the liquid a seed yeast really free from "wild" forms. Since 1883 carefully selected types of yeast from pure cultures, according to Hansen's researches, have been introduced into Denmark, Norway, and Bavaria, with the most satisfactory results, whilst in England nothing of the kind has yet been done, although, at Burton several experiments have been made in this direction. Sufficient has already been done to show that several varieties of *Saccharomyces cerevisiæ* can be separated, which, however, do not differ morphologically, but may be distinguished from each other, inasmuch as they give entirely different results, both as to flavour brightness, attenuation of the beer, and to the mode of separation of the yeast. The proportion of these different varieties in various breweries seems to remain constant, and to give the peculiar flavour and appearance which the various fermented liquors possess.

Another article is that by Prof. Noel Hartley on cements, a subject which though of great importance is not usually considered of great chemical interest, but it has been made so by the writer. He points out the fact, certainly not known to the majority of chemists, that we owe to Lavoisier the first explanation of the phenomena of the baking and hardening of plaster of Paris. At so early an age as 21, he published a short note in the *Comptes rendus* of February 17, 1765, in which he showed that water is removed from the gypsum in two stages, that the first three-quarters of the combined water must be removed in order that the plaster shall afterwards set, but that if the whole of the combined water be removed, the gypsum becomes overburnt and loses its value as plaster.

It is probable that this volume will have even a larger sale than that of the corresponding "Dictionary of Pure Chemistry," and, as with that important work, so with this, the public may well be congratulated on possessing such a valuable book of reference so creditable to all concerned in its production. H. E. ROSCOE.

OATES'S ORNITHOLOGY OF INDIA.

The Fauna of British India, including Ceylon and Burma. Published under the authority of the Secretary of State for India in Council. Edited by W. T. Blanford. *Birds.* Vol. I. By Eugene W. Oates. Pp. i.—xx., 1—556. (London: Taylor and Francis, 1889.)

The Nests and Eggs of Indian Birds. By Allan O. Hume, C.B. Second Edition. Edited by E. W. Oates. Vol. I. Pp. i.—xii., 1—397. (London: R. H. Porter, 1889.)

THE two volumes on the birds of India, which Mr. Oates has recently published, will supply a much needed want. The period of twenty-six years which has elapsed since the publication of Jerdon's "Birds of India" has been prolific in ornithological work, to such an extent that a new adjustment of the scattered details which had accumulated since that time had become an absolute necessity. Mr. Oates has already won his spurs in the field of Indian ornithology; for his "Hand-book of the Birds of Burma," published in 1883, has always been looked upon as a standard work; and by coming to England, at great personal sacrifice, to write the bird volumes of the "Fauna of British India," he has deserved the gratitude of all zoologists. Those of us who are acquainted with the "Hand-book" before mentioned, will not be surprised to find that in the present volumes Mr. Oates has done his work in a thoroughly conscientious manner. Without commencing, as Jerdon did, with a general outline of ornithology, for which space was not available, Mr. Oates has contrived to give a condensed introduction, which will give the student some small idea of classification of passerine birds, with which this volume deals. We could have wished that the author had followed a more natural arrangement of passerine families, as his scheme of arrangement results in some very incongruous affinities, but these will doubtless be further explained when the author gives a detailed arrangement of the orders and families of birds in his third volume. As the furlough which has been granted to Mr. Oates is quite insufficient for him to finish the work in anything like a reasonable period, we are glad to learn that a representation has been made to the Government of India, by some of our leading men of science, for a further extension of leave, to enable the author to finish the work, which he has begun so creditably. It would be a thousand pities to see the completion of this book intrusted to less capable hands, of which there seems to be some fear expressed in Mr. Blanford's preface.

Since Mr. Seebohm, in the fifth volume of the "Catalogue of Birds in the British Museum," laid stress on the importance of the plumage of the young as distinguishing characters between the Thrushes and the Warblers, this character has been thoughtfully considered by many ornithologists; but Mr. Oates has been the first to apply it in any large measure to the bulk of the passerine birds, and it enables him to divide them into five sections, characterized by the plumage in the nestling. This arrangement brings about some rather startling results, for the Titmice (*Paridæ*) become merged in the family *Corvidæ*, and the Dongos (*Dicruridæ*) range in close proximity to the Nuthaches (*Sittidæ*) and the Creepers (*Certhiidæ*). This character of the plumage of the nestlings, like all single characters, carries the author too far, and it is becoming more and more plain every day that the natural classification of birds in the future will be founded on a combination of characters, not on any single one alone. Mr. Oates himself, in his arrangement of the *Crateropodidæ*, shows how this can be done.

It is impossible to praise too highly the method in which the present book has been worked out, though it is to be regretted that four volumes were not allowed for the birds, instead of three, for the constriction of the work has compelled the author to treat of 563 species in 544 pages, which is an allowance of less than a page to each species, including the space necessary for family characters and "keys" to genera and species. We notice that the author has been driven to create a good many new genera, but we are not disposed to quarrel with him on this account, though we notice that, like ourselves, in writing the "Catalogue of Birds," he has found it hard to be consistent, and he certainly varies somewhat in his estimate of characters in different families. Thus he divides the Bulbuls into a number of slenderly defined genera, yet he places the Rook and the Jackdaw in the same genus, *Corvus*, as the Raven. What was sauce for a Bulbul ought to have been sauce for a Rook! It is very interesting to notice the immense strides which our knowledge of Indian ornithology has made in the last twenty years. This is mostly due to the energy of Mr. Allan Hume, whose marvellous collection of Oriental birds was given by him to the British Museum in 1885. Since that date the registration and arrangement of the Hume Collection, has occupied the bulk of our own time and that of our colleagues in the Bird Room, so that the whole of the Indian Passeres have been placed conveniently at Mr. Oates's disposal for the present work. It may, indeed, be said that Mr. Hume sowed, the officers of the British Museum watered, and Mr. Oates came over from India in time to gather the increase. It must be a great pleasure to Mr. Hume, and to Major Wardlaw Ramsay, who gave the Tweeddale Collection and Library to the Museum two years ago, to see that already their magnificent donations have been turned to such good account.

The number of new species described by Mr. Oates is, as might be expected, small; but ornithology has now reached a stage when the description of new species will be surpassed in interest by the study of greater facts, of which the geographical distribution of birds is likely to prove the most absorbing. For this purpose the splendid Collection of skins amassed by Mr. Hume will be invaluable, for in most instances the specimens in the Hume collection trace out definitely the range of each species, and Mr. Oates has shown great talent in condensing into his limited space the large amount of material which was at his command. It is, in fact, impossible to speak too highly of the way in which he has performed his task.

The volume before us is profusely illustrated with woodcuts, which will undoubtedly be of great service to the student in enabling him to identify the species of birds which are to be met with in India. These woodcuts are, almost without exception, well executed, and are the best specimens of ornithological work which we have seen from the pencil of Mr. Peter Smit. We are not quite able to grasp the plan on which the names of Indian localities have been altered in the present book to bring them into a recognized system of correct orthography, but we suppose that there is some sound reason for the changes. If, however, our old friend "Mooleyit" is to become "Muleyit," and "Malewoon" to become "Malawun," why does not "Masuri" take the place of "Mussoorie"? Surely it is pedantic to alter the specific name of "nipalensis" to "nepalensis," because it suits modern notions to speak of "Nepal" instead of "Nipal." As this mode of orthography does not appear in any of Mr. Oates's previous writings, we suppose that the editor is responsible for the changes in the spelling of the names of places. We would gladly adopt a complete method of spelling the names of Indian localities, but that adopted in the present work seems neither one thing or the other.

It was a happy idea of Mr. Oates's to issue the new edition of Mr. Hume's "Nests and Eggs of Indian

Birds" in volumes of simultaneous issue with his volumes of birds. This egg-book of Mr. Hume's is one of the best oological works ever published, and has long been out of print. A good deal of the additional matter which Mr. Hume had accumulated for a second edition, was stolen by a dishonest servant, and sold for waste paper in the Simla Bazaar, but enough has remained to enable Mr. Oates to put before us a very interesting record of the breeding habits of Indian birds; and if any tribute be wanted to Mr. Hume's energy and ability, the reader has but to refer to the present work, to study the oological records of the best circle of field-ornithologists which ever rallied round the central figure of any zoologist. The portraits of naturalists who have contributed to the development of our knowledge of Indian birds lend an additional interest to Mr. Oates's volume on the "Nests and Eggs of Indian Birds."

R. BOWDLER SHARPE.

EPHEDRA.

Die Arten der Gattung Ephedra. Von Dr. Otto Stapf. Pp. 112, 1 Map and 5 Plates. (Vienna: R. Tempsky, 1889.)

EPHEDRA is one of the three genera of the small Gymnospermous order Gnetaceæ, the two others being Gnetum and Welwitschia, that most curious of all gymnospermous plants. Ephedra is a type of remarkable habit, specially modified, though in a different way from Welwitschia, to inhabit the dry and sandy regions of the world. It has shrubby stems, with copious slender, whip-like, straight or turning branches, foliar organs and flower-wrapper reduced to a minimum, unisexual mostly dioicous flowers in small catkins with dry imbricated scales, the female catkins containing one or two flowers only, and the males several, with from two to eight stamens with the filaments usually joined in a column. The species are numerous and difficult of determination, partly because the leaves are nearly suppressed, partly because the stems of all the species are very similar, and that it is needful to have both staminate and pistillate flowers to study before any given plant can be determined confidently.

The map shows clearly at a glance the geographical range of the genus. It surrounds the basin of the Mediterranean, climbs the lower levels of the Central European Alps, attains its highest development in Central Asia, reaching southward to the north of India and all through Arabia, northward to Lake Baikal and the Ural Mountains, and eastward to the western provinces of China; and reappears in the New World—in North America in California and Mexico, and in South America in the Andes and over a wide area south of the tropic from Chili across to Buenos Ayres. Though spread so widely over extra-tropical South America, it does not reach either the Cape or Australia, where the climate and soil seem so suitable for it. None of the single species have a very wide range, but it is one of the instances where a well-marked, sharply isolated generic type is represented in many different geographical areas by distinct specific types.

The present monograph is one of the best and most complete works of the kind that have lately appeared. It is extracted from the second part of the sixteenth volume of the *Denkschriften der Mathematisch-Naturwissenschaftlichen* class of the Kaiserlichen Akademie der Wissenschaften in Vienna. Dr. Stapf is one of the officials of the Botanic Garden of the University of Vienna, and has had the advantage of full command of material, both in the way of specimens and books. Two of the plates and a large proportion of the letterpress are devoted to the anatomy and morphology of the vegetative and reproductive organs of Ephedra. In the structure of the woody bundles Gnetaceæ establish some links of transition between Coniferæ and the typical Dicotyledons. Ephedra approximates in some points towards Casuarina. In the veining of its well-developed leaves Gnetum recedes from the ordinary Gymnospermous type. In Ephedra there is an unmistakable perianth to the male flower, but the homology of the outer wrapper of the seed is not so clear. Then follows the systematic portion of the monograph. Dr. Stapf admits twenty-eight certain and three imperfectly-known species, and for each of these he gives a diagnosis, a figure showing its essential characters, an extended description, and a full account of its synonymy and geographical distribution. He makes three sections, Alatæ, Asarea, and Pseudo-baccatæ, dependent mainly upon whether the seed is fleshy in a mature state, or dry and furnished with a wing. Then follows a list of local names, and a very full list of the books in which the genus is noticed, extending from Gerarde and Ray down to the present time. The monograph is one that deserves to be studied carefully, both by structural and systematic botanists.

J. G. B.

OUR BOOK SHELF.

Geological Mechanism; or, An Epitome of the History of the Earth. By J. Spottiswoode Wilson, C.E. (London and Manchester: John Heywood, 1890.)

THE nature of this little work of 135 pages will be best indicated by a brief statement of its contents. The book is divided into three portions of not very unequal length.

The first of these is "autobiographical," and relates, with much circumstance, the author's adventures at the Geological Society and Club, where, on the invitation of the late Sir Roderick Murchison, he read a paper in the year 1854. This is followed by an account (his own) of the causes which led to a disagreement between himself and the leaders of an exploring expedition of which he had been appointed a member. This part of the book is relieved from the charge of being prosaic, however, by the introduction of some very remarkable, and undoubtedly original verses.

Having devoted more than forty pages to himself, the author has left for the earth little more than fifty pages more; and in this space he contrives to dispose of a great number of highly important problems, beginning with "intelligence supreme; the nebular theory of Laplace; hypothesis of incandescence; theory of the crystalline rocks; hypothesis of metamorphism," &c.; and finishing up with "the lunar, magnetic, and solar tides; the progressive desiccation of the atmosphere and earth; the change of time; and the theory of creation."

Comprehensive as is this portion of the book, however, the author still finds much to put into his third part, or appendix—such as, "tails or atmospheres of planets and comets; the magnetic pole and change of climate; the magnetic tide of the atmosphere, &c." As in the first part he rose into poetry, here, in the appendix, he soars into the realms of prophecy, and tells us about the climate which may be expected in these islands in the years 1970, 2020, and 2130!

The author assures us that he writes especially for civil engineers, and is not careful to conceal his contempt for "prominent men in other branches of science" and their opinions. But as there are some works "profitable for instruction," so there are others calculated to afford amusement; and it is very hard indeed that civil engineers should have a monopoly of all the fun that is to be got out of this one.

The Scenery of the Heavens. By J. E. Gore, F.R.A.S. (London: Roper and Drowley, 1890.)

THE title of this work is so suggestive of pictures that one cannot help feeling disappointed with the limited number of illustrations, especially as the book is designed for general readers. We look in vain, for example, for representations of Saturn and Mars, solar prominences, and many other celestial objects, of which no descriptions can convey so much to the mind as good illustrations. Some of the illustrations are reproduced more or less faithfully from photographs by Mr. Roberts and the Brothers Henry, but we regret to note that the wonderful photograph by Mr. Roberts of the Great Nebula in Orion is not amongst these. We may suggest also that in future editions some account be given of the instrument which reveals to us the greater part of the "scenery of the heavens."

On the whole, the text is excellent, and will no doubt greatly interest the general reader. There is, however, a very loose statement on p. 24—namely, "if we assume that the attraction of gravitation at the earth's equator is 32·2 feet, we have the accelerating force of gravity on the sun equal to 895 feet per second." One of the most notable features of the book is the large number of poetical selections having reference to astronomical phenomena. The book contains a good deal of information, in some cases perhaps too much to serve the avowed purpose of the author, unless his readers intend to become amateur observers. The long lists of red stars, doubles, variables, and star clusters, for example, are much too detailed for general readers, although not sufficiently so for regular observers. The chapter on variable stars, as might be expected from Mr. Gore, is especially good. There is also an excellent chapter on shooting-stars, by Mr. Denning, who is eminently fitted for such a task.

We may remind Mr. Gore that probably no one now supposes that the so-called "gaseous" nebulæ consist of nitrogen (pp. 197, 206), and that the structure of the Great Nebula in Andromeda as revealed in Mr. Roberts's photograph indicates that the nebula is probably not "a vast cluster of very small stars placed at an immense distance from the earth" (p. 204).

No attempt is made to touch upon any theoretical astronomy, and the scope of the book is therefore correctly described by the title.

A Trip through the Eastern Caucasus. By the Hon. John Abercromby. (London: Edward Stanford, 1889.)

Is it worth while for a traveller to make a six weeks' tour the subject of a book? Probably most people would answer promptly and emphatically, No; but any one who reads Mr. Abercromby's work will see that the reply may be wrong, and that everything depends on the nature of the scenes visited, and on the traveller's ability to give an account of his impressions. In the course of six weeks Mr. Abercromby twice crossed the main chain of the Caucasus by passes which are little used except by natives. He was fortunate enough to secure, through the instrumentality of Prince Dondukoff Korsakoff, the Governor-General of the Caucasus, a circular letter in Russian and Arabic to all in authority wherever he might wish to go. This, he says, acted like a charm, securing for him at every place the utmost hospitality. He had, therefore, the best possible opportunities of seeing what he desired to see, and of forming just opinions as to the characteristics of the people whom he visited.

Particularly good is his description of the strange village called Kubächi, in which there was at one time a flourishing school of the higher kinds of artistic craftsmanship. The village is "a long, narrow, extremely compact agglomeration of houses, built on the southern face of a very steep slope with a shallow ravine on both sides." A high round tower, commanding a wide view, stands at the top. All the roofs are flat, and, seen against the sky, the profile of the village is not unlike "a gigantic staircase." Before reaching Kubächi, Mr. Abercromby heard all sorts of wonderful stories about the inhabitants, and was assured that they were of Frankish origin. He found that there was nothing specially European-looking in the type of face either of the men or women. They appeared to him "quite like the Lesgians, though milder in their manners, and less wild-looking." Their speech has no sort of relation to the Indo-European languages, but belongs to the Lesgian family. There are in the village many sculptured stones and other relics of a period when the workers of Kubächi had a genuinely artistic impulse; and of these remains Mr. Abercromby gives a remarkably clear and attractive account. Not less interesting in its way is his description of the extraordinary wall of Derbend, which, according to the current native belief, is 3000 years old. For this idea there is of course no real foundation. Mr. Abercromby, with the enthusiasm of a thorough antiquary, investigated this structure with the greatest care, and even readers who are not generally attracted by archæological research will find much to please them in his narrative. Altogether, the work is fresh and bright, and we recommend it to the attention of those who find in good works of travel intellectual refreshment and stimulus.

