THURSDAY, JUNE 16, 1904.

OXFORD ON THE UP GRADE.

"You will not find your highest capacity in statesmanship, nor in practical science, nor in art, nor in any other field where that capacity is most urgently needed for the right service of life, unless there is a general and vehement spirit of search in the air."

An Oxford Correspondence of 1903. Edited by W. Warde Fowler. (Oxford: B. H. Blackwell; London: Simpkin, Marshall, Hamilton, Kent and Co., Ltd.)

OUTSIDE Oxford, the sub-rector of Lincoln College is known as a nature student—his many "Tales of the Birds" having afforded infinite pleasure to a large circle of readers, old and young, on account of their subject-matter, their truthfulness and sincerity and their great literary charm; within the university, he ranks as an authority on classical subjects. To know the views of such a man, at such a time as the present, is a matter of no slight consequence.

The booklet which Mr. Warde Fowler has most opportunely published takes the form of a series of letters exchanged between a tutor, a certain Mr. Slade, and his pupil, Jim Holmes—who, having distinguished himself by taking a second in Greats and muffed the I.C.S., goes to Switzerland on a holiday; he there falls in with two Swiss professors engaged in bug-hunting and subsequently takes a short course in architecture at Zürich under one of them. Jim is somewhat old for his age—so is Mr. Slade, for an Oxford Don, in the sense that he is far ahead of his time in the liberality of his views: but this no doubt comes of mixing with the birds. When a small boy at a private school, he tells Jim, he was what would now perhaps be called slack; he did not even play games—*but*, he read all the books he could lay hands on collected butterflies and laid the foundation of one other pursuit which had been a constant delight to him all his life since. What this was we may easily guess. He is thankful that he was a small boy then and not now. After referring to the success of several of his schoolmates, he adds:—

"I do not think we could have wasted our time altogether. Anyhow I think we went to our respective public schools with our minds fresh and our interests pretty numerous and lively. If we really were idle boys, then I think that the extirpation of the idle boy, a process on which the headmasters seem to have set their hearts, is a process that needs a little consideration and criticism."

The wisdom of this utterance is beyond question; it is undoubtedly all-important that interests should be developed in early youth and it is unfortunate that the combination of classic with naturalist is so far from being a common one; contact with nature is perhaps the most effective of all means of correcting the narrowness of outlook, the lack of alertness and of observational power, as well as the intolerable self-complacency, which, if not peculiarly characteristic, are far too often met with in the student trained on purely classical lines. Nature can be approached from so many sides, some acquaintance with scientific method can be so easily gained, that the almost complete neglect of natural knowledge by humanists, especially by the Oxford school, is nothing short of inexcusable. The irrational conservatism which makes progress so difficult at the present time is probably almost wholly attributable to this neglect.

The story is opened by a letter (full of significant remarks) from Mr. Slade to Jim's father:—

"I fear Jim himself will be disappointed. . . . No one else will mind. Why it is I hardly know but it is the fact that the Greats list attracts much less general attention now than it used to . . . it may be that we don't believe any longer that a man who has taken a first is something quite out of the common. . . . I want him to get into the I.C.S. . . . but honestly I don't think he will. There's a fine quality in him which is apt to be trampled out by these elephantine examinations. . . . He would be a first-rate man for India but I doubt if they will catch him by an examination. Never mind, he will do good work in life as soon as he recovers from the effects of his education."

The kind of consolation administered to the father in this closing sentence is noteworthy. The correspondence shows how the recovery takes place—partly at Mr. Slade's hands, partly because Jim is for a time translated into an atmosphere which should but does not yet exist at Oxford.

Jim's father displays no little sanity of mind in his reply to the tutor's letter:—

"What on earth is to become of Jim if he fails—I should have thought that four years of Oxford with a little finishing at Wren's . . . would make a lad quite safe who had been in the Sixth at a public school and got a scholarship and first in Mods. However, I shall get over it and so must he; he must look out for a mastership or take to architecture like his uncle, who might take him into his office if he meant business. But that is just what Oxford men don't. The young fellows peddle along until the awful question comes down on them and then if you ask what they would like to do they say, they don't exactly know. Affairs of tremendous importance have occupied their attention—boat-races, football matches, tennis and all the rest of it—and after all it is as much our fault as yours; we like to see them enjoying themselves when they come home. And their sisters arrange an out-of-door life for them lasting pretty well all the vacation."

Jim goes to the Maderanerthal with a friend, who is soon called away, however, so that he is left with "only some stupid foreigners, professors, I fancy"; having injured his knee on the way, he is laid up there for a time. Mr. Slade sends him a parcel of books to supplement the novels in the hotel saloon—a translation of Goethe's conversations with Eckermann, Mat. Arnold's "Essays in Criticism," Gardner's "Oxford at the Cross Roads," Bury's inaugural lecture at Cambridge and Boissier's "Promenades Archæologiques." At the same time, he suggests to Jim, "Might it possibly be worth while to cultivate the acquaintance of the stupid professors?" Jim takes the fly gradually but greedily—both books and professors. The bug-hunter exhibits his catch and asks him if he knows Prof. Bolton at Oxford; of course he does not—the prophet having little honour in his own country, especially in the eyes of undergraduates, who have no love for prophets at our universities. But on

writing to his tutor, Jim asks—"Who the mischief is Prof. Bolton?"