LETTERS TO THE EDITOR.

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

The Royal Society's Catalogue of Scientific Papers: a Suggested Subject-Index.

THE method advocated by Mr. J. C. McConnel (NATURE, February 13, p. 342) would undeniably be feasible. But I should pity the fellow-craftsman who should have to carry it out. The idea of numerical subdivision has been worked out by Prof. Dewey with great ingenuity and industry in his "Decimal Classification and Relative Index," 1885. We find, on referring to p. 31, that 016·9289551 will indicate the "Bibliography of Persian poets." Natural science occupies a place from 500–600, and does not seem to have been as yet reduced to an equal degree of elegant simplicity, for the subject of "observing chairs, &c.," is merely denoted by 522·28.

After this it does not seem over bold to pronounce the result one of the most amusing things in cataloguing literature. It is, however, surpassed by Mr. J. Schwartz's "King Aquila's Library," in which the system is fairly demolished. But the London inquirer into the actual working of such a cumbrous device may gain a useful hint by noting that at the Guildhall Library there is an alphabetical index to these totally unnecessary numbers. Indeed, one is found in Prof. Dewey's own book, and would, of course, be an absolute necessity in the proposed case.

No, a good subject-index can be constructed on much simpler lines. See, for example, Poole's "Index to Periodical Literature," which includes in its first supplement (1882–87) some 1090 volumes (indexed in 483 pages). Another example may be found in the subject-index at the end of the "List of Books of Reference in the British Museum Reading Room," 1889. In this some twenty thousand volumes are included, which would lead one to suppose that the size Mr. McConnell suggests is ample, not to say generous. I had hitherto supposed that a scientific writer does not necessarily treat of a fresh subject each time he writes.

Might I add that an index is not a pedigree or diagram, any more than a gazetteer is the same thing as a map? I fear that to mix up such distinct things would merely introduce an altogether needless difficulty. A CATALOGUER.

The Period of the Long Sea-Waves of Krakatão.

IN connection with the great explosion at Krakatão at 10 a.m. on August 27, 1883, a great wave was generated, which at Batavia, 100 miles distant, reached a height of 7½ feet above the ordinary sea-level. It was followed by a fairly regular series of fourteen waves, at intervals of about two hours, gradually diminishing in height. Captain Wharton, who writes this part of the Royal Society Report, is much puzzled by the long period. He says:—"If the wave was caused by any sudden displacement of the water, as by the falling of large masses of ejected matter and huge fragments of the missing portion of Krakatão, or by the violent rush of steam from a submarine vent through the water, it is hardly to be conceived that two hours would elapse before the following wave, the second of the series, started after it. . . . If, however, upheaval of the bottom of the sea, more or less gradual, and lasting for about an hour, took place, we should have a steady long wave flowing away from the upheaved area, which as it approached the shore would be piled up considerably above its normal height. Thus these waves of long period would be set up. . . . The water would flow back on the motion ceasing."

I do not understand how the series of waves would be produced by the sea-bottom being upheaved in the manner described. When the upheaval ceased, the water would probably flow back, and, after the centre of disturbance was reached, a second wave would be generated. But there would be no reason for the water flowing back a second time, and no more waves would be generated. Further, in another part of the Report, we find Prof. Judd expressing the opinion that no upheaval has taken place (p. 25).

Another explanation has occurred to me, which seems satisfactory. Let us assume, with Prof. Judd, that the first wave was due to a great quantity of fragments falling into the sea. This wave would be reflected by the shores of the Straits several times backwards and forwards, each time giving rise to a fresh disturbance, travelling out towards Batavia through the narrow opening to the east. Opposite Krakatão both on the northern and on the southern shore of the Straits is a great bay. The time a wave would take to travel from Krakatão to the head of the bay on the north is given by Captain Wharton at sixty-one minutes, and the distance to the head of the other bay is much the same. This agrees very well with the two-hour period. Moreover the first disturbance at Batavia would be a rise of the water, which was the case.

In a similar way some of the short periods observed at distant stations may have been due to peculiarities of the channels in which the tide gauges were placed.

Hotel Buol, Davos. JAMES C. M. MCCONNEL.

The Distances of the Stars.

YOUR note of Prof. Eastman's address to the Philosophical Society of Washington in your columns of February 13 (p. 351) raises some questions of interest on which I think the Professor is mistaken.

As regards the nearness of particular stars, there are several indications which astronomers have sought to verify by observation and computation. One of these is brightness; a second is large proper motion, and a third is a binary system easily separated by the telescope (especially if the period is comparatively short). Some persons have also supposed that red stars, variable stars, &c., are nearer than most of their neighbours. Stars possessing one or more of these characteristics have been selected for parallax measurements.

One of these characteristics being brightness, almost every bright star in the northern hemisphere and a good many of those in the southern have been at one time or another measured for parallax. But no one has attempted to measure the parallax of *all* stars of the third, fourth, fifth, or sixth magnitudes. Astronomers have selected from among these stars those which afford some striking indication of nearness, such as the great proper motion of 61 Cygni. If, therefore, we take the parallaxes arrived at in this manner for comparison, we are comparing the results attained for *all* stars of the first magnitude with those attained for a small number of exceptional stars of the fifth or sixth.

How far Prof. Eastman's data are otherwise trustworthy I need not consider. I may refer your readers to a very full list of paraxalles hitherto determined, published by Mr. Herbert Sadler in the February number of *Knowledge*, by which it will appear how discordant and untrustworthy these results are. But the exceptional character of Prof. Eastman's faint stars is sufficiently evident from the table itself. His first group, with mean magnitude 5·57, has a mean proper motion of 4″·93; the second group, with a mean magnitude 5·59, has a mean proper motion 2″·33. Surely Prof. Eastman does not mean that the average proper motion of stars of the magnitude 5·58 is 3″·63. There is not one star in a hundred of this degree of faintness which possesses such a proper motion as this. W. H. S. MONCK.

Dublin, February 15.

P.S.—It is possible that a sphere enclosing the thirty nearest stars to us would include more faint stars than bright ones; but I think it certain that it would not include as large a percentage of fifth magnitude stars as of first magnitude stars. The first magnitude stars do not exceed twenty, and a few of them seem to be very distant. The fifth magnitude stars are reckoned by hundreds, and a few of them are comparatively near.

The Longevity of Textural Elements, particularly in Dentine and Bone.

WHATEVER views we may take of the theories of Weismann, which at present occupy the attention of biologists, they may be hailed as giving new directions to research, and one of the subjects about which his allusions will probably lead to further inquiry is the length of time during which textural elements continue individually. I have used the word longevity at the top of this letter; but, perfectly admitting the justice of Weismann's criticism—that division into two, each of which is a unity like the first, is not death—I feel driven to the dire necessity of inventing a new word, *permanunity*, to denote permanence without division; and it is of such permanence or longevity of the undivided unit that I wish to note a circumstance which has recently presented itself to my mind.

Every anatomist is aware that the living elements of dentine are nucleated corpuscles with elongated branches, which are embedded in the matrix, and lengthen as the dentine increases in thickness, while the corpuscles themselves retire inwards, remaining at the boundary of the lessening pulp-cavity. The continuity of the tubes containing these fibres furnishes, as soon as one thinks of it, convincing proof that they are the same branches and the same dentine-corpuscles which are found when the dentine begins to be deposited and when it is completed. But the dentine begins in childhood, and may go on increasing in thickness in old age, with its tubes still continuous, though losing their regularity of position. Therefore, dentine-corpuscles continue alive and without division through the greater part of the life of the organism.

The interest of this is exceedingly great, if the relation of dentine to bone be considered. Bone has a matrix similar to dentine, and has branched corpuscles; but the bone-corpuscles differ from the dentine-corpuscles in becoming completely embedded in the mineralized matrix, without any attempt to retire from it, and thus come to have branches on every side. Under the microscope one can see in compact bony tissue that there is a continual reabsorption and redeposition of bone going on; and these alternating processes are brought about in a way which is easy to understand, though very generally misapprehended. In consequence, probably, of the very pressure exercised by the bony deposit on the corpuscles, the corpuscles are excited to absorb it; and one sees absorption spaces commencing sometimes in the centres of haversian systems, and sometimes in individual lacunæ. The activity thus aroused in the corpuscles causes them to enlarge and to attempt proliferation; which being in the first instance modified by their close surroundings leads to their being converted into large multinucleated masses, the so-called giant-cells or osteoclasts. But when a greater amount of room has been obtained, these masses separate up into corpuscles with one nucleus each, bone-corpuscles or osteoblasts, which, arraying themselves around the cavity, initiate the formation of new concentric laminæ of bone. Thus it is certain that the permanunity of the bone-corpuscle is very inconsiderable indeed. It may be difficult to define it exactly, but a general consideration of the rapid changes in the shafts of young bones leads me to think it probably much less than a year.

There is thus a very surprising contrast between the undivided persistence or permanunity of a bone-corpuscle and that of a dentine-corpuscle, which is in various respects so similar to it. While there are numerous instances of very short-lived corpuscles in the body, I am not aware that until now proof has been offered of the persistence of any living tissue-elements throughout the life of the organism. JOHN CLELAND.

Some Notes on Dr. A. R. Wallace's "Darwinism."

I HAVE just read this most interesting work, "Darwinism"—seeming to me the clearest and most useful account of the Darwinian theory of evolution ever yet published—and while reading it I have made note of a few matters which I may, perhaps, be allowed to touch on here.

On p. 43 are quoted the numbers of varieties of the two snails, *Helix nemoralis* and *H. hortensis*, enumerated by a French author—no doubt Moquin-Tandon. These numbers, however, fall far below those actually known at the present day. These snails vary in many ways, but taking variations of *banding alone*, I know of 252 varieties of *H. nemoralis*, and 128 of *H. hortensis*.

To further illustrate the extreme variability of the Mollusca, take the varieties of land and freshwater Mollusca found in the British Islands. Of the 88 species of land shells we have 465 named varieties, and of the 46 species of British freshwater shells are 251 varieties. So that, excluding probable synonymy, we have about 5 named varieties in Britain to every species of inland mollusc.

In the same way, the numbers of *Rosa* and *Rubus* quoted on p. 77 are below the mark. Of *Rosa canina*, 33 varieties are known in the British Islands, while the British *Rubi* number 63 supposed species.

A good example of a species "occupying vacant places in nature" (p. 110), is afforded by the little mollusc *Cæcilianella acicula*, which is simply organized, and lives in great numbers underground (*vide Naturalist*, 1885, p. 321).

The true cause (as it seems to me) of the variability of freshwater species seems hardly indicated on p. 110. All freshwater productions, except those inhabiting large river basins (as the Mississippi), present these peculiarities—they are exceedingly variable and plastic, so that we get few but polymorphic species. Now, for the successful spread of freshwater organisms, it is necessary that they should be *plastic*, to adapt themselves to the new environment of every pond or river, and the varieties thus required must *not become fixed species*, because it is their very changeability under new environment that makes them successful in the struggle for existence and increase. Freshwater forms migrate more than is commonly supposed, and the contents of any pond or river are ever varying. Hence the necessities I have indicated. These points are exceptionally clear in the case of the *Unionidæ* of Europe and North America (see *Science Gossip*, 1888, pp. 182–184).

Colorado presents an exception to the rule (p. 112), that two species of *Aquilegia* are rarely found in the same area. In Colorado we have *five* columbines, viz. *A. formosa*, *A. chrysantha*, *A. brevistyla*, *A. cærulea*, and *A. canadensis*. But *A. cærulea* is the only one that can be called abundant.

On p. 139, it is stated that specific characters are essentially symmetrical. Yet the ocelli and spots on the butterflies of the families *Satyridæ* and *Lycænidæ* surely afford specific characters, and they are frequently asymmetrical (see *Entomologist*, 1889, p. 6).

On p. 151, we are told that in Ireland hardly one of the land molluscs has undergone the slightest change. This is not quite true, as the following forms seem to be peculiar to Ireland: *Arion ater* var. *fasciata*, *Geomalacus maculosus* vars. *allmani*, *verkruzeni*, and *andrewsi*, *Limax arborum* var. *maculata*, *L. arborum* var. *decipiens*, *Succinea vitrea* var. *aurea*, and *S. pfeifferi* var. *rufescens*. But these peculiar forms are not more numerous (but less so) than would be found in almost any continental area of equal size.

The theory (p. 206) that a recent change of food-plant has to do with the presence of green and brown varieties of the larva of *Macroglossa stellatarum* seems hardly tenable, as so many larvæ of different species and genera vary in the same manner.

I have thought (*Ent. Mo. Mag.*, 1889, p. 382) that asymmetrical variation in insects occurred most often on the left side. On p. 217 it appears that the same thing occurs in some Vertebrata.

On p. 230 the idea of environment directly influencing the prevalent colours of organisms is put aside as improbable. Yet it has seemed that moisture was the cause of a certain phase of melanism, especially among Lepidoptera. Evidence bearing on this point has been given during the last few years in the *Entomologist*.

The land shells on the small islands off the coast of Kerry, Ireland, are pale in colour, as I have recorded in Proc. South London Entom. and N.H. Soc. for 1887, pp. 97–98.

The point on p. 233, about the conspicuous colours of the Aculeate Hymenoptera, seems open to question. In temperate regions, at least, the *Aculeata* are mostly of very dull colours—as the *Andrenidæ*, many of the *Apidæ*, and hosts of others. Even the brilliant green *Agapostemon* flies among bright green foliage and yellow flowers, and is not very conspicuous when alive in its native haunts. On the other hand, the non-aculeate *Chrysididæ* and *Chalcididæ* are often exceedingly brilliant in colouring.

It seems quite doubtful whether the abundance and wide distribution of *Danais archippus* (p. 238) is due to immunity from parasites, &c., while its migratory habits are a quite sufficient explanation of the facts. Besides, it has at least one parasite—the *Pteromalus archippi*.

The "progressive change of colour" (p. 298) is well illustrated by the change from yellow to scarlet exhibited by so many groups of species. Scarlet species nearly always occasionally revert to yellow, and there are generally yellow species in the same genus. For details see Proc. South Lond. Ent. and N. H. Soc. for 1887.

Yellow flowers (see p. 316) seem the most attractive to insects in Colorado, and Mr. F. W. Anderson tells me that the same is the case in Montana. From reasons given in *Canadian Entomologist*, 1888, p. 176, I am of the opinion that insects cannot distinguish red from yellow.

It has seemed to me (see p. 359) that the agency of wind in distributing insects is greatly exaggerated. I believe whirlwinds may be most important as distributing agents, but ordinary gales less so. Many species of insects migrate, but usually *during calms*. Also (p. 360) the opinion that insects are often carried to the summits of mountains by winds seems to me without sufficient support. Many species of insects *live* only or habitually at high altitudes, and their presence there is no proof that they were carried there by winds, especially when they are specifically distinct from the species of lower regions. *Plusia gamma*, on the summit of Mont Blanc, is not very remarkable, as the moth is a great wanderer, and quite capable of finding its own way to high altitudes. Finally, I believe winds very rarely blow *up* mountain slopes. I have lived some time at the base of the great Sangre de Cristo Range in Colorado, and although violent winds blow *down* very frequently, I have *never observed an upward wind*, and residents whom I have questioned are unanimous in saying that they have never known a strong wind blow *up* the mountains. And the way the trees are bent and twisted at timber-line (11,500 feet), often with only branches on the side towards the valley, well indicates the direction of the winds.

I think, perhaps, the scarcity of Monocotyledons in the Rocky Mountains (p. 401) as compared with northern regions, is more apparent than real—the difference indicated in the books being due to the fact that the western grasses are not so well known as the eastern ones. Ferns are rarer on continents than on islands, and the dryness of the Rocky Mountain region is unfavourable to them.

A good instance of the effect of environment (see p. 419) recently came under my notice. The polymorphic snail *Helix nemoralis* was introduced from Europe into Lexington, Virginia, a few years ago. Under the new conditions it varied more than I have ever known it to do elsewhere, and up to the present date 125 varieties have been discovered there. *Of these, no less than 67 are new, and unknown in Europe, the native country of the species!* The variation is in the direction of division of the bands. An incomplete list of these varieties is given in *Nautilus*, 1889, pp. 73–77.

It seems doubtful (see p. 433) how far prickles are a protection from snails and slugs. I found prickles in the stomach of *Parmacella* (a slug), as recorded in *Journal of Conchology*, 1886, pp. 26–27.

It is a minor matter, but it seems a pity that the nomenclature of the species in a standard work like "Darwinism" should not be scrupulously exact. Thus (p. 17), "*Phalæna*" *graminis* should be *Charæas graminis*. "*Helisonia*" (p. 44) should be *Helisoma*, and it is only a section, or subgenus, of *Planorbis*. On p. 235, "*filipendula*" and "*jacobeæ*" should read *filipendulæ* and *jacobææ*. "*Sphinx fuciformis*," of Smith and Abbott (p. 203), is really *Hemaris diffinis*, while on p. 204, "*Sphinx*" *tersa* is a *Chærocampa*, and "*Sphinx pampinatrix*" is *Ampelophaga myron*.

T. D. A. COCKERELL.

West Cliff, Custer Co., Colorado, January 22.

A Formula in the "Theory of Least Squares."

SOME time ago, having had occasion to investigate the relation between $\Sigma(x^2)$ and $\Sigma(v^2)$ in the "Theory of Least Squares," I found a simple formula which connects them, and which I have never seen given in any of the text-books on the subject. I inclose it, and hope it is worth publishing in your journal.

University of Toronto, February 1. W. J. LOUDON.

Let a number of observations be made on a quantity whose true value is T. If these observations be represented by M_1, M_2, M_3, . . . M_n, then the most probable value is A, the arithmetic mean, and $A = \frac{\Sigma(M)}{n}$. If, moreover, the true errors be denoted by x_1, x_2, x_3, . . . x_n, and the residuals by v_1, v_2, v_3, . . . v_n, then $\Sigma(v) = 0$ by the definition of the arithmetic mean. It is required to find a relation between $\Sigma(x^2)$ and $\Sigma(v^2)$. We have—

$$\begin{array}{lcl} x_1 = T - M_1 & \text{and} & v_1 = A - M_1 \\ x_2 = T - M_2 & & v_2 = A - M_2 \\ x_3 = T - M_3 & & v_3 = A - M_3 \\ \text{\&c.,} & & \text{\&c.,} \end{array}$$

from which $\Sigma(v) = 0$.

∴ equating equal values of M_1, M_2, M_3, . . . , &c., we get—

$$\left.\begin{array}{l} T - x_1 = A - v_1 \\ T - x_2 = A - v_2 \\ T - x_3 = A - v_3 \\ \text{\&c.} \end{array}\right\} \quad \text{or} \quad \begin{array}{l} x_1 = v_1 + T - A \\ x_2 = v_2 + T - A \\ x_3 = v_3 + T - A \\ \vdots \end{array}$$

$$\text{and adding} \quad \Sigma(x) = \Sigma(v) + n(T - A)$$

$$\text{and} \quad \Sigma(v) = 0.$$

$$\therefore \quad \Sigma(x) = n(T - A) \quad . \; . \; (1)$$

Again—

$$\begin{array}{l} x_1 = v_1 + T - A \\ x_2 = v_2 + T - A \\ \text{\&c.} \end{array}$$

∴ squaring, we have—

$$\begin{array}{l} x_1^2 = v_1^2 + 2v_1(T - A) + (T - A)^2 \\ x_2^2 = v_2^2 + 2v_2(T - A) + (T - A)^2 \\ x_3^2 = v_3^2 + 2v_3(T - A) + (T - A)^2 \\ \text{\&c.} \end{array}$$

$$\therefore \quad \Sigma(x^2) = \Sigma(v^2) + 2\{\Sigma(v)\}\{T - A\} + n(T - A)^2$$

But $\Sigma(v) = 0$; and from (1), $T - A = \frac{\Sigma(x)}{n}$;

$$\therefore \quad \Sigma(x^2) = \Sigma(v^2) + n\left\{\frac{\Sigma(x)}{n}\right\}^2$$

$$\Sigma(x^2) = \Sigma(v^2) + \frac{\{\Sigma(x)\}^2}{n}.$$

This is the exact formula; from which it may be seen that, as positive and negative errors are equally likely, a close approximation will be obtained by taking $\{\Sigma(x)\}^2 = \Sigma(x^2)$, neglecting $2\Sigma(xx^1)$.

And we obtain Gauss's formula—

$$\Sigma(x^2) = \Sigma(v^2) + \frac{\Sigma(x^2)}{n}, \quad \text{or} \quad \frac{\Sigma(x^2)}{n} = \frac{\Sigma(v^2)}{n - 1}.$$

Galls.

ADMITTING, with Prof. Romanes (NATURE, February 20, p. 369), the plausibility of Mr. Cockerell's view that galls may be attributed to natural selection acting on the plants directly, I beg leave to point out a very obvious difficulty—viz. the much greater facility afforded to the indirect action through insects, by the enormously more rapid succession of generations with the latter than with many of their vegetable hosts—oaks, above all.

Freiburg, Badenia, February 22. D. WETTERHAN.

The Cape "Weasel."

IN Prof. Moseley's account of his visit to the Cape of Good Hope ("Notes of a Naturalist on the *Challenger*," p. 153), the following sentence occurs:—"Again, there are tracks of the Ichneumon (*Herpestes*), called by some name sounding like 'moose haunt.'"

In Todd's "Johnson's Dictionary," 1827, we find: "*Mouse-hunt*, a kind of weasel;" two quotations being given:—(1) "You have been a mouse-hunt in your time" ("Romeo and Ju'iet," iv. 4). (2) "The ferrets and mouse-hunts of an index" (Milton, "Of Ref. in Engl.," B. 1).

Halliwell's "Dictionary of Archaic and Provincial Words" (1847) gives, on p. 564: "*Mouse hound, East.* A weasel." Halliwell denies the identity of this word with Shakespeare's mouse-hunt; and Nares ("Glossary") inclines to a similar view. But in any case it seems clear that Prof. Moseley's "moose-haunt" is a dialectical English form—mouse-hunt or mouse-hound; a general word for "weasel." E. B. TITCHENER.

3 Museum Terrace, Oxford, February 17.

The Chaffinch.

THE chaffinch sings almost throughout the year in this locality. The male bird never leaves us in winter like the female, and can be seen in large flocks daily. A singular circumstance that occurred here in December 1888 with regard to a chaffinch may be of interest. At one o'clock in the morning, during a gale, a chaffinch tapped at my study window. On this being opened, it flew into the room and roosted on a bookshelf; next morning it was liberated. This was repeated on two subsequent gales. Not only did it sing each time on being liberated, but all through the winter and spring it followed me about the garden, singing. E. J. LOWE.

Shirenewton Hall, near Chepstow, February 11.

ON THE NUMBER OF DUST PARTICLES IN THE ATMOSPHERE OF CERTAIN PLACES IN GREAT BRITAIN AND ON THE CONTINENT, WITH REMARKS ON THE RELATION BETWEEN THE AMOUNT OF DUST AND METEOROLOGICAL PHENOMENA.[1]

THE portable dust-counting apparatus, with which the observations given in the paper were taken, was shown to the meeting. The apparatus, which was described in a previous communication to the Society, is small and light. It is carried in a small sling-case measuring 8 × 5 × 3 inches. The stand on which it is supported when in use packs up, and forms, when capped with india-rubber ends, a handy walking stick, 1¼ inch in diameter and 3 feet long. No alterations have been made in the original design, and the silver mirrors which at first gave trouble and required frequent polishings, have been used every day for two or three weeks without requiring to be polished, when working in fairly pure country air.

With the paper is given a table containing the results of more than two hundred tests made with the apparatus. In addition to the number of dust particles there is entered in the table the temperature and humidity of the air, the direction and force of the wind, and the transparency of the air at the time.

The first series of observations were made at Hyères, a small town in the south of France, situated about 2 miles from the Mediterranean. The observations were made on the top of Finouillet, a hill about 1000 feet high. The number of particles on different days varied here from 3550 per c.c. to 25,000 per c.c., the latter number being observed when the wind was blowing direct from Toulon, which is distant about 9 miles.

Cannes was the next station, the observations being

[1] Abstract of Paper read before the Royal Society of Edinburgh on February 3. Communicated by permission of the Council of the Society.

made on the top of La Croix des Gardes. The number here varied from 1550 per cubic centimetre, when the wind was from the mountainous districts, to 150,000 when it came from the town.

At Mentone the number varied from 1200 per cubic centimetre in air from the hills to 7200 in the air coming from the direction of the town.

Tests were made of the air coming towards the shore from the Mediterranean at three different places—at La Plage, Cannes, and Mentone. In no case was the amount of dust small. The lowest was 1800 per cubic centimetre, and the highest 10,000 per cubic centimetre.

Observations were also made at Bellagio and Baveno, on the Italian lakes. At both stations the number was always great—generally from 3000 to 10,000 per cubic centimetre. This high number was owing to the wind, during the time of the observations, being light and southerly—that is, from the populous parts of the country. Smaller numbers were observed at the entrance to the Simplon Pass and at Locarno, at both of which places the wind blew from the mountains when the tests were being made.

A visit of some days was made to the Rigi Kulm. On the first day, which was May 21, the top of the mountain was in cloud, and the number of particles was as low as 210 per cubic centimetre. Next day the number gradually increased to a little over 2000 per cubic centimetre, after which the number gradually decreased till on the 25th the number was a little over 500 per. cubic centimetre at 10 a.m. On descending the mountain to Vitznau the same day, the number was found to be about 600 per cubic centimetre at midday, and in the afternoon at a position about a mile up the lake from Lucerne the number was 650 per cubic centimetre.

Most of the observations taken of Swiss air show it to be comparatively free from dust. This is probably owing to the vast mountainous districts extending in many directions. It is thought that much of the clearness and brilliancy of the Swiss air is due to the small amount of dust in it.

Owing to the kindness of M. Eiffel an investigation of the air over Paris was made on the Tower on May 29. The day was cloudy and stormy, with southerly wind. Most of the observations were taken at the top of the Tower, above the upper platform, and just under the lantern for the electric light. The number of particles was found to vary very rapidly at this elevation, showing that the impure city air was very unequally diffused into the upper air, and that it rose in great masses into the purer air above. Between the hours of 10 a.m. and 1 p.m. the extreme numbers observed were 104,000 per cubic centimetre and 226 per cubic centimetre. This latter number was obtained while a rain-cloud was over the Tower, and, as the shower was local, the descending rain seems to have beaten down the city air. The low number continued some time, and was fairly constant during the time required for taking the ten tests of which the above low number is the average.

The air of Paris was tested at the level of the ground on the same day, the observations being made through the kindness of M. Mascart in the garden of the Meteorological Office in the Rue de l'Université. The number on this day varied from 210,000 to 160,000 per cubic centimetre.

Very few tests have been made of the air of London. The air coming from Battersea Park, when a fresh wind was blowing from the south-west, on June 1, was found to vary from 116,000 to 48,000 per cubic centimetre. The numbers observed in cities are of no great value, as so much depends on the immediate surroundings of the position where the tests are made; so that, while no ow number can be observed, a very high one can always be obtained. Those recorded were taken where it was thought the air was purest.

Observations have been made in Scotland for periods of two or three weeks at three stations—namely, at Kingairloch, which is situated on the shore of Loch Linnhe, and about fourteen miles to the north of Oban, at Alford in Aberdeenshire, the observations being made at a distance of two miles to the west of that village, and at a situation six miles north-west of Dumfries.

At Kingairloch the number varied from 205 per cubic centimetre to 4000 per cubic centimetre. At Alford from 530 to 5700 per cubic centimetre, and at Dumfries from 235 to 11,500 per cubic centimetre. These three stations were in fairly pure country air—that is, pure as regards pollution from the immediate surroundings.

Tests were also made of the air on the top of Ben Nevis on August 1, when the number was found to be 335 per cubic centimetre at 1 p.m., and 473 two hours later. On the top of Callievar, in Aberdeenshire, on September 9, the number was at first 262, and rose in two hours to 475 per cubic centimetre.

The pollution of the earth's atmosphere by human agencies is then considered, and it is pointed out that, while on the top of the Rigi and in the wilds of Argyllshire air was tested which had only a little over two hundred particles per cubic centimetre, near villages the number goes up to thousands, and in cities to hundreds of thousands. The increase, though great, is shown not to be in proportion to the sources of pollution, and it is pointed out that part of this is owing to the impure stream of air being deepened as well as made more impure.

About 200 particles per cubic centimetre is the lowest number yet observed, but we have no means of knowing whether this is the lowest possible, or of knowing how much of this is terrestrial and how much cosmic, formed by the millions of meteors which daily fall into our atmosphere. Even in the upper strata there seems to be dust, as clouds form at great elevations.

The effect of dust on the transparency of the atmosphere is then discussed with the aid of the figure in the table. It is shown that the transparency of the atmosphere depends on the amount of dust in it, and that the effect of the dust is modified by the humidity of the air. With much dust there is generally little transparency, but it is pointed out that air with even 5000 particles per c.c. may be clear, if it is so dry as to depress the wet-bulb thermometer 10° or more. By comparing days on which there was the same amount of dust, it is seen that the transparency varied with the humidity on two days with the same amount of dust; but the one with a wet-bulb depression of 13° was very clear, while the other, with a wet-bulb depression of only 2°, was very thick.

To show the effect of the number of particles on the transparency, a number of days are selected on which the humidity was the same, when it is seen that when the wet-bulb was depressed 4°, with 550 particles the air was clear, medium clear with 814, but thick with 1900. From the table a number of cases are taken illustrating the dependence of the transparency of the air on the number of particles in it, and on the humidity, both dust and humidity tending to decrease the transparency. Humidity alone seems to have no influence on the transparency apart from the dust, but it increases the effect of the dust by increasing the size of the particles.

The modifying effect of the humidity is shown to be influenced by the temperature. The same wet-bulb depression which will give with a given number of particles a thick air at a temperature of 60° will give a clearer air if the temperature be lower. This is illustrated by examples taken from the table. The increased thickening effect accompanying the higher temperature will be due to the increased vapour-pressure permitting the dust particles to attach more moisture to themselves. These remarks all refer to what takes place in what is called dry air—that is, air which gives a depression of the wet-bulb thermometer.

The conclusion come to from the consideration of all the observations is that the dust in the atmosphere begins to condense vapour long before the air is cooled to the dew-point. It seems probable that in all states of humidity the dust has some moisture attached to it, and that, as the humidity increases, the load of moisture increases with it.

Another method of testing the condensing power of dust for water-vapour is then described. In working this method the dust is collected on a glass mirror, and its condensing power is determined by placing the mirror over a cell in which water is circulated, in the manner of a Dines hygrometer. The temperature at which condensation takes place on the dust and on a cleaned part of the glass is observed. The difference in the two readings gives the condensing power of the dust. One kind of dust artificially prepared was found to condense vapour just at the dew-point, while another condensed it at a temperature 17° above the saturation-point. The atmospheric dust was collected on the mirrors on the same principle as that used in the thermic filter described by the author in a previous paper, the dust being deposited by difference of temperature, the necessary heat being obtained by fixing the collecting mirrors on a window-pane. Dust was also collected by allowing it to settle on the plates. The atmospheric dust was found to condense vapour at temperatures varying from 1°·8 to 4°·5 above the dew-point. This condensing power of dust explains why glass such as that in windows, picture frames, &c., often looks damp while the air is not saturated; and in part it explains why it is so necessary to keep electrical apparatus free from dust, if we wish to have good insulation.

The constitution of haze is then considered. It is shown that in many cases it is simply dust, on which there seems to be always more or less moisture. But as what is known as haze is generally seen in dry air, the effect is principally due to dust.

Some notes from the Rigi Kulm are given, where "glories" and coloured clouds were seen. The condition of the transparency of the lower air as seen from the top of the mountain is discussed with the aid of the observations made by observers at the lower levels. These observations were kindly supplied by M. Bilwiller, of the Swiss Meteorological Office. The difference observed at the top of the mountain in the transparency of the air in different directions is shown to have been caused by a difference in the humidity of the air in the different directions. The variation in the number of particles on the top of the mountain is considered, and it is shown that the great increase in the number which took place on the second day was probably due to the valley air being driven up the slopes, reasons being given for this supposition. The colouring in clouds, and on scenery at sunrise and sunset, as seen from the tops of mountains and valleys, is remarked upon, and it is shown that there is reason for supposing that when seen from the lower level the colours will generally be the more brilliant and varied.

The relation of the amount of dust to the barometric distribution is then investigated—as to whether cyclonic or anticyclonic areas have most dust in them. It is shown that there is most dust in the anticyclonic areas. The interpretation of this, however, is shown to be that the amount of dust depends on the amount of wind at the time, and as there is generally little wind in anticyclonic areas, there is generally much dust. Diagrams are given showing by means of curves the amount of dust on each day, and also the velocity of the wind. The curves are found to bear a close relation to each other—when the one rises the other falls. The only exceptions to this are when the stations where the observations were made are not equally surrounded in all directions by sources of pollution. In that case, even with little wind, if it blows from an unpolluted direction the amount of dust is not great.