The butterfly man, Herr Nägeli, turns out to be a doctor and, after inspecting the knee, actually goes away to fetch bandages, &c., thereby winning Jim's heart; his companion is the architect. The three soon become the best of friends.

Mr. Slade explains in due course who Prof. Bolton is—paying him the well deserved compliment of describing him as "one of the centres of gravity of the world's entomology." In this letter, he refers to Prof. Gardner as

"The Chamberlain of Oxford, who does not see why things should always go on exactly as they have done for fifty years or so and who clearly and resolutely puts out his opinion that there is room for improvement and that we must become less of a big school and more of a real University."

He asks Jim for his opinion of Gardner's book, as that of a "friendly person not wholly without intelligence" who has lately been himself through the mill which, according to Gardner, "is very much out of order and needs new scientific appliances to make it grind well." The opinion comes a good deal later: that it may be well to keep the essential principle of Greats but to adjust it to new needs, finding a way somehow to give a man a chance of keeping his kettle really on the boil.

Jim develops apace in the free Swiss air under professorial guidance. In acknowledging the arrival of the books, he confesses that he has not yet recovered the taste for reading. "I feel," he says, "with a friend devoted to natural history who complained that he had not time to read, *'for as long as there is light I want to be looking at things.'* Books may be made for men, but I deny that man was made for books."

In the next letter or two, the subject discussed is the need of treating every subject from a scientific point of view, Mr. Slade remarking:—

"It is astonishing what nonsense able men will sometimes write, just because they don't know even the elementary laws of scientific investigation." And he then dwells on the importance of attention to style in writing—of attention "to the 'ars rhetorica,' which is after all in its proper sense only the result of a conscientious effort to think clearly and get down your meaning neatly. Rhetoric need not mean adornment, though it is often used in that sense. No one would call Darwin a rhetorican, yet he was one in so far as he positively refused to let any sentence stand of which the meaning was not clear in his mind and pellucid to the reader."

Matthew Arnold is referred to on the same subject. The letter ends in a P.S., in which the following most appropriate passage from Roger Ascham's "Schole-master" is quoted:—

"All soch Authors, as be fullest of good matter and right judgement in doctrine, be likewise always most proper in wordes, most apte in sentence, *most plain and pure in uttering the same.*"

"If I am not mistaken," Mr. Slade adds, "this would have delighted Darwin." His appreciation of Darwin is indeed very noticeable; it is much to be desired that the example which Darwin has set—his modesty, his reverence of fact and of exactness—should be brought home to humanists generally. Jim hits the nail on the head in a subsequent reply in saying:—

"I never had enough to say to trouble much about how I said it; I think that's probably the mischief rather than rhetoric—want of stuff and the necessity of writing an essay when you know nothing about the subject and care less, &c."

We seldom realise how often "want of stuff" is at the root of schoolboy failures. The discussion may be commended to the many schoolmasters who, thinking to teach English composition,[1] vainly require their pupils to write essays on subjects of which they know practically nothing and in which they cannot take the slightest interest. It is worth noting that Prof. Gardner takes up a similar attitude in his "Oxford at the Cross Roads":—

"If men were set to write out clearly what they had really learned, it would be an excellent training. But I think that to set men to write on subjects about which they know little and about which under the conditions they can learn but little is not merely inexpedient but radically immoral. It trains the writer to conceal his ignorance, to pretend to know what he does not know, to cultivate sophistries of all kinds. And worst of all, a man who has once learned the fatal art of writing plausibly, without knowledge, will scarcely in after life be persuaded to take the pains necessary in order to discover the truth of things."

We next come to a very important *dissertatio de examinationibus*. After the I.C.S. exam. Jim writes:—

"My mental liver is out of order as well as my bodily one. They do their work well at Wren's and we slaved away in the heat all day like convicts; the unlucky lecturers seem to bemoan their fate and would fain go into things a little further than they dare, but they are slaves of the lamp too—the glorious illuminating lamp of competitive exam."

In writing of his failure to pass the exam. he gives utterance to a truth which we too often lose sight of in considering examinations:—

"These . . . (adjective to taste) competitive examinations do as much harm as good by damaging more than half the competitors for no reason at all."

In his reply, Mr. Slade proceeds to "uncork himself" in a very noteworthy manner:—

"Exams there must be of one kind or another; but the less we have of exams that do not positively help us in education the better we shall be as a nation. . . . We in England have become so completely salted, soused and pickled in these exams, that we no longer use our natural intelligence in judging of them. We take them for granted and never or rarely inquire into their effect on the human mind. We have lost the power of summing up the general result of them on the nation during a long series of decades. . . . I am strongly inclined to think that our system of exams has seriously damaged the natural intelligence of the nation by almost destroying the freshness of interest which a fair average of boys ought to take in their work and by robbing them of much

[1] It is quite likely that we may progress apace. I notice in the May number of the *School World* an interesting article on the teaching of English by a master at Haileybury College—who actually urges that English boys should be taught English by much reading of English books and by speaking; who can say there is no hope for the future when such things are happening?

mental freedom and elasticity. We get into a habit of looking at knowledge in terms of examination. . . ."