The increase in the dust particles which takes place when the wind falls, seems to point to a probable increase of the infection germs in the atmosphere when the weather is calm. As, however, the conditions are not quite the same, the organic germs being much larger than most of the dust particles, and settling more quickly, it may be as well, while accepting the suggestion, to refrain from drawing any conclusion.

In all the fogs tested, the amount of dust has been found to be great. This is shown to be what might now be expected from a consideration of the conditions under which fogs are formed. One condition necessary for the formation of a fog is that the air be calm. But when the air is calm both dust and moisture tend to accumulate, and the dust, by increasing the radiating power of the air, soon lowers its temperature and causes it to condense vapour on the dust and form a fog. The thickness of a fog seems to depend in part on the amount of dust present, as town fogs, apart from their greater blackness, are also more dense than country ones. The greater amount of dust in city air, by increasing its radiating power, it is thought, may be the cause of the greater frequency of fogs in town than in country air.

At the end of the paper some relations are pointed out between the amount of dust and the temperature at the time the observations were made, showing that when there was a large amount of dust there was also a high temperature; and some speculations are entered into as to the effect of dust on climate. But it is at the same time pointed out that the observations are far too few and imperfect to form a foundation for any important conclusi n on that subject.

In a short appendix is given the result of some tests made between January 23 and 29 of this year at Garelochead. During the gale on Saturday, the 25th, the number was rather under 1000 per cubic centimetre. On Monday, though the wind was still high, the number fell to about 250; and on Tuesday, when the wind had fallen and veered to the north, the number fell lower than had been previously observed. The number varied from a little over 100 to about 90 per cubic centimetre. On this day the air was remarkable for its clearness, the sun was very strong, and the evening set in with a sharp frost.

JOHN AITKEN.

P.S.—The author of the paper also showed at the same meeting of the Society the apparatus which have just been constructed from his designs for the Observatory on Ben Nevis. The apparatus has been constructed by the aid of a Government grant, obtained by the Council of the Scottish Meteorological Society, for the purpose of carrying on the investigation on the dust in the atmosphere at the top of Ben Nevis. Two complete sets of apparatus were shown. The one is the large laboratory form of the dust-counter, and is to be fixed, in the meantime, in the tower of the Observatory; the air being taken in to it by means of a pipe. The other is the small portable form of instrument, to be used when the direction of the wind is such as to bring the smoke of the Observatory towards the tower. This latter instrument has for a short time been in the hands of Mr. Rankin, one of the Ben Nevis observers, who has been practising with it near Edinburgh before beginning regular work at the Observatory.

A UNIFORM SYSTEM OF RUSSIAN TRANSLITERATION.

UP to the present time no one system of transliterating Russian names and titles into English has been generally adopted. Some of those most interested in the cataloguing and recording of Russian scientific literature have therefore arranged the following scheme in order to secure the general use of a system which will enable those unacquainted with Russian, not only to transliterate from that language into English, but also to recover the original Russian spelling, and so to trace the words in a dictionary.

RUSSIAN-ENGLISH.

Roman. Capital.	Roman. Small.	Written. Capital.	Written. Small.	English equivalents.	Roman. Capital.	Roman. Small.	Written. Capital.	Written. Small.	English equivalents.
А	а	А	а	*a*	Ф	ф	Ф	ф	*f*
Б	б	Б	б	*b*	Х	х	Х	х	*kh*
В	в	В	в	*v*	Ц	ц	Ц	ц	*tz*
Г	г	Г	г	*gh*	Ч	ч	Ч	ч	*ch*
Д	д	Д	д	*d*	Ш	ш	Ш	ш	*sh*
Е	е	Е	е	*e*	Щ	щ	Щ	щ	*shch*
Ж	ж	Ж	ж	*zh*					
З	з	З	з	*z*	Ъ	ъ	Ъ	ъ	ʻ *Not indicated at end of word.*
И	и	И	и	*ī*					
І	і	І	і	*i*	Ы	ы	Ы	ы	*ui*
К	к	К	к	*k*					
Л	л	Л	л	*l*	Ь	ь	Ь	ь	ʼ *Not indicated at end of word.*
М	м	М	м	*m*					
Н	н	Н	н	*n*	Ѣ	ѣ	Ѣ	ѣ	*ye*
О	о	О	о	*o*	Э	э	Э	э	*é*
П	п	П	п	*p*	Ю	ю	Ю	ю	*yu*
Р	р	Р	р	*r*	Я	я	Я	я	*ya*
С	с	С	с	*s*	Ѳ	ѳ	Ѳ	ѳ	*th*
Т	т	Т	т	*t*	Ѵ	ѵ	Ѵ	ѵ	*œ*
У	у	У	у	*u*	Й	й	Й	й	*ĭ*

ENGLISH-RUSSIAN.

a	А	*ī*	И	*p*	П	*ui*	Ы
b	Б	*ĭ*	Й	*r*	Р	*v*	В
ch	Ч	*k*	К	*s*	С	*ya*	Я
d	Д	*kh*	Х	*sh*	Ш	*ye*	Ѣ
e	Е	*l*	Л	*shch*	Щ	*yu*	Ю
é	Э	*m*	М	*t*	Т	*z*	З
f	Ф	*n*	Н	*th*	Ѳ	*zh*	Ж
gh	Г	*o*	О	*tz*	Ц	ʻ	Ъ
i	І	*œ*	Ѵ	*u*	У	ʼ	Ь

With reference to some of the letters a few words of explanation are necessary.

gh is adopted in preference to *g* for г, since this letter is also the equivalent of *h* in such words as Гидра, which, if transliterated *gīdra*, would lose its resemblance to the word *hydra*, with which it is identical.

Although і and и have the same sound, and with a few rare exceptions the letter used in the original may be recognized by a simple rule, it is recommended that the latter should be distinguished by the sign ‾, since the use of the same English symbol for two Russian characters is objectionable.

The semi-vowels, ъ and ь, must be indicated when present, except at the end of a word, by the sign ʻ placed above the line; otherwise, the transliteration of two Russian characters might give the same sequence as one of the compound equivalents, and it would become difficult to trace the words in a dictionary.

As regards the compound equivalents, nine out of the twelve may be at once recognized, since *h* must always be coupled with the preceding, and *y* with the succeeding, letter.

Where proper names have been Russianized, it is better whenever possible to use them in the original form rather than to re-transliterate them; there is no reason why *Wales* should be rendered *Uel's*, or *Wight* written as *Uait*. When a Russian name has a more familiar transliterated form, it is advisable to quote this as well as an exact transliteration with a cross reference.

The system will be adopted without delay in the following publications: the Catalogue of the Natural History Museum Library; the Zoological and Geological Records; the publications of the Royal Society, the Linnean, Zoological, and Agricultural Societies, and the Institution of Civil Engineers; the Mineralogical Magazine, and the Annals of Botany; and it is hoped that the system will be generally used.

An expression of grateful thanks is due to those who have assisted in the arrangement of this system by criticisms and suggestions; more especially to Madame de Novikoff and N. W. Tchakowsky.

The undersigned either accept the proposed system in the publications with which they are severally connected, or express their approval of the same:—

W. H. Flower, C.B. ... *Director, Natural History Museum.*
W. R. Morfill ... *Reader in Russian, &c., Oxford.*
F. Löwinson-Lessing ... *University, St. Petersburg.*
S. H. Scudder ... ... *U.S. Geological Survey.*
W. H. Dall ... ... *Smithsonian Institution.*
B. Daydon Jackson ... *Bot. Sec., Linnean Society.*
P. L. Sclater .. .. *Zoological Society.*
F. E. Beddard ... ... *Zoological Record.*
W. Topley ... ...
C. Davies Sherborn ... } *Geological Record.*
I. Bayley Balfour ... ...
S. H. Vines ... ... } *Annals of Botany.*
H. A. Miers ... ... *Index to Mineralogical Papers.*
J. T. Naaké... ... ... *British Museum.*
B. B. Woodward ... ... *Natural History Museum Library.*
J. W. Gregory ... ... *Natural History Museum.*

THE BOTANICAL INSTITUTE AND MARINE STATION AT KIEL.

PROF. J. REINKE contributes to the *Botanisches Centralblatt* a very interesting account of the Botanical Institute at Kiel, and of the Marine Station attached to it, as far as they are employed for botanical researches.

The harbour of Kiel is remarkably favourable for the observation of marine Algæ and the investigation of their life-history. In brown seaweeds the immediate neighbourhood is exceedingly rich, being scarcely inferior in the number of species to any other spot on the coasts of Europe. One important order, the Dictyotaceæ, is altogether wanting; but another very interesting order, the Tilopterideæ, is well represented. In green Algæ, the large Siphoneæ of the Mediterranean and other warmer seas are represented only by *Bryopsis*. Of red Algæ, the number of species and genera is inferior to that found in the Mediterranean or on the coasts of England and France; but almost all the different types of growth are well represented. Although the Baltic has, like the Mediterranean, no tides, the sea-level of Kiel harbour falls so considerably with a south wind, that many littoral Algæ are then completely exposed.

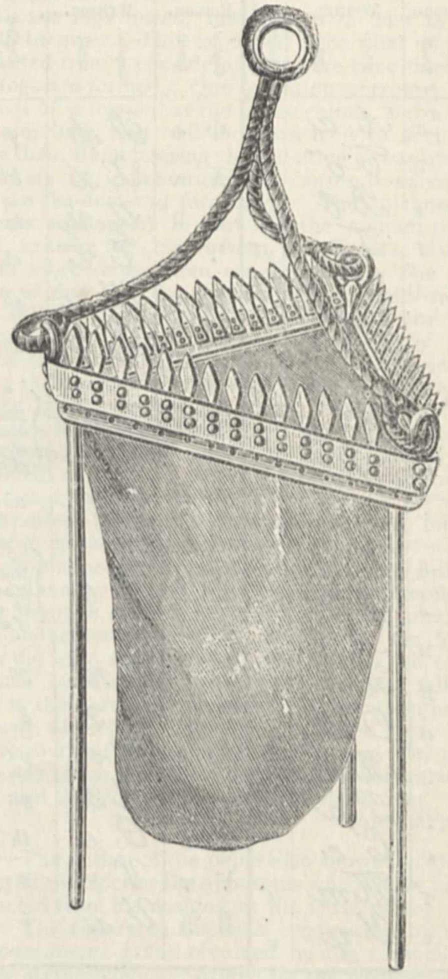
The growing-houses consist of a horse-shoe-shaped block of buildings, on one side of which is a long low house, and of a detached underground house. In designing the plan, the object specially kept in view was to furnish favourable conditions for the cultivation of all the important types of warmer climates; and the houses were therefore not built higher than seemed absolutely necessary. The chief part of the block consists of a higher and a lower cool-house, a higher and a lower hot-house, and a propagating-house. The higher houses are eight, the lower four metres in height, and the propagating-house still lower. Each of the lower houses is again divided into two, for different temperatures. The warmer division of the lower hot-house contains three basins for the culture of tropical fresh-water plants. The propagating-house is, in the same way, divided into two. The underground house is a long building entirely buried, the glass roof alone projecting above the surface of the ground. The heating is effected by hot-water pipes.

The various study-rooms are devoted partly to morphological and systematic, partly to physiological work. The former comprise a large herbarium in the top story, and four roomy work-rooms on the ground floor, in which are also kept those portions of the herbarium which are required for reference for the work in hand, and the whole of the dried Algæ. The first story is devoted to the residence of the Director. One of the work-rooms is devoted entirely to marine Algæ; each is fitted up with microscopical apparatus, and they are furnished with a very extensive reference-library. The second portion comprises a room with a small chamber opening out of it for chemico-physiological work; a room with stone floor, facing the north, for physico-physiological work; and a dark chamber with a balcony in the top story. Before the balcony a large sandstone slab is let into the wall of the building for the erection of a heliostat. In the basement story is a dynamo-machine.

For the collection of the seaweeds both row-boats and steamers are employed. For scraping the larger species off the rocks, Dr. Reinke has contrived a special drag-net, of which a drawing is appended, furnished with a row of sharp teeth at the mouth.

The culture of seaweeds presents greater difficulties in summer than in winter. They continue to grow in the Baltic at any temperature above zero C.; and, in cultivation, a low temperature is much more favourable to their growth than a high one. In the Institute they continue to fructify through the winter in the cool houses if protected from actual frost, the smaller species going through their complete cycle of development from the germinating spore; but a frequent change of the sea-water, or the addition of nutrient substances, is desirable. In summer the incidence of direct sunlight must be carefully avoided, and the temperature of the air must be kept as low as possible. For this purpose ice-cupboards have been built. Prof. Reinke has contrived a special arrangement for the cultivation of seaweeds in their native habitat. In the harbour near to the Botanic Garden, a wooden buoy is anchored, from which is suspended a wire basket by chains from 3 to 4 metres in length. In this floating aquarium the seaweeds grow exposed to their most favourable natural conditions of currents and variations of temperature in the water during the summer months. Next spring it is proposed to build an aquarium for seaweeds for public exhibition in connection with the Institute.

The Government of Prussia has rendered great assistance in the establishment of the Botanical Institute and



Marine Station at Kiel through its Minister for Education. The Director is very anxious that, especially in the department of marine Algæ, the herbarium and library, already so rich, should be rendered still more complete, by the addition of specimens or of treatises published in journals in which it may still be deficient.

SIR ROBERT KANE, LL.D., F.R.S.

SIR ROBERT KANE was born on September 24, 1810, in Dublin. This was the fiftieth year of King George III. and the tenth of the Union. Shortly afterwards his father established chemical works on the North Wall, by the side of the River Liffey, which in time developed into important and well-known sulphuric acid and alkali works. His mother was Ellen Troy, of whose family Dr. Troy, Roman Catholic Archbishop of Dublin, was a member. Sir Robert Kane very early in his life developed a taste for chemical knowledge, and in 1828 his first paper, "On the Existence of Chlorine in the Native Peroxide of Manganese," was published, and followed by a series of contributions on kindred themes. He entered Trinity College, Dublin, in 1829, and proceeded to his B.A. degree in the spring commencements of 1835, taking the LL.D. in the summer of 1868. In 1834 he was appointed Professor of Natural Philosophy to the Dublin (now the Royal Dublin) Society, and he at this period devoted himself with great ardour to original research in the field of chemistry, as the long list of his papers in the Royal Society's list will testify. He studied in Germany during his summer vacations under both Liebig and Mitscherlich, and passed some time under Dumas at Paris. In 1831 he was elected a member of the Royal Irish Academy; he was Secretary of its Council from 1842 to 1846, and was elected President in 1877. In 1849 he was made a Fellow of the Royal Society; shortly afterwards he was selected by the Government as head of the Museum of Irish Industry, which post he held until appointed the first President of the Queen's College, Cork. He was a Fellow of the King and Queen's College of Physicians, Ireland, a Commissioner of National Education, and a Justice of the Peace, Ireland.

After over twenty-two years of hard and earnest work in the development of the Cork College, he resigned the presidency in 1873, and took up his residence in Dublin, where he died on Sunday, the 16th instant.

Sir Robert Kane, in addition to the very numerous papers above referred to, was the author of a large and most important work on the industrial resources of Ireland, a theme which he handled in a painstaking and judicious manner. In his very early days he had acquired a practical knowledge of the value and importance of many of the neglected industries of Ireland, and from his chair in the lecture theatre of the Dublin Society, he often called attention to this subject, one which throughout his long life he never lost sight of. It is not without interest to note the fact that much is owing to the Royal Dublin Society for the ready help afforded to their two Professors, now both deceased, Sir Richard Griffith and Sir Robert Kane, in their efforts to advance the industries of Ireland.

In 1841, Sir R. Kane was awarded by the Royal Society a Royal Medal for his researches into the chemical history of archil and litmus; and in 1843, the Cunningham Gold Medal of the Royal Irish Academy, for his researches on the nature and constitution of the compounds of ammonia. These memoirs will be found published in the Transactions of the respective institutions.

In recognition of his scientific labours, and on his appointment to the presidency of Queen's College, Cork, he received knighthood in 1846 from Lord Heytesbury, the then Irish Viceroy. On the passing of Mr. Fawcett's Act in 1875, which altered the constitution of the University of Dublin, and appointed a Council, Sir Robert Kane was elected one of the first Roman Catholic members of that body, a post which he held until 1885, when the late Dr. Maguire was elected.

In this brief obituary notice, it is not necessary to attempt any analysis of the scientific work accomplished by Sir Robert Kane, but it is impossible to conclude it without a tribute of respect and affection to the many high and excellent qualities of the man, who in the various positions of Professor, head of a young educational establishment, or President of an Academy, won equally, from all with whom he came in contact, regard and esteem.

NOTES.

PROF. SCHUSTER has been elected Bakerian Lecturer for the present year. The lecture is to be delivered in the apartments of the Royal Society on March 20.