The really important subject in the essay—for Oxford—is first touched upon in a P.S. by Jim, who says :—

"I have been looking into the 'Crossways' again. What does he mean when he says that everyone ought to do a piece of first-hand work? A piece of work that no one has done before? I am so ignorant that this puzzles me. Have you ever done such a thing?"

The sweet innocency of the young English graduate is well displayed in this passage. Mr. Slade is clearly cornered; he answers :—

"Excuse my saying that you are an 'enfant terrible.' You ask me if I have ever done a piece of first-hand work? . . . I decline altogether to answer the question. But I will tell you that the joy of discovering something that you did not know before is in my experience very great, and that the joy of finding that so far as your knowledge goes no one ever found it out before is far greater. I have not ever dug up anything, or caught any insect, as yet unknown to the world: but I do know how the world feels to you when you have found a new clue to an old mystery. But what Gardner meant, I think, is this: that every real student who means to occupy himself with subjects proper to a University in these days should not delay too long to try his hand at a piece of original work, suggested perhaps by a Professor or someone of real learning and certainly supervised by him: so that he may not waste time in doing what other people have done before, or in going to work the wrong way for want of knowledge of the right way to set about it. . . . The wares of German workers have become part of our stock-in-trade in Oxford and we retail them often without even marking them as 'made in Germany.' You take them all from us without questioning, without testing them, and when the examination is over you let them moulder away in obsolete note-books and sell such few books as you do possess to second-hand booksellers. Why could not *we*, too, do something in the way of investigation? No doubt some of us do, but we do it under great disadvantages, because we have no pupils who help us, or want supervision in such work themselves, and so keep us at the boiling-point. We are so many kettles that never quite get to the boiling point. . . . Yes, the tea that we make is generally weak—made with water out of kettles that have never got beyond a gentle singing on the hob. Now do you understand what Gardner wants? I daresay he is thinking of his own Archæology, in which original work and good training are essential, and more obviously so perhaps than in some classical departments: but you may take my word for it that in every department of learning the same thing holds good and that a University that does not find some room for original work, but insists upon foreign supplies, is pretty sure to lose its reputation sooner or later."

Jim settles down to work at Zürich; but somehow it doesn't seem like work: he finds that a student there *is* a student, not a gamester; and is led to believe that the professor of architecture is really keen that he should do something worth doing. His tutor, in replying, expresses his delight at hearing that he is starting work with a sense of its not being work—or at any rate grind; then he enters on a dissertation to explain why work is grind for so many Oxford men :—

"A few men," he says, "of course are 'keen,' but not nearly enough for a great University. Is it the examination system, or the charms of out-door Oxford, or national feebleness, or overwork at school (including games), dullness of lecturers, or over-conscientiousness on the part of tutors, who do so much for their pupils that they extinguish the desire, natural (I should imagine) to human beings, as to cats and dogs, to find out things for themselves? Or is it a disease accompanied by so many symptoms that it is impossible to tell which is the primary one, or where the doctor is to begin operations?"

At the end of two months Jim is sent by his professor to survey the houses in a certain district near to the Austrian frontier, to see if they are really as primitive as they are reported to be. He goes off with knapsack and camera; after a few days he returns with a number of photos, measurements and a report in English: being no longer hampered by "want of stuff" he is able to write. The reception he meets with somewhat startles him: after examining the photos for a minute, the professor embraces him; what happens as he reads the report, modesty forbids Jim to tell—but his description of the interview is none the less graphic :—

"I never yet saw a college tutor go and fetch two bottles of beer while reading a man's essay, to overcome his feelings. The fact is that the poor man does not get pupils who can write, and as I had put down exactly what I saw and what I thought to the best of my ability and in my own tongue, it was something quite new to him. We had to clink glasses so often that I began to be afraid I should be up all night and ill the next morning. . . . Before we parted he uttered these memorable words: 'You are a very remarkable young man.' No, I am not a very remarkable young man, but I have found out that I can take a tremendous interest in a bit of work when it is new and with some relation to my life's work as it is to be. And I think I can put a fair amount of intelligence into it. Is this what Gardner means by first-hand work? If so I am a convert to his views."

There is no need to point the moral of Jim's conversion: we can scarcely doubt what the result would be if professors at Oxford could be got up to the beer point of enthusiasm—many of the graduates might then "find themselves" while at the university, and would receive the most efficient preparation possible for the work of life. It is only necessary to visit, for example, the Hope collections at the museum in company with their curator to see how "a vehement spirit of search" can be developed even by the study of a few butterflies. But the iron grasp of examinations must be relaxed to make progress possible.