LAST week Mr. Justice Kay complained that judicial time is sadly wasted over patent cases, and he declared that the smaller and more petty the dispute the more time seemed to be expended. Now, as we have pointed out more than once, enormous waste of time is inevitable where the suitors in patent cases, especially in cases which involve scientific details, as most of them do at the present day, have to appear before a judge who is not himself a man of science. They have to begin by teaching his lordship the rudiments of that branch of science of which the disputed patent is a practical application. That our judges are painstaking, rapid, and acute pupils may readily be granted, but still time has to be consumed in the task, and there is something pathetic in the spectacle of an able and conscientious lawyer wrestling with the problems presented by the highest applications of, say, electricity or chemistry to industry, while scientific witnesses are contradicting each other all round him. We fear that judicial time will continue to be wasted so long as judges without a knowledge of science are left unaided to decide questions which demand long scientific training. There can be no change for the better until judges have sitting on the bench with them scientific assessors as they have now nava assessors, or until scientific cases are passed on as a matter of course to qualified referees as cases involving accounts are. It requires at least as much special training, and is as far outside the experience of ordinary lawyers, to settle a scientific case, as to decide whether a ship has been properly navigated, or whether a set of accounts tell in favour of a plaintiff or a defendant.

ON Tuesday evening there was some discussion in the House of Commons as to the supplemental vote of £100,000 for the purchase of a site at South Kensington for a suitable building for the housing of the science collections. Mr. Jackson explained that the extent of the land was four and a half acres, and the sum at which it was valued included a building for which the Government now paid a rent of £1500 a year, which would, of course, fall out of the Estimates when the Government became the proprietors of the land in question. No commission was to be paid to any person on either side in respect of this transaction, which was a direct one between the Commissioners of the 1851 Exhibition and the Government. Sir H. Roscoe thought it desirable that the money should be voted at once. The plot of land was the only one ever likely to be available for the purpose. Mr. Mundella said that as he had been pressing upon Governments for the last ten years the necessity for them to acquire this land, he thought that he ought to say something in defence of what the Government had done in asking for the sum on the present occasion. He did not approve of supplementary estimates, and he thought that no one would be more glad to get rid of them than the Government themselves. This question, however, had been pressing for the last ten years, because for the whole of that period the most valuable national science collections, such as no other country in the world possessed, had been housed in the most disgraceful manner. The Treasury had all along resisted the demands made upon them to sanction the expenditure necessary for the erection of a Museum to hold these collections, notwithstanding that three departmental committees had reported in favour of that expenditure. The only question, therefore, was whether the Government were getting good value for their money in making this purchase. He knew something of the value of the land, which had been fixed by eminent surveyors at £200,000, while the Government were going to get it for £70,000. The money which the Commissioners would receive in respect of the sale would be appropriated to providing scholarships for the promotion of technical education to the amount of £5000 per annum, which were to be open to all schools of every denomination in the United Kingdom. He therefore urged the Committee to agree to this proposal at once. Sir L. Playfair explained that the Commissioners of the Exhibition of 1851 had formed their estimate of the value of the land upon the value of the surrounding property. The Commissioners had been pressed year after year to apply their surplus revenues to educational purposes. They had pressed the Government to come to some conclusion on the subject, as it had been going on for from three to ten years. They could not go on waiting continually, and the Government at last came to the conclusion—and, he thought, came to a wise conclusion—to accept the offer. He thought the Committee would see that they had been very patient. Mr. W. H. Smith, replying to the objection that the vote ought to have been included in the ordinary estimates, pointed out that if the vote were not taken at once, probably it could not be reached before June or July, or even August. It was unreasonable to ask the Commissioners to wait until that time. He had resisted the expenditure at South Kensington as long as he could, and until he was satisfied that in the interests of the country it was necessary. He strongly resisted the expenditure before, but when the Committee they had appointed reported that further accommodation was required, they had no alternative but to carry out their recommendations. The proposal of the Government was accepted by a majority of 77—the number of those in favour of the reduction of the vote being 67, while 144 voted on the other side.

We regret to notice the death, on February 2, of M. Ch. Fievez, the assistant in charge of the spectroscopic department of the Royal Observatory of Brussels, at the comparatively early age of 45. M. Fievez did not enter the Observatory until 1877, having been originally intended for the military profession. M. Houzeau, then the Director of the Observatory, being desirous of creating a spectroscopic department, sent Fievez, to whom he proposed to commit its management, to study under Janssen at Meudon, with whom he remained six months. Fievez's most important work was the construction of a chart of the solar spectrum on a scale considerably greater than that of Ångström; but besides this he was not able to effect much in astronomical spectroscopy, owing to the unfavourable position of the Observatory for such observations. He therefore turned his attention principally to laboratory work, and in this department made a detailed study of the spectrum of carbon, besides numerous experiments on the behaviour of spectral lines under the influences of magnetism and of changes of temperature. M. Fievez was Correspondant of the Royal Academy of Belgium, and Foreign Member of the Society of Italian Spectroscopists.

Students of palæontology heard with much regret of the recent death of Prof. von Quenstedt, of Tübingen. He was the most famous of German palæontologists, and did much important work in mineralogy also. He had an especially profound knowledge of the Lias of Würtemberg and its fossils. His work on "Der Jura" is well known, and so recently as 1885 a new edition, greatly modified, of his "Handbuch der Petrefactenkunde" was issued. Dr. von Quenstedt died at an advanced age on December 21, 1889.

A writer who is contributing to *Industries* a series of articles on the "Recent Growth of Technical Societies," infers, from a comparison of the balance-sheet for 1878 with that for 1888, that the Proceedings of the Royal Society are "evidently less sought after than they were." An average of four years would have pointed to an opposite conclusion. For the years 1876–79 the average sale was £743 1*s.* 7*d.*, while that of 1886–89 was £810 3*s.* 3*d.* The writer leaves out of account, moreover, that in 1878 the Royal Society, according to their published list, presented their Transactions and Proceedings to 276 institutions, while at present they give them to no fewer than 363 institutions.

Much interest has been excited by the announcement of the discovery of coal in Kent. The search for coal at a point near the South-Eastern Railway, adjoining the experimental heading for the Channel Tunnel, has been carried on for several years. The following report, by Mr. Francis Brady, C.E., the engineer-in-chief of the South-Eastern and Channel Tunnel Companies, was published in the daily papers on February 20:—"Coal was reached on Saturday last, the 15th inst., at 1180 feet below the surface. It came up mixed with clay, and reduced almost to powder by the boring tools. A small quantity of clean bright coal found in the clay was tested by burning, and proved to be of good bituminous character. The seam was struck after passing through 20 feet of clays, grits, and blackish shales belonging to the coal-measures, which at this point lie close under the Lias, there being only a few intervening beds of sand, limestone, and black clay separating them. The correspondence of the deposits with those found in the Somersetshire coal-field is thus pretty close, the difference consisting in the absence of the red marl at the Shakespeare boring. The lines of bedding in the shale are distinctly horizontal. This is an indication that the coal-measures will probably be found at a reasonable depth along the South-Eastern Railway to the westward. I beg to hand you herewith two specimens of the clay containing coal, one taken at 1180 feet, and the other at 1182 feet. I also inclose a specimen of clean coal taken to-day at 1183 feet 6 inches from the surface." With regard to this report, Prof. Boyd Dawkins writes to us:—"As the enterprise resulting in the discovery of coal near Dover was begun in 1886, and is now being carried on under my advice, I write, after an examination of the specimens from the boring, to confirm the published report of Mr. Brady, so far as relates to the coal. The coal-measures with good blazing coal have been struck at a depth of 1160 feet, well within the practical mining limit, and the question is definitely answered which has vexed geologists for more than thirty years. Further explorations, however, now under consideration, will be necessary before the thickness of the coal and the number of the seams can be ascertained. This discovery, I may add, with all the important consequences which it may involve, is mainly due to the indomitable energy of Sir Edward W. Watkin."

The second meeting of the Australasian Association for the Advancement of Science seems to have been in every way most successful. It was held at Melbourne, and began on January 7. At the Sydney meeting last year there were 850 members. This year the number rose to 1060. Baron von Müller, F.R.S., was the President. Great efforts were made to secure that members from a distance should enjoy their visit to Melbourne, and the serious work of the various Sections was varied by pleasant excursions. An excellent "Hand-book of Melbourne," edited by Prof. Baldwin Spencer, was issued.

This year the University of Helsingfors will celebrate its two hundred and fiftieth anniversary. It was founded at Abo, but transferred to Helsingfors in 1820.

At a recent meeting of the French Meteorological Society, M. Wada, of the Tokio Observatory, gave a *résumé* of the seismological observations made in Japan during 1887. The number of earthquake shocks amounted during the year to 483. The hourly and monthly distribution of the shocks at Tokio during the last 12 years shows a slight excess in favour of the night-time, above the day; and also an excess in winter and spring, over the other seasons. The area affected during the year 1887 represented five times the superficies of the empire. M. Wada gave details of the shocks, their direction, intensity, and distribution.

Tidings of another great volcanic eruption have come from Japan. Mount Zoo, near the town of Fukuyama, in the Bingo district, began to rumble at 8 o'clock on the evening of Jauuary 16, and the top of the mountain is said to have been soon "lifted off." There was a din like a dynamite explosion, and sand and stones were belched forth. Stones and earth also fell at Midsunomimura, a village six miles away. No previous eruption of Mount Zoo is recorded. Only one man lost his life, but some cattle were killed, and 55 houses were destroyed. The total loss entailed by the eruption is estimated at nearly $3,500,000.

Two rather strong shocks of earthquake were felt at Rome on Sunday last, February 23, shortly after 11 p.m. They were more distinct in the environs than in the city itself, and especially at the Rocca di Papa in the Campagna. The Rome correspondent of the *Daily News* says it was remarked that flocks of sheep "showed great signs of fear some time before the shocks were felt." The correspondent of the *Standard* notes that in several public buildings the gas was almost extinguished, that electrical apparatus was disturbed, and that electric bells were set ringing. "My own experience," he adds, "was that of feeling lifted up from my seat, and then set down again with a slight, but sickening, jar, while doors rattled, and furniture was moved so as to produce noise in knocking against walls."

According to a telegram sent through Reuter's agency from Lisbon, a slight shock of earthquake was felt on February 24 at Leiria and places between it and the sea coast.

The Pilot Chart of the North Atlantic Ocean for February states that the month of January was remarkable for the tempestuous weather that prevailed almost uninterruptedly over the steamship routes. Storms succeeded each other in rapid succession, the majority of them having developed inland and moved east-north-east on very similar paths from Nova Scotia and across southern Newfoundland. The most notable storm of the month was probably one that developed in the St. Lawrence valley, and crossed the Straits of Belle Isle early on the 3rd. It then moved nearly due east, rapidly increasing in intensity until reaching the 20th meridian, when it curved to the north-eastward, and was central on the 5th about lat. 55° N., long. 17° W., and disappeared north of Scotland. The barometric pressure in this storm was remarkably low, 27·93 inches having been recorded at 4 p.m. on January 4, about lat. 53° N., long. 23° W. There was a slight increase in the amount of fog experienced; it was confined for the most part to the regions west of the Grand Banks. Much ice has been reported since the 5th; the positions and dates plotted on the chart indicate that the ice season is one of the earliest on record—nearly a month earlier han usual. This is due in a great measure to the prevalence of .... northerly gales east of Labrador, coincident with the heavy westerly gales of December and January along the Transatlantic route.

The Japanese Government, we observe, is about to establish a meteorological observatory in the Loochoo Islands. This is one of the most important positions in the East for meteorological purposes, for it fills up the very large gap at present existing between Shanghai and Manilla in one direction, and Hong Kong and Tokio in the other. Besides, the Loochoo Archipelago is a specially valuable position for observing the phenomena connected with the course of the typhoons of the China seas.

The meeting of the International Congress of Hygiene and Demography, which is to be held in London in 1891, will probably be thoroughly successful. An organizing committee, with Sir Douglas Galton as President, has been formed, and already delegates have been appointed by the leading scientific societies. On Tuesday, February 18, a deputation waited upon the Lord Mayor to discuss the arrangements that ought to be made for the meeting. The Lord Mayor, having heard what Sir Douglas Galton, Prof. Corfield, and other members of the deputation had to say as to the importance of the Congress, undertook that the matter should be brought forward at a public meeting in the Mansion House. This meeting will take place on Thursday, April 24, and the Lord Mayor will preside.

The ninth annual meeting of the members of the Sanitary Assurance Association was held on Monday, February 17, Sir Joseph Fayrer, F.R.S., in the chair. Mr. Joseph Hadley, Secretary, read the annual report, which concluded as follows:—"Though the important bearing of the work of the Association on the public health is not yet fully appreciated by the general public, the financial statement for the past year proves that the Association is making progress, and that after nine years' experience its work continues to be appreciated. The income for the year was £398 8*s.* 10*d.*, and after meeting all liabilities a balance is carried forward." The Chairman, in proposing the adoption of the report, said that the more he saw of the work of the Association, and the need for sanitary improvement, the more was he interested in its progress, and he expressed a hope that not only might this Association prosper, but that others might be formed, so great was the work to be done. General Burne and Dr. Danford Thomas were re-elected members of the executive council, and Sir Joseph Fayrer and Prof. T. Roger Smith were re-elected President and Vice-President respectively.

Some time ago we referred to the fact that the Manchester Field Naturalists' and Archæologists' Society had appointed a committee for the purpose of promoting the planting of trees and shrubs in Manchester and its immediate suburbs. The idea has commended itself to the Corporation, and it is expected that evergreen shrubs, planted in boxes or tubs, will soon be placed in some of the principal squares. Meanwhile, the committee are trying to obtain the aid of experienced practical men. They have issued a circular with the following list of questions:—"What description of trees would you especially recommend for open spaces?" "What kind of shrubs, especially such as would succeed in tubs or boxes?" "What suggestions can you offer as to soil, treatment, and upon any important point relating to tree culture in towns?" When the best information that can be obtained has been brought together, it will be embodied in a pamphlet, which may, it is hoped, serve as a general guide for tree planting and culture.

At the meeting of the Royal Botanic Society on Saturday, the Secretary called attention to several plants of hygrometric club moss from Mexico, which had been presented, with other specimens, by Mr. A. Gudgeon. The Secretary stated that these plants had the power, ascribed to the well-known rose of Jericho, of rolling themselves up like a ball when dry, and becoming apparently dead; but that they were able to unfold and grow again when exposed to moisture. The specimens shown had been kept for three months in a dry place, but now were green, and to all appearance flourishing.

The following lectures will be given at the Royal Victoria Hall during March:—March 4, Mr. F. W. Rudler, on "Geology in the Streets of London"; 11th, Dr. Dallinger, on "The Infinitely Great and the Infinitely Small"; 18th, Prof. Beare, on "Australia"; 25th, Mr. W. North, on "Rome."

"Our Earth and its Story" (Cassell and Co.) consists of three volumes, not two, as inadvertently stated in our notice of the work on February 13 (p. 341).

A series of new compounds of hydroxylamine, NH_2OH, with several metallic chlorides, are described by M. Crismer in the current number of the *Bulletin de la Société Chimique*. The first member of the series obtained was the zinc compound $ZnCl_2.2NH_2OH$, whose existence was unexpectedly discovered during the course of experiments upon the action of metallic zinc on aqueous hydroxylamine hydrochloride. A ten per cent. solution of this latter salt was treated with an excess of pure zinc; no evolution of gas was noticed in the cold, but on warming over a water-bath a slow disengagement of bubbles was found to occur. After allowing the reaction to complete itself during the course of a few days, the liquid, which had become turbid, was filtered, allowed to cool, and again filtered from a little more flocculent material which separated out, and finally concentrated and allowed to crystallize. A large quantity of hemispherical crystal aggregates then separated, which were found on analysis to consist of the new salt, $ZnCl_2.2NH_2OH$. Several other methods of obtaining it were investigated; it may be obtained by treating an aqueous solution of hydroxylamine hydrochloride, $NH_2OH.HCl$, with zinc oxide or carbonate, or with a mixture of zinc sulphate and barium carbonate, or by treating an alcoholic solution of hydroxylamine with zinc chloride. But the best method, and one which gives 97 per cent. yield, consists in dissolving ten parts of hydroxylamine hydrochloride in 300 c.c. of alcohol in a flask provided with an inverted condenser; the liquid is then heated to the boiling-point and five parts of zinc oxide added, the boiling being continued for several minutes afterwards. The clear liquid is then decanted and allowed to cool. After the deposition of the first crop of crystals, the mother liquor may be returned to the flask and treated with a further quantity of zinc oxide, four repetitions of this treatment being sufficient to obtain an almost theoretical yield of the salt. The white crystals are then washed with alcohol and dried in the air. They resist the action of most solvents, water only slightly dissolving them, and that with decomposition. Organic solvents are practically without action upon them. When heated in a narrow tube, as in attempting to determine the melting-point, the salt violently explodes. If a quantity is heated to about 120° C., in a flask connected with a couple of U-tubes, the second containing a little water, gas is abundantly liberated, and drops of hydroxylamine condense in the first U-tube together with a little nitrous acid. The water in the second tube is found to contain hydroxylamine, ammonia, and nitrous acid, while fused zinc chloride remains behind in the flask. A similar cadmium salt was also obtained, $CdCl_2.2NH_2OH$, in brilliant crystals which separated much more quickly than those of the zinc salt. This cadmium compound is much more stable under the action of heat, gas being only liberated in the neighbourhood of 190°-200°, and only a little hydroxylamine distils over. The barium salt, $BaCl_2.2NH_2OH$, is a specially beautiful substance, crystallizing from water in large tabular prisms, which are very much more soluble in water than either of the salts above described.

THE additions to the Zoological Society's Gardens during the past week include an Esquimaux Dog (*Canis familiaris* ♀), bred in England, presented by Mr. W. Tournay; two Barbary Turtle-Doves (*Turtur risorius*) from North Africa, presented by Miss Teil; a Bonnet Monkey (*Macacus sinicus* ♀), a Macaque Monkey (*Macacus cynomolgus* ♂) from India, a Common Raccoon (*Procyon lotor*) from North America, deposited; a Green Monkey (*Cercopithecus callitrichus*) born in the Gardens.

OUR ASTRONOMICAL COLUMN.

OBJECTS FOR THE SPECTROSCOPE.

Sidereal Time at Greenwich at 10 p.m. on February 27 = 8h. 30m. 43s.

Name.	Mag.	Colour.	R A. 1890.	Decl. 1890.
			h. m. s.	° ′
(1) G.C. 1711	—	—	8 45 37	+51 44
(2) 58 Hydræ, U.A. ...	7	Yellowish-red.	8 39 53	−10 45
(3) ζ Hydræ	3	Yellowish-white.	8 49 36	+ 6 22
(4) ε Hydræ	3	Yellowish-white.	8 41 0	+ 6 49
(5) 115 Schj.	6	Yellowish-red.	8 49 11	+17 39
(6) W Tauri	Var.	Reddish-yellow.	4 21 45	+15 51

Remarks.

(1) "Very bright; very large; at first very gradually, then very suddenly much brighter in the middle." The spectrum of this nebula has not yet, so far as I know, been recorded.

(2) Dunér classes this with stars of Group II., but states that the spectrum is very feebly developed, and expresses a doubt as to the type. As I have before remarked, Mr. Lockyer's discussion of the stars of this group seems to indicate that the spectra which are described as "feebly developed" really represent stages in the passage from one group to another. If, for example, we consider a rather faint star with the banded spectrum a little more developed than in the case of Aldebaran, its spectrum would no doubt be described as "feebly developed," if classed with Group II. In such a case the star would be more condensed than those in which the spectrum is said to be well developed, and the flutings would have almost entirely given way to lines. Line absorptions would therefore indicate that the star belonged to a late stage of the group. On the other hand, if the star be at a very early stage of condensation, the flutings would still only be feebly developed, and might be accompanied by bright lines. In any case, further examination is necessary, as the star may belong to an early stage of Group VI., and not to Group II. at all.

(3) A star classed by Vogel with stars of the solar type. The usual differential observations are required.

(4) A star of Group IV. (Vogel). The usual observations are required.

(5) A "superb" example of stars of Group VI. (Dunér). The principal bands are very wide and dark, and the secondary bands 4 and 5 are also well seen. Bands 7 and 8 are doubtful.

(6) This variable will reach a maximum about March 7. The period is about 360 days, and the magnitudes at maximum and minimum are 8·2 ± and < 13 respectively. The star is not included in Dunér's catalogue, but Vogel states that the spectrum is of the Group II. type. Observations before and after maximum, with special references to changes of spectrum, should be made.

NOTE ON THE ZODIACAL LIGHT.—In favourable localities the zodiacal light should now be visible in the evening, and as further spectroscopic observations are desirable, it may be convenient to briefly summarize here the results already obtained. Ångström first observed the spectrum at Upsala, in March 1887, and noted the presence of the chief line of the aurora spectrum, at a wave-length stated as 5567. Respighi, in 1872, also observed this line, in addition to a faint continuous spectrum, and believed this to demonstrate the identity of the aurora and zodiacal light. He found, however, that at the same time the bright line was visible in almost every part of the sky, and this led to the suggestion that it originated from a concealed aurora. Prof. Piazzi Smyth, in Italy, observed nothing but a faint continuous spectrum, extending from about midway between D and E to F. A. W. Wright's observations led him to the following conclusions:—"(1) The spectrum of the zodiacal light is continuous, and is sensibly the same as that of faint sunlight or twilight. (2) No bright line or band can be recognized as belonging to this spectrum. (3) There is no evidence of any connection be-between the zodiacal light and the Polar aurora" (Capron's "Auroræ," p. 69). Mr. Lockyer believes the zodiacal light to be due to meteoritic dust, which is to a certain extent self-luminous, as indicated by the bright line in the spectrum, and argues in favour of a connection between auroræ and the zodiacal light (Proc. Roy. Soc., vol. 45, p. 247). He says:—"The observations of Wright and others, showing that the spectrum is continuous, are not at variance with Ångström's observation, for we should expect the spectrum to be somewhat variable. It is probable that the observations showing nothing but continuous spectrum were made when the temperature was only sufficient to render the meteoritic particles red hot. That the zodiacal light does consist of solid particles, or, at all events, of particles capable of reflecting light, is shown by the polariscope." He also quotes from a letter in which Mr. Sherman, of Yale College, states that he has reason to believe that the appearance of the bright line in the zodiacal light has a regular period.

On January 20 I saw the zodiacal light very well at Westgate-on-Sea, but was unable to detect anything beyond a faint continuous spectrum.

Mr. Maxwell Hall's observations at Jamaica (see NATURE, February 13, p. 351) also record continuous spectra, but with remarkable changes in the region of maximum intensity. He suggests comparative observations with the spectrum of twilight.

In connection with the suggestion of the variability of the spectrum, it is important to secure further observations. If the existence of the bright line at some periods be established, we may then safely conclude that the luminosity of the zodiacal light is not entirely due to reflected sunlight.

A. FOWLER.

OBSERVATIONS OF ζ URSÆ MAJORIS AND β AURIGÆ.—The periodic duplicity of the K line in the spectra of these stars before noted (January 23, p. 285) led Prof. Pickering to conclude that the time of revolution of the former system was 104 days. In the current number of the *Sidereal Messenger*, however, Prof. Pickering adds a note, dated January 11, 1890, in which he records that later observations make it probable that the period of ζ Ursæ Majoris is 52 days instead of 104, and that its orbit is noticeably elliptical. The velocity of the components of β Aurigæ seems to be 150 miles per second, their period 4 days, their orbit nearly circular, with a radius of 8,000,000 miles, and their masses 0·1 or 0·2, that of the sun being unity.

COMET BROOKS (*d* 1889).—The following ephemeris is given by Dr. Knopf in *Edinburgh Circular* No. 5, issued on the 22nd inst. :—

1890. March.	R.A. h. m. s.	Decl. ° ′	1890. March.	R.A. h. m. s.	Decl. ° ′
1 ...	2 22 54 ...	+17 58·6	15 ...	2 49 26 ...	+20 8·0
3 ...	26 40 ...	18 17·9	17 ...	53 17 ...	20 25·3
5 ...	30 26 ...	18 36·9	19 ...	57 8 ...	20 42·3
7 ...	34 13 ...	18 55·6	21 ...	3 0 59 ...	20 59·1
9 ...	38 1 ...	19 14·1	23 ...	4 51 ...	21 15·6
11 ...	41 49 ...	19 32·3	25 ...	8 43 ...	21 31·8
13 ...	45 37 ...	19 50·3			

The brightness on March 1 = 0·24, and on March 25 = 0·17, that at discovery being unity.

NEW SHORT-PERIOD VARIABLE IN OPHIUCHUS.—Mr. Edwin F. Sawyer announces the discovery that the star 175 (*Uranometria Argentina*) Ophiuchi, R.A. 17h. 45m. 57s., Decl. − 6° 6′·7 (1875·0), is a variable of short period (*Astronomical Journal*, No. 210). The range of variation appears to be from 6·2m. to 6·95m., and the period slightly greater than 17 days.

OBSERVATIONS OF THE MAGNITUDE OF IAPETUS.—In the January number of *Monthly Notices* is found an interesting communication to the Royal Astronomical Society by Mr. Barnard, of the Lick Observatory, on the eclipse of this outermost satellite in the shadows of the globe, crape ring, and bright ring of Saturn. By frequent comparison of the light of Iapetus with that of Tethys and Enceladus, the effect of the shadow of the crape ring on the visibility of the satellite was tested, seventy-five comparisons being made. It was found that, after passing through the sunlight shining between the ball and the rings, Iapetus entered the shadow of the crape ring. As it passed deeper into this, there was a regular decrease in light until it disappeared in the shadow of the inner bright ring. From the observations it appears that the crape ring is truly transparent, the sunlight sifting through it. The particles composing it cut off an appreciable quantity of sunlight, and cluster more thickly, or the crape ring is denser, as it approaches the bright rings.

GEOGRAPHICAL NOTES.

AT the ordinary meeting of the Royal Geographical Society, on Monday, Mr. C. M. Woodford read a paper on "Further Explorations of the Solomon Islands." He has visited these islands three times, and in the present paper he described what he saw during his third visit, in 1888. He took up his residence in the small island of Gavotu, off the coast of Gola, or Florida Island, a place centrally situated for visiting Ysabel, Guadalcanar, and other islands. He stayed with a trader named Lars Nielson, who had since been killed and eaten by the natives, as had also three of his boys. Since last June no fewer than six white men had been murdered by the natives of the Solomon Group, out of a total white population estimated at about thirty. Mr. Woodford's principal object in his last journey was to identify the places visited by the Spanish Expedition under Mendaña that discovered these islands in the year 1568. In this, he thought he might say, he had been entirely successful. The Spaniards related that when they were between Florida and Guadalcanar they passed an island in the centre of which was a burning volcano. This island was now conclusively identified with the Island of Savo. The lecture was illustrated with photographs of natives of Guadalcanar and other places, as well as specimens of rude architecture, by means of the dissolving-view apparatus.

ACCORDING to the Copenhagen correspondent of the *Frankfurter Zeitung*, an Expedition for the exploration of Greenland will start next summer from Denmark. The plan of work has been arranged by the Naval Lieutenant Ryder. The party will consist of nine persons. They will have three boats, and a steamer will convey them to the eastern coast as soon as the condition of the ice will allow of a landing. It is proposed that the region lying between 66° and 73° north latitude shall be explored in the course of the summer, and that the party shall push as far as possible into the interior. Sledges will be employed during the winter. The Expedition will be provisioned and equipped for two years, at the end of which time the steamer will return to take them away, cruising along the east coast till they get down to the shore. The expenses have been estimated at from 250,000 to 290,000 kroner (equal to from about £13,900 to £16,100), and the project is so popular, and looked on so favourably by the Government, that it is practically certain that the Diet will grant the money.

THE Geographical Society of Vienna issues a circular letter, dated February 1890, announcing the election of officers made last December. The new President is Herr Hofrath Ritter von Hauer, Intendant des naturhistorischen Hofmuseums.

LOCUSTS IN INDIA.

IN 1889, parts of Sind, Guzerat, Rajputana, and the Punjab were much troubled by locusts. A report on these destructive creatures is being prepared under the direction of the trustees of the Indian Museum, Calcutta; and, in the hope that information about them, with specimens, may be obtained from persons who have had opportunities of observing them, Mr. E. C. Cotes, of the Indian Museum, has issued a preliminary note, summing up some of the principal facts that have already been brought together. This note is very interesting, and has been compiled chiefly from the records of the Revenue and Agricultural Department of the Indian Government.

The generally received idea is that the locust which invades India belongs to the species usually spoken of as *Acridium peregrinum*, and supposed to have been the locust of the Bible. The identity of Indian locusts has not yet, however, been definitely ascertained, and this is one of the points which require elucidation. As far as we at present know, there seems reason to believe that while *Acridium peregrinum* extends its ravages into the dry plains of the Punjab and Rajputana, the locust which proved injurious in Madras in 1878, and in the Deccan in 1882–83, belongs to a very different species, which is probably *Acridium succinctum*. In order to settle the question it will be necessary to examine further specimens taken from destructive flights which have appeared in various localities, the material in the Indian Museum being at present insufficient.

Dealing with the natural history of locusts generally, Mr. Cotes observes that all the different species which occur in various parts of the world breed permanently in barren elevated tracts where the vegetation is sparse. In years when they increase inordinately they descend in flights from their permanent breeding-grounds upon cultivated districts, where they destroy the crops, lay their eggs, and maintain themselves through one complete generation, but are unable to establish themselves permanently, usually disappearing in the year following the invasion, to be succeeded, after an interval of years, by fresh swarms from the permanent breeding-ground.

Generally speaking, the life circle of a locust extends through one year, in which period it passes through its various stages of egg, young wingless larva, active pupa, and winged locust, which dies after laying the eggs that are to produce the next generation. The eggs are laid in little agglutinated masses in holes, which the female bores with her ovipositor in the ground. In temperate climates the eggs are usually deposited in the autumn, but in sub-tropical countries, such as India, where there is but little winter, the winged locusts live on through the cold season, and only die off after depositing their eggs in the following spring. In this case the eggs hatch after lying in the ground for about a month. In both temperate and sub-tropical regions alike, the young wingless locusts, on emerging from the eggs in the spring or summer, feed voraciously and grow rapidly for two or three months, during which period they moult at intervals, finally developing wings and becoming adult. The adult insects fly about in swarms, which settle from time to time and devour the crops. The damage done by locusts is thus occasioned in the first instance by the young wingless insects, and afterwards by the winged individuals into which the young are transformed after a couple of months of steady feeding.

In Rajputana and the Punjab in 1869 the flights were said to have come chiefly from the vast tract of sand hills (*Teeburs*) between the Runn of Kutch and Bhawulpore, and partly from the Suliman Range in Afghanistan. Locusts were reported as usually to be found in the autumn in the *Teeburs*, and it is thought that this tract is probably a permanent breeding-ground. The whole question, however, of the permanent breeding-grounds of these locusts is one that requires further investigation. The winged flights appeared throughout Central Rajputana in the latter part of the hot weather, and laid eggs which hatched as the rains set in; the old locusts dying after they had deposited their eggs. From these eggs were hatched young locusts which became full grown and acquired wings in August and September. The eggs laid by the original flights at the end of the hot weather were distributed throughout the whole of Central Rajputana, and a vast amount of injury was done, the crops being damaged, in the first instance, by the young locusts before they acquired wings, and afterwards by the winged swarms which flew about the country and settled at intervals to eat what had escaped the ravages of the young wingless locusts.

In the Punjab, flights of locusts, from the Suliman Range, Afghanistan, appeared in the western border, in the end of April and in May. Eggs and young locusts were also found about this time near the hills in the sandy tracts of the same district. The flights seem generally to have moved from west to east, and by July to have spread themselves throughout the Punjab; but the laying of eggs and the hatching out of young went on, at least in the south-east, throughout August and September.

In Bombay, locusts were noticed in May and June 1882, in the south-west of the Presidency; but they attracted little attention, such swarms being annual visitors of the Kanarese forests, and neither in Kanara nor in Dharwar did they cause any material injury. With the setting in of the south-west monsoon, however, they spread in flights over the Presidency to the north and north-east, and early in the rains proceeded to lay their eggs and die. These eggs hatched in the end of July and beginning of August, and the young locusts did a large amount of damage, over a wide area, through the months of August and September. In the early part of October, with the setting in of the north-east monsoon, the young locusts, which had by this time acquired wings, took flight, and travelled with the prevailing wind in a south-westerly direction, doing some injury in the Poona Collectorate as they passed. They then struck the Western Ghâts, and spread slowly over the Konkan in November, and thence travelled into the Native States of Sawantvadi and the Kanara district. During the remainder of the cold season and the following hot weather (December 1882, to the end of May 1883), the flights clung to the Ghâts, occasionally venturing inland into Belgaum, Dharwar, the Kolhapur State, and Satara, and devouring the spring crops in the Coast Districts, but ordinarily keeping in the vicinity of the hill ranges. With the commencement of the south-west monsoon, in the latter part of May 1883, the flights began to move in a north-easterly direction, as they had done the preceding year, but in larger numbers.

At the commencement of the rains they began to alight in vast numbers over an immense tract of country, comprising six Deccan Collectorates and three Coast Collectorates. They deposited their eggs and died; and early in August the young locusts hatched out in countless numbers, but were apparently more backward, and possessed of less strength and stamina than were those of the previous year. The unusually heavy rainfall killed vast numbers of them in some parts of the country, and elsewhere the insects seemed stunted and feeble, and grew but slowly. They were destroyed in vast numbers by the vigorous measures initiated by Government officers, and were also said to be diseased and attacked by worms and other parasites. As late as November, the mass of the young locusts appeared still unable to fly, and made no general move, as they had done the year before, towards their permanent home in the south-west. The invasion was in fact at an end, and though swarms appeared in Sawantwadi in 1883-84, no further injury of a serious nature seems to have occurred.