It is a significant fact that Mr. Warde Fowler's book should follow so closely that of Prof. Gardner—by which it is obviously inspired. We have to recollect also the correspondence on research at Oxford printed in *The Times* last summer. The "spirit of search" is clearly hovering over the university: we may hope that it will, ere long, descend upon it and dominate every branch of its work. The remarkable passage at the head of this article is printed by Prof. Gardner on the title-page of his "Oxford at the Cross Roads"; it expresses the opinion not of a writer on any branch of experimental science but of a literary authority, Mr. John Morley, being taken from his "Rousseau." It may be said without hesitation to

embody the policy which we should adopt as a national policy, which alone can give us an assured position as a nation, as we are bound to develop a forward policy.

Prof. Gardner's work is essentially a plea for the reconstruction of humanist studies—but he is not altogether free from the narrowness of outlook which is so often met with in the humanist. "If," he says, "the lead in higher education is left to Manchester or to London, the turn which it will take is probably not towards a more enlightened and scientific humanism but towards physical science. The study of nature will encroach and the study of man recede."

Whereas, however, in ancient times, the study of nature held an entirely subordinate place in the scheme of knowledge, we have now to recognise that man is but a part of nature; and since we have tamed the forces of nature to the service of man, an enlightened and scientific study of humanism is impossible without considerable knowledge of physical and biological science; it must, therefore, be the work of the universities to develop the application of scientific method to all branches of study, as humanism will suffer grievously if studied from a too narrow point of view. Matthew Arnold recognised this when he wrote:—

"The ideal of a general liberal training is to carry us to a knowledge of ourselves and the world. . . . The circle of knowledge comprehends both the study of the humanities and the study of nature and we should all have some notion, at any rate, of the whole circle of knowledge."

May the birds and the butterflies help us to sounder views!

Conduct is impaired, he says, by the want of science and culture. That our universities should hold so narrow a conception of culture as to accord a knowledge of scientific method no regular place in the curriculum is a striking commentary on the sufficiency of humanist studies as hitherto conducted.

H. E. A.

A NEW TYPE OF BOTANICAL TEXT-BOOK.

Lehrbuch der Pflanzenkunde für höhere Lehranstalten. By Dr. Karl Smalian. Pp. iii+626; illustrated. (Leipzig: G. Freytag.) Price 8 marks.

IT has become more and more clear of late years that for one man to write a satisfactory text-book of modern botany is practically an impossible task. It is true that such text-books do appear, fortunately at much rarer intervals than formerly, but they only serve to give support to this view. The well known "Bonn text-book," which has run through so many editions, is a step in the right direction, for though the whole is complete in a single volume, the authorship is composite. It cannot be long, however, before the student will finally have to give up the long cherished belief that it is possible to find within the covers of a single volume a complete manual of his subject. Dr. Smalian's volume, with its numerous closely printed pages, suggests an attempt in this direction, but an examination shows that the author has succeeded in producing a text-book of a distinctly novel type.

General and special morphology and physiology are relegated to the last hundred pages, while the whole of the rest of the book deals with the plant from what is usually termed the natural history point of view. A large number of plants, representatives of the chief natural orders, are selected, and an attempt is made to give a picture of them as living beings. Their naked eye anatomy is described, and its relation to their environment, both animal and vegetable as well as inorganic, is considered. Any special adaptations which they may exhibit are dealt with, stress being laid on their exact method of pollination, while their geographical distribution and their uses to man are also included. In many cases, to make the picture more complete, any striking animal or vegetable parasites which may seriously affect the life of the plants under consideration are figured and described. The œcological factor and the question of plant communities are always kept clearly in mind.

The descriptions of the plants are exceedingly well done, and are profusely illustrated with figures in the text, all the more important orders, both European and exotic, being dealt with, some at considerable length. Thus, under Ranunculaceæ, after an account of the external anatomy, habitat and environmental relationship of *Ranunculus acris, Ficaria verna, Caltha palustris* and *Anemone nemorosa,* no less than twelve genera are treated in detail. Furthermore, when occasion arises, other matters of general botanical interest are discussed. The Rosaceæ are an excuse for dealing with various methods of grafting; under Leguminosæ the nature of root tubercles, the morphology and function of tendrils, the movements of sensitive plants are all described. When dealing with the Horse-chestnut, the structure of the buds and their method of opening are made clear with the help of exceedingly good figures. Insectivorous plants, parasites, saprophytes, leaf mosaic, &c., are all dealt with in their appropriate places, and in considering domestic plants, such as the carrot, the striking effect on the plant of change of environment is pointed out, and a short digression made to consider the differences between mutations and variations.

The part dealing with morphology and physiology is by far the smaller portion of the book, and is of too condensed a nature to be of much value. The figures are in the main well chosen, but surely in these days of active cytological investigation of plants it is not necessary to illustrate nuclear division by a series of schematic figures drawn from an *animal* cell.

It is clear from what has been said above that the main portion of the book is literally packed with information, and certainly the author has made good the two claims in his preface, that he has given "einen reichen Stoff," and put it forward in a *readable* form. Of its value to teachers, and as a book of reference, there can be no question, and the author must be congratulated on the pen-pictures of the selected plants. But it cannot be considered satisfactory as a text-book, for its sheer plethora of facts must surely produce mental indigestion even in a subject endowed with such strong assimilating power as

the German student. Also, in a general text-book, a study of the common finer adaptations of the parts of the plant machine to one another and to ordinary conditions of environment, *i.e.* general morphology and physiology, should certainly not be sacrificed to a study of the almost endless variety of special, grosser adaptations by which plants fit themselves to special conditions of life.

The book is certainly a marvellous example of German publishing, for it has 600 pages of good paper, 597 very good figures in the text, 36 fairly satisfactory coloured plates, and the whole is well bound in serviceable and artistic cloth covers; yet the cost is only 8 marks. In no other book can so much valuable botanical information be obtained at so cheap a price.

V. H. B.

A SYSTEM OF GEOGRAPHICAL CLASSIFICATION.

Katalog der Bibliothek der Gesellschaft der Erdkunde zu Berlin. Versuch einer Systematik der geographischen Literatur. Bearbeitet von Dr. Paul Dinse. Pp. xxvii+925. (Berlin: Mittler und Sohn, 1903.) Price 12 marks.

INTENDED primarily as an index to the contents of the library of the Berlin Geographical Society, this catalogue will be of service to a far wider circle than is constituted by the members of that body. While forming probably the best guide that has yet appeared to the literature of geography in general (for few works of real geographical importance will be found to be excluded), it does a second and no less important service in the direction of a classification of geography, a service of especial value in the present stage of the development of the science.

Dr. Dinse, who is himself both a geographer and librarian, has evidently bestowed much thought and pains on the elaboration of the system adopted, and the general result is thoroughly satisfactory. The whole arrangement of the body of the work is a subject one, all the purposes of an authors' catalogue being at the same time supplied by the alphabetical index, which has been kept within small compass by a judicious abbreviation of titles. In the rest of the work the compiler has wisely eliminated the alphabetical arrangement, the fetters of which too often mar the usefulness of attempts at subject classification. Two main divisions are laid down at the outset, the first concerned with the wider and more general aspects of geography, the second with the topographical subdivisions of the earth's surface. A glance at the schedule of classification for the former category shows in a striking way the great development of geographical science within recent years, the subject-matter being divided into no fewer than eleven main divisions, most of them in turn subdivided into groups of the second, third or fourth order. It may possibly be thought that this minute subdivision militates against facility of reference, as few bibliographical items are of so restricted a scope as to belong definitely to one ultimate subdivision only. But this objection has to a certain extent been met by a duplication of entries. Of the eleven main headings, that denoted "general physical geography" is naturally the most comprehensive, while of its eight subdivisions, the last, or "geomorphology," is perhaps the most important as dealing with what may be regarded as the kernel of the whole science. On the whole, the groups are logically and clearly defined, though it is perhaps inevitable that the boundaries should occasionally lack this character of precision. It is not easy, *e.g.*, to draw a hard and fast line between geophysics and geomorphology, for both seismology and vulcanism might, from one point of view, be rather grouped with the former than (as is done by Dr. Dinse) with the latter. Again, the reason for the order adopted is sometimes not quite apparent. Thus historical topography (Länderkunde) seems separated by a needlessly wide interval from the history of geographical science in general. But such difficulties are no doubt inseparable from any attempt at a linear arrangement of mutually inter-related groups. In the topographical section political divisions are necessarily taken as a basis, but others of a more elastic nature, in part based on physical factors, have been wisely introduced alongside of the former.

It should be mentioned that the catalogue deals not with books only, but with the contents of a certain number of series or collections, besides including the titles of a large number of separate copies ("Sonderabdrücke") of articles in geographical periodicals.

E. H.

OUR BOOK SHELF.

The Sporting Dog. By J. A. Graham. American Sportsman's Library. Pp. x+327; illustrated. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1904.) Price 8*s.* 6*d.* net.

QUITE apart from its interest to the class for whom it is primarily intended (and to whose requirements it appears in every way admirably suited), this volume appeals strongly to the naturalist and to the student of variation. Despite certain pretensions (of which the author makes very short work) of some of them to derivation from "native breeds," American sporting dogs, other than mongrels, are admittedly derived from English stocks, but their new environment, and the different conditions under which they are employed, have in all cases, except that of the greyhound, caused them to display considerable variation from the parent type. It is the author's description of these variations which will cause his volume to have a considerable interest and value to the naturalist.

"It is foxhounds and shooting dogs," writes Mr. Graham in his introductory chapter, "which have become, under American conditions, something essentially different from what the British sportsmen established and have maintained as filling their conceptions of utility and good looks. Reduced to the simplest terms, the change wrought over here comes to this: the dry climate of extreme temperatures, the nature of the ground and game, and the methods of hunting the fox and shooting game birds cause the survival of the fittest to proceed in the direction of a faster, lighter, more enduring animal; perhaps not more sensitive of nose, but quicker in the reflexes of judgment and action which are the sequences of scent."