The injury occasioned to the rain crops by the locusts was very considerable, over a great portion of the Deccan and Konkan, both in 1882 and 1883. But it was found, at the end of the invasion, that abundance of the cold weather crops had compensated to so great an extent for the injury done to the rain crops, that, on the whole, no very widespread suffering had arisen.

In 1878, when the Madras Presidency was invaded, the young locusts began to appear in January, and were found in great numbers in different districts from then on till September and October, the earlier swarms being found in the west and south of the Presidency, and the later ones in the north and east. Winged locusts were first observed, in the end of March and beginning of April, in the hills to the south-west (Wynaad and Nilgiri), where they may be supposed to breed permanently. Thence, aided by the south-west monsoon, they gradually worked their way over the Presidency to the east and north, finally disappearing about November and December.

The information hitherto obtained hardly justifies any very decided conclusion as to the life history of the locust. But it may be noticed that locusts were observed pairing in the Salem District, in the latter part of June, and also that the young locusts, which were found, in the early part of May, in the Udamalpet *Taluk*, were supposed to be the offspring of the large flights of winged locusts which had appeared in the preceding February in the same *taluk*. The connection between the autumn broods of locusts and those which appeared in the early part of the year has not been made out satisfactorily.

Mr. Cotes ends his paper with an account of the chief measures which have at different times been adopted in India against locusts, pointing out that, the locust of North-West India being distinct from that of South-West India, measures found useful in one invasion are not necessarily applicable in another.

FIELD EXPERIMENTS ON WHEAT IN ITALY.[1]

PROF. GIGLIOLI, of the Agricultural College at Portici, a graduate of the Royal Agricultural College, Cirencester, has given to the Association of Proprietors and Farmers of Naples a voluminous and most carefully compiled Report on the results of the first year's experiments on wheat-growing at the experimental field of Suessola, about six kilometres fom Acerra. The field is on the estate of Count Francesco Spinelli, who generously lends it to the Association for experimental purposes. The district was celebrated in olden time for its fertility, but was afterwards long neglected on account of its marshy nature, and the land became sour and productive of disease. Now, again, drainage and improved cultivation have changed these marshes into some of the best land of a fertile district. The soil of the experimental field is easily worked, friable, and bears a good natural vegetation; no analysis of it, however, is furnished. Giglioli points out that it is in too high condition at present for comparative manuring experiments, but admirably suited for comparing different varieties of corn and different methods of sowing and cultivation, as by dibbling and the Lois-Weedon system.

There are in all 102 plots devoted to trying the effects of different manures, each plot being about 43 square metres; 18 unmanured plots of a similar size devoted to different varieties of wheat; and 3 plots, each about twice the above-mentioned size, used for different methods of seeding and cultivation. Paths were made round each plot, the paths being at rather a lower level than the plots themselves The author discusses the question of large and small plots, but concluded that under the conditions obtaining, small plots were the best for use here.

On the 102 manured plots, Scholey squarehead wheat was sown, with a great variety of manures—organic, nitrogenous, phosphatic, and potassic; but it was afterwards found this variety of wheat was, unfortunately, not well suited to the climate and to the general purpose of these experiments.

The 18 varieties experimented with, on the second series, included several well-known English varieties, such as Hallett's pedigree white and red wheats, Chiddam, golden drop, Hunter's

[1] "Resultati del Primo Anno di Esperimento sulle Varietà e sui Concimi del Frumento al Campo Sperimentale di Suessola nell' Anno Agrario 1887–88." By Italo Giglioli. Pp. 508. (Naples, 1889.)

white and Victoria white, also some Hungarian wheats, besides Italian varieties.

It was found that the English varieties gave very poor results; the squarehead was a very poor sample indeed, and it was unfortunate that it was used for the manuring experiments. The degeneration of English wheats during the first year is probably due to the great amount of transpiration taking place in this climate, especially during such a hot and dry summer as that of 1888. Giglioli enters into an interesting discussion of this important physiological result.

The most productive wheat was a variety known as Noé, from the South of France, originally from Bessarabia—this yielded at the rate of 3485 kilograms per hectare; next in order were two Italian varieties, Rieti and Puglia grain, yielding at the rate of about 3150 kilograms per hectare. The Puglia wheat was the finest in quality of grain, but its yield of straw was very low.

The great importance of a careful selection of varieties is pointed out, and Giglioli is of opinion that much more good will be done by improving and selecting Italian varieties than by importing new varieties; which, if from colder countries, will probably not be able to stand the climate.

Incidentally, the experiments showed the great benefit of good cultivation and of surface draining, the plots being above the level of the surrounding paths, for the produce of the unmanured plots was double that of the neighbouring land under ordinary cultivation.

From the manuring experiments it was shown that farmyard manure gave fair results, but the season was unfavourable to the action of artificial manures, being much too dry. Of nitrogenous manures, acidified urine gave the best results, but nitrate of soda and sulphate of ammonia were often worse than useless. Phosphates had some good effect, and Thomas-Gilchrist slag was useful. Potash salts had no particular effect; the chloride seemed rather better than the sulphate.

The results of the manuring experiments, considering the great care and labour bestowed on them, must be disappointing; but the soil is in too high condition for manures to show great effects, also the variety of grain sown was unsuitable to the climate, and the season was against manures, especially nitrogenous manures.

In this Report the details of the experiments are given in full, with the appearance of the plots at different dates, and the whole results tabulated in various ways in nearly a hundred tables. All the weighings at harvest were carried out under the personal superintendence of Prof. Giglioli, who evidently has spared neither time, trouble, nor health, in conducting these important researches. Already the results have yielded important information, especially on the suitability or the reverse of special varieties of wheat to the climate of Southern Italy, and with their continuance there can be no doubt that results most valuable to the Italian farmer on the cultivation and manuring of wheat will be obtained.

Whilst heartily congratulating Prof. Giglioli and the Agricultural Association of Naples on having inaugurated these experiments with the prospect of continuing them for some years, we cannot but think that their value would be greatly increased if the plots were larger; or, if this cannot be arranged with the appliances at command, if the experiments were always in duplicate, or preferably in triplicate, and this might be rendered possible by reducing the number of experiments on manures in future seasons.

E. K.

SCIENTIFIC SERIALS.

American Journal of Science, February.—The magnetic field in the Jefferson Physical Laboratory, by R. W. Willson. One of the wings of this Laboratory in Harvard University has been constructed wholly without iron for the purpose of research, and the author has made a series of experiments to determine how far the end sought has been gained. He has found the magnitude of the disturbance which may arise in practice from such objects as stoves and iron pipes, and has made the interesting discovery that the brick piers of the building have a sufficient amount of free magnetism to produce quite an appreciable effect.—On Cretaceous plants from Martha's Vineyard, by David White. The author has studied a number of fossil plants collected at several localities and horizons in the Vineyard series for the purpose of solving the question as to the age of the underlying clays, lignites, and sands, of Martha's Vineyard. He concludes that the evidence from the fossil plants bespeaks an age decidedly Cretaceous, and probably Middle Cretaceous, for the terrane in which they were deposited.—Review of Dr. R. W. Ell's second report on the geology of a portion of the Province of Quebec, with additional notes on the "Quebec group," by Charles D. Walcott. The geological systems recognized in the area reported upon include the Devonian, Silurian, Cambro-Silurian (Ordovician), Cambrian, and pre-Cambrian.—Measurement by light-waves, by Albert A. Michelson. The telescope and microscope are compared with the refractometer, some remarkable analogies in their fundamental properties are pointed out, and a few cases in which the last-named instrument appears to possess a very important advantage over the others illustrated. Previous experiments have shown that the utmost attainable limit of accuracy of a setting of the cross-hair of a microscope on a fine ruled line was about two-millionths of an inch, whereas direct measurements of the length of a wave of green light emitted by incandescent mercury vapour, show that the average error in a setting was only about one ten-millionth of an inch. The method is also extended to angular and spectrometer measurements.—On lansfordite, nesquehonite, a new mineral, and pseudomorphs of nesquehonite after lansfordite, by F. A. Genth and S. L. Penfield. The authors have examined the crystallization of lansfordite ($3MgCO_3.Mg(OH)_2.21H_2O$), and another new mineral having the composition $MgCO_3.3H_2O$, which has been named nesquehonite. A crystallized artificial salt of the same composition is also described.—Weber's law of thermal radiation, by William Ferrel. An examination of Weber's new law, and a test of his formula by means of experimental results, in which the absolute rate of losing heat is determined from the observed rate of cooling of heated bodies of known thermal capacity, and the relative rate from the galvanometer needle of the thermopile.—Tracks of organic origin in rocks of the Animikie Group, by A. R. C. Selwyn. Traces of fossils, or what are supposed to be such, have been discovered in the Animikie rocks of Lake Superior. The fact is interesting and important, for, if the black Animikie shales represent the Lower Cambrian of the Atlantic border, the Paradoxides and Olenellus fauna will probably be found in them sooner or later.

IN the numbers of the *Journal of Botany* for January and February, two important monographs are commenced—by Mr. E. G. Baker, a synopsis of genera and species of Malveæ; and by Mr. G. Massee, a monograph of the genus *Podaxis*. This last genus of Fungi, Mr. Massee proposes to transfer, in consequence of the mode of formation of the spores, from the Gastromycetes, where it has hitherto been placed, to the Ascomycetes.

THE *Botanical Gazette* for October 1889 contains an interesting summary of our present knowledge of protoplasm, by Prof. Goodale, in the form of an address to the Botanical Section of the meeting of the American Association for the Advancement of Science held at Toronto.

WITH the exception of an interesting paper by Prof. Massalongo, descriptive of some curious instances of teratology in the floral and foliar organs, the number of the *Nuovo Giornale Botanico Italiano* for January is chiefly occupied by a report of the proceedings of the Italian Botanical Society. Among a number of short papers, is one on the fertilization of *Dracunculus vulgaris*, the most important insect agent in which is stated by Prof. Arcangeli to be *Saprinus subnitidus*; one on the fertilization of *Arum pictum*, by Prof. Martelli; and one on the development of the picnids of Fungi, by Prof. Baccarini.

SOCIETIES AND ACADEMIES.

LONDON.

Linnean Society, February 6.—Mr. Carruthers, F.R.S., President, in the chair.—Referring to an exhibition at a previous meeting, Prof. Stewart communicated some interesting observations on the habits of certain seaweed-covered crabs. He also made some remarks on the "pitchers" of *Nepenthes Mastersiana*, upon which criticism was offered by Mr. Thomas Christy, Prof. Howes, and Mr. J. Murray.—Prof. G. E. Boulger exhibited a series of original water-colour drawings of animals and plants of the Falkland Islands.—Mr. W. H. Beeby exhibited some forms new to Britain of plants from Shetland.—Mr. C. B. Clarke, F.R.S., then read a paper on the stamens and setæ of *Scirpeæ*, illustrated by diagrams, which elicited a detailed criticism from Mr. J. G. Baker, to which Mr. Clarke replied.—A paper was then read by Mr. B. D. Jackson, which had been communicated by the late Mr. John Ball on the flora of Patagonia, prefaced by some feeling remarks by the President, on the loss which the Society had sustained through the recent death of this able botanist.

Zoological Society, February 18.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—Mr. Tegetmeier exhibited and made remarks on two Cats' skulls, out of the large quantity of remains of these animals recently brought to this country from Egypt.—Mr. G. A. Boulenger read a report on the additions made to the Lizard collection in the British Museum since the publication of the last volume of the British Museum Catalogue of this group. A list was given of 91 species new or previously unrepresented in the collection. Ten species and three genera were described as new.—Mr. P. L. Sclater, F.R.S., read some notes on a Guinea-fowl from the Zambesi, allied to *Numida cristata*, and gave a general account of the recognized species of this group of Gallinaceous birds.—Dr. Mivart, F.R.S., read some notes on the genus *Cyon*, mainly based on an examination of the specimens of this genus of Canidæ contained in the British Museum.—Mr. P. L. Sclater, F.R.S., read a paper containing the characters of some new species of the family Formicariidæ.—Dr. Augustine Henry read some notes on the Mountain Antelopes of Central China (*Nemorhedus argyrochætes* and *N. henryanus*).

Royal Meteorological Society, February 19.—The following papers were read:—Observations on the motion of dust, as illustrative of the circulation of the atmosphere, and of the development of certain cloud forms, by the Hon. Ralph Abercromby. The author has made numerous observations on the motion of dust in various parts of the world, especially on deserts on the west coast of South America. He finds that the wind sometimes blows dust into streaks or lines, which are analogous to fibrous or hairy cirrus clouds; sometimes into transverse ridges and furrows, like solid waves, which are analogous to certain kinds of fleecy cirro-cumulus cloud; sometimes into crescent-shaped heaps with their convex side to the wind, which are perhaps analogous to a rare cloud form called "mackerel scales"; sometimes into whirlwinds, of at least two if not of three varieties, all of which present some analogies to atmospheric cyclones; sometimes into simple rising clouds, without any rotation, which are analogous to simple cumulus-topped squalls; and sometimes into forms intermediate between the whirlwind and simple rising cloud, some of which reproduce in a remarkable manner the combination of rounded, flat, and hairy clouds that are built up over certain types of squalls and showers. Excessive heating of the soil alone does not generate whirlwinds; they require a certain amount of wind from other causes to be moving at the time. The general conclusion is, that when the air is in more or less rapid motion from cyclonic or other causes, small eddies of various kinds form themselves, and that they develop the different sorts of gusts, showers, squalls, and whirlwinds.—Cloud nomenclature, by Captain D. Wilson-Barker. The author proposes a simple division of cloud-forms under two heads, viz. cumulus and stratus, and recommends that a more elaborate and complete division should be made of these two types. A number of photographs of clouds were exhibited on the screen in support of this proposal.—An optical feature of the lightning flash, by E. S. Bruce. It has been stated in the Report of the Thunderstorm Committee of the Royal Meteorological Society, that there is not the slightest evidence in the photographs of lightning flashes of the angular zigzag or forked forms commonly seen in pictures. The author, however, believes that this is an optical reality, as the clouds on which the projection of the flash is cast are often of the cumulus type, which afford an angular surface. In support of this theory he exhibited some lantern slides of lightning playing over clouds.

Anthropological Institute, February 11.—Dr. Garson, Vice-President, in the chair.—Mr. T. W. Shore read a paper on characteristic survivals of the Celts in Hampshire. He considered the round huts of the charcoal-burners a survival of the huts which were common in the Celtic period; and some of the industries of the Celtic period appear to have survived in Hampshire to the present day, such as that of osier-working or basket-making. There can be little doubt that Hayling, anciently spelt Halinge, has derived its name from the Celtic word *hal*=salt; the salt works which still exist there are in all probability an example of a survival of a Celtic industry. Several instances were given of earthworks which must be ascribed to the Celts, and it was suggested that the mounds upon which many ancient churches in Hampshire are built may have been sacred sites of the same people. Reference was made to the peculiar orientation of many Hampshire churches, 20° north of east, and it was explained as a survival of a reverence for the May Day sunrise from Celtic pagan time to Saxon Christian time, and under a modification to a later date.—Dr. Garson exhibited and described some skulls dredged from the bed of the Thames by Mr. G. F. Lawrence, who afterwards gave an account of the strata in which they were found.

Mathematical Society, February 13.—J. J. Walker, F.R.S., President, in the chair.—Mr. S. Roberts, F.R.S., read a paper concerning semi-invariants.—Mr. Tucker (Hon. Sec.) communicated papers by Prof. K. Pearson, on ether-squirts; by Prof. G. B. Mathews, on class-invariants; and a note on the imaginary roots of an equation, by Prof. Cayley, F.R.S.

PARIS.

Academy of Sciences, February 17.—M. Hermite in the chair.—Observations of minor planets made with the great meridian circle and Jardin's meridian circle at the Paris Observatory during the first three months of 1889, by Admiral Mouchez. Comparisons with published ephemerides have been made in the following cases: Victoria (12), Astræa (5), Parthenope (11), Hebe (6), and Eugenia (45).—On the movements of planets, supposing their attraction represented by one of the electro-dynamic laws of Gauss or Weber, by M. F. Tisserand. The author has investigated the motions of Mercury and Venus on the hypothesis that they were not governed by Newton's law of gravitation, but by one of the above named. The change of the longitude of perihelion for a given time would be about twice as great, using Gauss's law, than by using Weber's. Taking the velocity of light as 300,000 kilometres per second, it is found that, on the hypothesis of Weber's law, the major axis of Mercury's orbit would have a direct motion of 14″·4 in a century; for Venus the variation would be only 3″·0. Using Gauss's law, the value for Mercury becomes 28″·2.—Posthumous article on polyhedrons by Descartes: a note by M. de Jonquieres, in which he shows that Descartes not only knew and employed the relation $S + F = A + 2$, but that he announced it explicitly, and prior to Euler.—On a new reviving plant, by M. Ed. Bureau. Two specimens of a supposed new plant which revived when placed in water, similar to the Rose of Jericho, have been investigated. The change, however, is not simply hydration, as in the latter plant. The specimens, which were found in Arkansas, prove to be the *Polypodium incanum*, Pluck, but the above property does not appear to have been previously observed in it.—On the distribution of pressures and velocities in the interior of liquid sheets issuing from weirs without lateral contraction, by M. Bazin.—On some objections to the theory of deep vertical circulation in the ocean, by M. J. Thoulet. It is concluded that the circulation of water between the equator and the Poles only affects a depth of about a thousand metres. Below this the water is in a state of repose. The conclusion has been arrived at from a consideration of deep-sea sediment and the observations of the density of water at great depths given in the *Challenger* Report.—On the St. Petersburg problem, by M. Seydler. Two solutions are given of this "probability" problem.—On the regular surfaces of which the linear element is reducible to the form of Liouville, by M. Demartres.—On the surfaces of which the linear element is reducible to the form $ds^2 = F(U + V)(du^2 + dv^2)$, by M. A. Petot.—Summary of the observations of the total solar eclipse of December 22, 1889, by M. A. de la Baume Pluvinel.—Note on the calculation of the compressibility of air up to 3000 atmospheres, by M. Ch. Antoine. In the expression $pv = D(\beta + t)$ (the pressure, p, being given in atmospheres, and the volume, v, in litres), for air

$$\beta = 273{\cdot}6 - \sqrt{p}.$$

If up to 40 atmospheres $D = 2{\cdot}835$,
and beyond 40 atmospheres $D = 2{\cdot}835 + 0{\cdot}0018\,(p - 40)$,

the table given for air at $t = 0°$ is found to agree well with the experimental results of Regnault and Amagat.—Extension of the theorems relative to the conservation of the flux of force and of magnetic induction, by M. Paul Janet.—Upon batteries with molten electrolytes, and upon the E.M.F. at the surface of contact of a metal and a melted salt, by M. Lucien Poincaré. The author finds the E.M.F.'s in this case to be nearly the same as those found by M. Bouty (*Comptes rendus*, t. xc. p. 217) in the case of saturated solutions.—Electrolysis by igneous fusion of the oxide and fluoride of aluminium, by M. Adolphe Minet. The author presents the result of three years' work on the electrolysis of the fused oxide and fluoride of aluminium, in a table which gives the quantity of metal obtained as a function of the time and of the quantity of electricity used.—Note by MM. P. Hautefeuille and A. Perrey, on the silico-glucinates of soda. In a preceding note, the authors have described a number of silico-glucinates of potash, obtained by heating together mixtures of silica, glucina, and the alkali, with neutral vanadate of potash. They now have applied the same method of mineralization with mixtures containing soda, heating to about 800°. Five forms, of different composition, have been thus obtained. Substituting tungstate for vanadate of soda, two species of crystals have been obtained, corresponding in composition with two of those obtained with vanadate as mineralizing agent.—Upon the *rôle* of foreign bodies in iron and steel; the relation between their atomic volumes and the allotropic transformations of iron, by M. F. Osmond. Prof. W. C. Roberts-Austen, studying the effect of minute percentages of foreign elements upon the mechanical properties of gold, found a relation between the results obtained and the position in the periodic table of the introduced elements, and has predicted a similar phenomenon in the case of iron. Reviewing his former work in the light of this new idea, the author has found the prediction to be verified. Shortly, it may be said that foreign bodies of small atomic volume tend to cause iron to assume or remain in that of its molecular forms in which it has itself the smaller atomic volume, bodies of great atomic volume produce the opposite effect.—M. J. Ville, on dioxyphosphinic and oxyphosphinous acids. In two preceding notes (*Comptes rendus*, t. cvii. p. 659, t. cix. p. 71), and in the present communication, it is shown that by the reaction of aldehydes upon hypophosphorous acid, two new classes of acids have been obtained, with the general formulæ :—

$$(1)\ \mathrm{PO}\begin{cases}(\mathrm{R\,.\,CH\,.\,CH})\\(\mathrm{R\,.\,CH\,.\,OH});\\\mathrm{OH}\end{cases}\qquad(2)\ \mathrm{PO}\begin{cases}\mathrm{H}\\(\mathrm{R{-}CH\,.\,OH}).\\\mathrm{OH}\end{cases}$$

—Dibromo-carballylic acid, by M. E. Guinochet. This acid has been obtained by the reactions of 4 equivalents of bromine upon one equivalent of aconitic acid in a sealed tube, heated for thirty-six hours to 115°-120°.—Estimation of uric acid in urine by means of a hot solution of hypobromite of soda, by M. Bayrac. The principle of the method consists in separating the uric acid from the urea and creatinin present by alcohol, and the titration of the isolated acid with sodic hypobromite at 90°-100°. Results are said to be as exact as those obtained by the best known methods, while the process takes much less time.—Researches upon the pathogenic microbes in the filtered waters of the Rhone, by MM. Lortet and Despeignes.—Upon the nutrition of the fungus of the *muguet*, by MM. Georges Linossier and Gabriel Roux. A complete study of the mineral, carbohydrate, and nitrogenous foods required and the substances produced by this fungus is given. —The perception of luminous radiations by the skin, as exemplified by the blind Proteus of the grottos of Carniola, by M. Raphael Dubois. By a number of experiments upon *Proteus anguinis*, the author demonstrates that the sensibility of its skin to light is about half of the sensibility of its rudimentary eyes, and further that this sensibility varies with the colour of the light employed, being greatest for yellow light.—The wax-organs and the secretion of wax in the bee, by M. G. Carlet. The author's researches lead him to conclude: (1) the wax is produced by the 4 last ventral arches of the abdomen; (2) it is secreted by an epithelial membrane and not by the cuticular layer of these arches, nor by the intra-abdominal glands; (3) this secretory membrane lies between the cuticular layer and the lining membrane of the antero-lateral part of the ventral arch; (4) the wax traverses the cuticular layer and accumulates on its outer surface.—Experimental plant cultivation in high altitudes, note by M. Gaston Bonnier. The modifications produced in Alpine plants by the climate have been studied and some general conclusions drawn, among which the most interesting is: "For the same extent of leaf surface, the assimilation is much more considerable in Alpine plants than in those of lower stations, on account of the greater thickness of the palisade tissue and the abundance of chlorophyll."

BERLIN.

Physiological Society, January 31.—Prof. du Bois-Reymond, President, in the chair.—Dr. Grabower spoke on root-area of the motor nerves of the laryngeal muscles.—Prof. Munk made a further communication on the subject of the cortical visual areas. His earlier researches on the extirpation of these areas had shown that the retina may be regarded as spatially projected on to the visual area in such a way that its external portion corresponds to the external part of the visual area of the *same* side, while the inner portion corresponds to the inner part of the area of the *opposite* side, and the middle portion to the middle part of the visual area of the opposite side. The upper half of the retina corresponds to the anterior part of the visual area, and the lower half to the posterior. More recently, Prof. Schäfer, of London, has found that, when the visual areas are stimulated electrically, movements result which are confined entirely to the eyes; when the anterior part of the area is stimulated, the eye is turned downwards and towards the opposite side; and when the posterior part is stimulated, the movement is similarly towards the opposite side, but now upwards. When, however, the central part of the area is stimulated, the result is merely a movement towards the opposite side. It was shown by the speaker, as the result of a large number of experiments on dogs which he had performed in conjunction with Dr. Obregici, that these movements are not dependent on the stimulation of any motor centres or upon any ordinary reflex movements, but that they are really movements which accompany visual sensations. They were shown by careful analysis to result in the directing of the eye towards that point in space into which the visual perception is referred whenever any definite point of the retina is stimulated by light, the point stimulated in this case being the corresponding part of the electrically stimulated visual area. Thus when the anterior part of the area is stimulated, the lower portion of the retina is stimulated, the resulting visual image is consequently referred out upwards, and the eyes accordingly also move upwards and towards the opposite side. Similarly for stimulations of other parts of the visual area. These experimental stimulations hence afford an evidence of the detailed spatial projection of the retina on to the visual areas, which is as certain and even more convincing than the evidence obtained from localized extirpations of the areas. They further permitted of a more certain delimitation of the visual areas than had been possible in the earlier experiments. It is impossible to enter here into the many interesting details of these experiments, or to give any account of the lengthy discussion which followed Prof. Munk's communication.

Physical Society, February 7.—Prof. Kundt, President, in the chair.—Dr. Budde spoke on the very rapid rotation of a solid body, possessed of three unequal moments of inertia, about a fixed point. He developed very fully the equations which hold good for this motion, and dealt, at the end of his communication, with the physical experiments which might be performed in order to test the equations.—Dr. Feussner spoke on the methods which are employed at the Government Physico-technical Institute for the measurement of electrical resistances. He exhibited and explained the several instruments used, pointing out that in their arrangement the greatest importance must be attached to the very accurate measurements of temperature. For this purpose the wires are wound upon metallic cylinders in order to provide for the rapid cooling of the wires as they are warmed by the passage of the current: these are then submerged in petroleum, whose temperature is recorded by a thermometer immersed in the liquid, which is itself kept constantly stirred. German-silver wires have shown themselves to be unsuited for the purposes of constructing the standard resistances, since their resistance increases regularly with lapse of time; neither could this increase be done away with by heating the wires until they were quite soft. This tendency was attributed to the occurrence of a gradual crystallization, which depended chiefly upon the zinc in the alloy. On this account an alloy of copper and nickel was employed, which is known commercially as "patent nickel," and examined as to its suitability. Wires made of this alloy possess a very low temperature-coefficient, and were found to be almost absolutely constant after being heated to 100° C. If they are kept for some time after they are made and wound, and are then heated, they may be used as standards for comparison. Several other alloys were also tried, as, for instance, various combinations of copper and manganese. The speaker described the experimental measurements made with these wires, and stated that up to 30 per cent. of manganese, above which amount it was not possible to draw a wire in this alloy, they have yielded a negative coefficient of temperature. When the alloy contained only a small percentage of manganese, the coefficient was very small, so that such wires would be suitable for the construction of standard coils. In conclusion, he described how the resistances are measured in the Government Institute. The method employed is that of compensation, and measurement of potentials.—Dr. Jäger announced that Dr. de Coudres, in Leipzig, had succeeded in detecting a thermo-electric tension between compressed and uncompressed mercury. The compression was produced either hydraulically or by means of its own weight acting through a column of mercury. It was found possible to determine with certainty the direction of the thermo-electric current, and to measure its intensity for given pressures and temperatures. The investigation is not yet completed, but Dr. de Coudres hopes to be soon in a position to give a full account of his experiments.

In the report of the meeting of the Berlin Physical Society, January 27 (p. 383), *for* Dr. Lehmann *read* Dr. Leman.

STOCKHOLM.

Royal Academy of Sciences, February 12.—Contributions to the flora of the Hieracia of South-Eastern Sweden, by Herr H. Dahlstedt.—On the remains of a bread-fruit tree from the Cenoman strata of Greenland, by Prof. A. G. Nathorst.—Report on researches in practical pomology and horticulture during a tour in France and Germany, by Herr C. V. Hartman.—On the lichens of the island of Bornholm, by Dr. P. J. Hellbom.—Algæ aquæ dulcis exsiccatæ quas distribuerunt, V. Wittrock et O. Nordstedt, Parts 18–21, exhibited and demonstrated by Prof. Wittrock.—The results of a determination of the rotation of the sun, executed during the years 1887–89 in the Observatory of Lund, by Prof. Dunér.—On the influence of the duration of exposure for a photographic image of a star, by Dr. Charlier.—Experimental determination of the principal elements of a divergent lens, by Dr. C. Mebius.—Derivatives of sulphur urates, by Dr. Hector.—On the $\beta_1 = \alpha_1$ bromium naphthalin sulphon acid, and on the constitution of the acids which are formed by the agency of concentrated sulphuric acid on β-naphthylamin, by S. Forsling.—Experiments on the humidity of the atmosphere, by Dr. K. H. Sohlberg.—Anatomical studies on the floral axes of diclinous Phanerogams, by Herr A. Grevillius.

DIARY OF SOCIETIES.

LONDON.

THURSDAY, February 27.

Royal Society, at 4.30.—The Croonian Lecture—The Relations between Host and Parasite in certain Epidemic Diseases of Plants: Prof. H. Marshall Ward, F.R.S.

Society of Arts, at 5.—The Northern Shan States and the Burma-China Railway: William Sherriff.

Institution of Electrical Engineers, at 8.—The Theory of Armature Reaction in Dynamos and Motors: James Swinburne.—Some Points in Dynamo and Motor Design: W. B. Esson.

Royal Institution, at 3.—The Three Stages of Shakspeare's Art: Rev. Canon Ainger.

FRIDAY, February 28.

Amateur Scientific Society, at 8.—Practical Coal-mining: H. S. Streatfeild.

Royal Institution, at 9.—Evolution in Music: Prof. C. Hubert H. Parry.

SATURDAY, March 1.

Essex Field Club, at 7.—Micro-Fungi of Epping Forest; how to Collect, Preserve, and Study Them: Dr. M. C. Cooke.

Royal Institution, at 3.—Electricity and Magnetism: Right Hon. Lord Rayleigh, F.R.S.

SUNDAY, March 2.

Sunday Lecture Society, at 4.—Apollonius of Tyana; the Story of his Life and Miracles: G. Wotherspoon.

MONDAY, March 3.

Society of Arts, at 8.—Stereotyping: Thomas Bolas.

Aristotelian Society, at 8.—The Psychological Development of the Conceptions of Causality and Substance: G. F. Stout.

Victoria Institute, at 8.—Chinese Chronology: Rev. James Legge.

Royal Institution, at 5.—General Monthly Meeting.

TUESDAY, March 4.

Zoological Society, at 8.30.—On the Classification of Birds: Henry Seebohm.—A Revision of the Genera of Scorpions of the Family Bathidæ, with Descriptions of some New South African Species: R. I. Pocock.—On some Galls from Colorado: T. D. A. Cockerell.—Report on the Insect-House for 1889: A. Thomson.

Institution of Civil Engineers, at 8.—The Hawksbury Bridge, New South Wales: C. O. Burge.—The Erection of the Dufferin Bridge over the Ganges at Benares: F. T. G. Walton.—The New Blackfriars Bridge on the London, Chatham, and Dover Railway: G. E. W. Cruttwell.

University College Biological Society, at 5 15.—A Peculiar Ferment in Balanoglossus: Dr. Halliburton.—The Weather Plant: Mr. Weiss.

Royal Institution, at 3.—The Post-Darwinian Period: Prof. G. J. Romanes, F.R.S.

WEDNESDAY, March 5.

Society of Arts, at 8.—Recent Progress in British Watch and Clock Making: J. Tripplin.

Entomological Society, at 7.—New Longicornia from Africa: C. J. Gahan.—Notes on the Lepidoptera of the Region of the Straits of Gibraltar: J. J. Walker, R N.—Some Water Beetles from Ceylon: Dr. D. Sharp.—The Classification of the Pyralidina of the European Fauna: E. Meyrick.—A New Species of Thymara and other Species allied to Himantopterus fuscinervis, Wesm.: Captain H. J. Elwes.—A Catalogue of the Pryralidæ of Sikkim collected by H. J. Elwes and the late Otto Möller: Pieter C. T. Snellen.

THURSDAY March 6.

Royal Society, at 4.30.—The following papers will *probably* be read:—On a Second Case of the Occurrence of Silver in Volcanic Dust—namely, in that thrown out in the Eruption of Tunguragua, in the Andes of Ecuador, January 11, 1886: Prof. J. W. Mallet, F.R.S.—On the Tension of Recently-formed Liquid Surfaces: Lord Rayleigh.—(1) On the Development of the Ciliary or Motor Oculi Ganglion; (2) The Cranial Nerves of the Torpedo (Preliminary Note): Prof. J. C. Ewart.

Linnean Society, at 8.—On the Production of Seed in some Varieties of the Common Sugar-Cane (Saccharum officinarum): D. Morris.—An Investigation into the True Nature of Callus; Part 1, the Vegetable Marrow, and Ballia callitricha: Spencer Moore.

Royal Institution, at 3.—The Early Developments of the Forms of Instrumental Music: Frederick Niecks.

FRIDAY, March 7.

Physical Society, at 5.—On Bertrand's Refractometer: Prof. S. P. Thompson.

Geologists' Association, at 8.

Institution of Civil Engineers, at 7.—Telephonic Switching: C. H Wordingham.

Royal Institution, at 9.—Electrical Relations of the Brain and Spinal Cord: Francis Gotch.

SATURDAY, March 8.

Royal Botanic Society, at 3.45.

Royal Institution, at 3.—Electricity and Magnetism: Right Hon Lord Rayleigh, F.R.S.

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