In a word, pace and the capacity to act on his own initiative, rather than as a member of a pack, are the

essential features of an American foxhound, while among pointers (which are special favourites in America) and setters a greater proportion of energy to weight is the feature at which the breeder aims. The admirable reproductions from photographs with which the excellent little volume is illustrated fully bear out the author's statement as to the marked physical differences of the dogs he describes from their European prototypes. R. L.

Histoire de l'Habillement et de Parure. Bibliothèque scientifique internationale. By Louis Bourdeau. Pp. 302. (Paris: Félix Alcan, 1904.) Price 6 francs.

THE history of clothing and of ornaments is an important aspect of the history of culture, and it well deserves independent treatment. M. Bourdeau deals with the primitive articles of clothing, skins, natural vegetable products and the like, the method of working these, and the fabrication of textiles and the methods of colouring them. The making and wearing of clothes are briefly noted with the history of costumes, in which are included dressing the hair, head, hand and foot gear, umbrellas and jewellery. The scheme is good enough, but, as the work is confined to 299 pages, the treatment is necessarily slight, for the author begins with Genesis, quotes Greek and Roman authors, and, glancing at intermediate periods, finishes with modern industrialism, making allusions by the way to non-European peoples of varied culture.

The book can be recommended to those who require a light, popular sketch of the history of clothing—the serious student will, however, be disappointed. The author's knowledge of ethnology appears to be extremely limited, judging from the imperfect statements in, and the omissions from the book; for example, the paper mulberry tree is not mentioned; he is unaware of the practice of the Roman Catholic women of Bosnia and Herzegovina to tattoo themselves so as to be further discriminated from the followers of Islam; like most other writers, he does not distinguish between the Maori *moko* and ordinary tattooing. No mention is made of the production of patterns in cotton fabrics by tightly tying several strands of a warp in different places and then dyeing the whole, which technique is carried to a high degree of excellence by many Malayan peoples; nor is the analogous method of waxing fabrics and dyeing the unwaxed portions referred to. Melanesians are confounded with Polynesians (p. 229), an error as great as speaking of Negroes as Europeans. But it is in the section on ornaments that the author is weakest. It is now well recognised that what are generally spoken of as "ornaments" are worn by nature-folk and by barbarians for magical purposes as prophylactics to ward off evil, to ensure good luck generally, or to produce some definite result. This aspect is entirely ignored by M. Bourdeau. Many "ornaments" have the value of currency, but probably very few are worn solely for purposes of adornment. There are no illustrations, and, as is usual with this class of book, there is no index.

The Ether: Some Notes on its Place in Nature. By John Rhind. Pp. viii+87. (Wick: W. Roe, 1904.)

LIKE the mythical Dog Diamond, Mr. Rhind little knows what mischief he is doing. If his amendments of accepted beliefs were adopted, the well built doctrine of science would become no better than

> "a tale told by an idiot,
> "Full of sound and fury, signifying nothing."

Mr. Rhind's knowledge of principles goes no deeper, apparently, than the most popular utterances of popular lecturers and writers, and these are subject to amendment *ad libitum* to square with "common sense." With this slender equipment he does not falter to lay violent hands upon the theory of gravitation, the conservation of matter, and the nebular hypothesis.

A single example (p. 45) of the method will suffice:—"We would suggest that the earth may have the power of converting, or in other words of condensing, the ether into oxygen, which is the principal agent in sustaining life. The sun's atmosphere being so much more powerful, will be able to condense this element into an electric fluid which, being sent to his planets, gives them light and heat, and in combination with the oxygen of our earth and its atmosphere completes the power, if not of introducing life, of maintaining the life that already exists on our globe." It seems that (p. 48) "ether, oxygen and the electric fluid are only different manifestations of the same substance." The moral of the book appears to be that if science were adequately taught us at school, a gentleman with an active and spontaneous interest in natural phenomena need not in after life go so pitifully astray.

A Safe Course in Experimental Chemistry. By W. T. Boone. University Tutorial Series. Pp. vi+180. (London: W. B. Clive, 1904.) Price 2*s*.

THIS little volume is quite up to the standard of the best of modern elementary books on practical chemistry. It clearly embodies the experience of a thoughtful teacher who has made his students work and think accurately, and is not without originality of treatment in the arrangement and character of the exercises.

It has the fault of all experimental books which ignore the presence of the teacher, inasmuch as it is forced to supply wordy and involved descriptions of such simple operations as, for example, removing a stopper when using a stoppered bottle, which a demonstration would make clear in a moment.

One of the "rules for a chemical laboratory" laid down at the beginning of the book—"do not use more of a reagent than is necessary"—raises an obvious question which might be difficult to answer at this early stage, and is rather like telling a child not to eat too much.

The use of the word "safe" in the title conveys a flavour of quackery, which is a little unfortunate in a book of much solid merit. The illustrations serve their purpose, no doubt, but the handiwork of the amateur is a little too evident.

Apart from these few criticisms, the book, as already stated, deserves a good reception. J. B. C.

Catalogue of British Coleoptera. By T. Hudson Beare, B.Sc., and H. St. J. K. Donisthorpe, F.Z.S. Pp. 51. (London: Janson, 1904.)

THIS is one of the lists which are imperatively required by students of British entomology to keep them informed from time to time as to what species are actually considered by good authorities to be found in these islands, genuine additions being allowed for, and doubtful records eliminated. The print is clear and good, and another edition on stout paper, and printed on one side only, to be used for labels or notes, has been issued. The authors' names are a sufficient guarantee for the care and accuracy with which they have apparently done their work. The list contains 3274 species admitted as indigenous, and there are supplementary lists of introduced or doubtful species. The introduced list is headed by two very conspicuous species, which, though not unfrequently taken in England, can hardly be considered indigenous. These are *Carabus auratus* (often introduced with vegetables, &c.) and *Calosoma sycophanta*.

The last critical list of British beetles, by Sharp and Fowler, was published eleven years ago, and we heartily recommend the present list to British entomologists.

A Preliminary Course of Practical Physics. By C. E. Ashford, M.A. Pp. 48. (London: Edward Arnold, 1904.) Price 1s. 6d.

THIS little book on practical physics is of a kind familiar to teachers of the subject. The experiments are simple and well within the power of schoolboys, but so far as we have examined them they differ little from those to be found in well known books. Indeed, in his preface the author says it is impossible adequately to acknowledge the debt "to those from whose books many of the experiments have been derived." But though the book contains much in common with previously published first courses of practical physics, the author has compiled a logical and useful manual of experiments which will serve to introduce boys to the study of physical science. The volume may be recommended to the attention of teachers deciding upon a book to place in the hands of their pupils.

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.*]

On the Radio-activity of Natural Gas.

IN a paper by Mr. E. F. Burton, recently published in the *University of Toronto Studies, Physical Science Series*, an account is given of some experiments with a highly radio-active gas obtained from crude petroleum. In this investigation it was found that air drawn through crude petroleum became charged with a radio-active emanation which, from the rate at which its activity decayed and from the nature of the induced radio-activity which it produced, the author concluded to be an emanation from radium.

The present writer has extended this investigation to an examination of the natural gas from different wells in western Ontario. The gas from every well examined, which included those in the Welland district, in the neighbourhood of Niagara Falls, as well as those near the city of Brantford, was found to be charged with a radio-active emanation. The activity of this emanation in all the gases tested was found to decay or die out to one-half its original intensity in about three days, and the intensity of the induced radio-activity which it produced died down to one-half value in about forty minutes.

The wells examined varied in their depths, but the amount of active emanation present was found to be practically the same in all wells coming from the same horizon. In the Welland district, the gas from those wells which had their source in the stratum known as the Niagara formation, and which were about 500 feet deep, possessed the highest initial conductivity. On an arbitrary scale this conductivity is represented by about 2000.

The gas of those wells which had their source in the Clinton limestone, 750 feet deep, possessed an initial conductivity of about 300 on the same scale, while that from wells coming from the Medina formation, about 900 feet deep, gave an initial conductivity of about 1200. One well, which had its source in the Trenton limestone, and had a depth of about 3000 feet, possessed an initial conductivity of about 200. The highest conductivity obtained in the investigation was that of the gas from a well near the city of Brantford, the conductivity in this case being about 9000. An investigation of this gas showed that, under the action of the emanation with which it was charged, there was produced, at normal pressure, about 15,000 ions per second in each cubic centimetre of its mass.

A test made on the conductivity of ordinary air, confined at atmospheric pressure in the receiver used in making the measurements on the conductivity of the different samples of natural gas, showed a production of 32 ions per cubic centimetre per second. J. C. MCLENNAN.

University of Toronto, May 28.

The Source of Radio-active Energy.

IN NATURE of June 2, Mr. Jeans brings forward the view that the energy manifested in radio-active processes is derived from the coalescence of positive and negative ions, thus involving an annihilation of matter. For some time it has seemed to me that some such fundamental change is needed to account for the observed phenomena, and I therefore venture to submit some general and numerical considerations bearing on this view.

Mr. Jeans is inclined (as I understand) to attribute the beginnings of the process to a change of type in advancing æthereal waves, arising from a lack of strict linearity in the equations of the electromagnetic field. It may be pointed out, however, that whether or not the circumstances of æthereal wave-propagation are strictly expressible by linear equations, there is a *universal tendency* towards loss of kinetic energy in orbitally moving systems of electrons. Unless the orbital periods are very long compared with the time taken by radiation to traverse the assemblage, there must be appreciable radiation of energy, and it is thus a necessary condition of permanence or quasi-permanence that *the orbital velocities should be very small compared with the velocity of light.* This view is confirmed by numerical consideration of simple cases in which the orbits are assumed to be of *atomic* dimensions; it is also borne out by the general optical properties of matter.

It should be remarked that as energy is dissipated and orbits become contracted, with corresponding rise of velocities, the total effective radiation will become more and more intense, so that conceivably very little time may be occupied in the transition from a quasi-permanent motion to a state of collapse and disintegration; indeed, once the orbital motions have begun to give out perceptible radiation, the life of the system must be excessively short.

Thus, whether we look for the main source of radio-active energy in enormous orbital velocities due to intra-atomic rearrangement, or in the constitutive electrostatic energy of individual electrons set free by mutual annihilations, the conditions favourable to radio-activity in any given atom must be confined to a momentary phase—momentary, that is, as measured by ordinary standards. It is not a long step from this conclusion to an exponential law of decay of radio-active matter.

If we adopt provisionally Dr. H. A. Wilson's very interesting suggestion (NATURE, June 2) that, the positive and negative electrons having numerically equal charges, the greater mass of the positive electron is due to its smaller diameter, it follows that *any* isolated electron has electrostatic energy $=\frac{1}{3}m.3V^2$, where m is the mass of the electron (when moving slowly) and V is the velocity of light. In other words, when matter of mass M is annihilated, energy $=\frac{1}{2}M.3V^2$ is set free—initially as an electromagnetic pulse of great intensity. *A further assumption involved in this estimate is the validity of the ordinary electrostatic-field relations for such enormous intensities as obtain in the neighbourhood of an electron.*

If annihilation of matter furnishes the energy of radio-activity, it follows from our estimate that, in the case of radium, the coalescence of one pair of electrons causes the break-up of a large number of radium atoms (something of the order of one hundred), otherwise the total energy emitted by radium would be much greater than that which has been observed by Curie and Laborde.

If the assumption in italics above is very wide of the mark (which is conceivable), our estimate of the energy of annihilation is probably in excess.

It may be supposed that some neighbouring atoms, which are not actually broken up by the pulse arising from a pair of coalescing electrons, receive a sufficient access of kinetic energy to *prolong* their existence. "Metabolons" of short average life may be conceived of as consisting of assemblages the orbital motions of which are especially liable to be damped out rapidly by radiation of energy.

Cambridge, June 9. C. V. BURTON.

NEW LAND.[1]

ON June 24, 1898, a vessel, insignificant in size and somewhat quaint in appearance, unlike ships generally engaged in ordinary mercantile avocations, might have been seen threading her way, under her own steam, through the numerous merchant ships that were at anchor in the harbour of Christiania. She was a vessel of no common type; her peculiarities of construction and rig were noticeable, even to the inexperienced eye of a landsman, and judging from the enthusiastic cheers with which she was greeted on all sides, she was evidently bound on a voyage of no common interest. The ships in harbour were all decorated with gay bunting; flags flew from their mastheads, and cheer after cheer resounded from their crowded decks and rigging as she steamed slowly past. The quays and wharves along the shore were also thronged with a vast concourse of people, bedecked in their smartest and gayest holiday attire, all equally enthusiastic in their demonstrations of farewell, while the fjord itself was alive with innumerable boats of all descriptions, including many small steamers, all intent upon one object, namely, to do honour to the little vessel that was so quietly proceeding to sea, and to wave her a last good-bye.

What was the cause of all this enthusiasm and excitement? and why was this little craft the centre of so much attention and attraction?

A glance at the name on her stern revealed the fact that she was the *Fram*, and that she was bound on an important voyage of geographical exploration and scientific research in high northern latitudes.

She was the same little *Fram* that was specially designed and constructed for Dr. Nansen in 1892, and had carried that bold explorer northwards on his memorable and adventurous voyage towards the North Pole. His second in command, and navigating officer, on that occasion was Otto Sverdrup, an officer of the Norwegian mercantile marine, who had been specially selected for the appointment in consequence of the experience he had gained in ice navigation while serving as a mate on board a Greenland whaler.

It was the same Otto Sverdrup who was in command of the little *Fram* as she steamed out of Christiania Harbour on the occasion to which we refer, but in this instance he was not only commander of the ship, but was also the leader of the expedition. He had already won his laurels as an Arctic explorer, and had proved himself a careful, as well as a skilful, navigator in ice-encumbered seas. His selection for the command of the *Fram* was more than justified, as a perusal of his account of the voyage, which has recently been published under the title of "New Land," will abundantly testify. The book, originally produced in Norway, has been well and ably translated into English by Ethel Hearn. The narrative of the cruise is presented to us in the shape of two handsomely bound volumes, profusely illustrated from sketches and photographs taken by members of the expedition. It is perhaps unfortunate that a great many of the illustrations in the text are not inserted on the pages to which they refer, but this does not detract from their excellence. The story as related is the plain unvarnished tale of a sailor; the incidents are graphically described, and a vein of humour pervades the whole narrative.

The Introduction informs the reader very curtly as to the origin of the expedition, and how it was that Otto Sverdrup was selected as leader. He writes:—

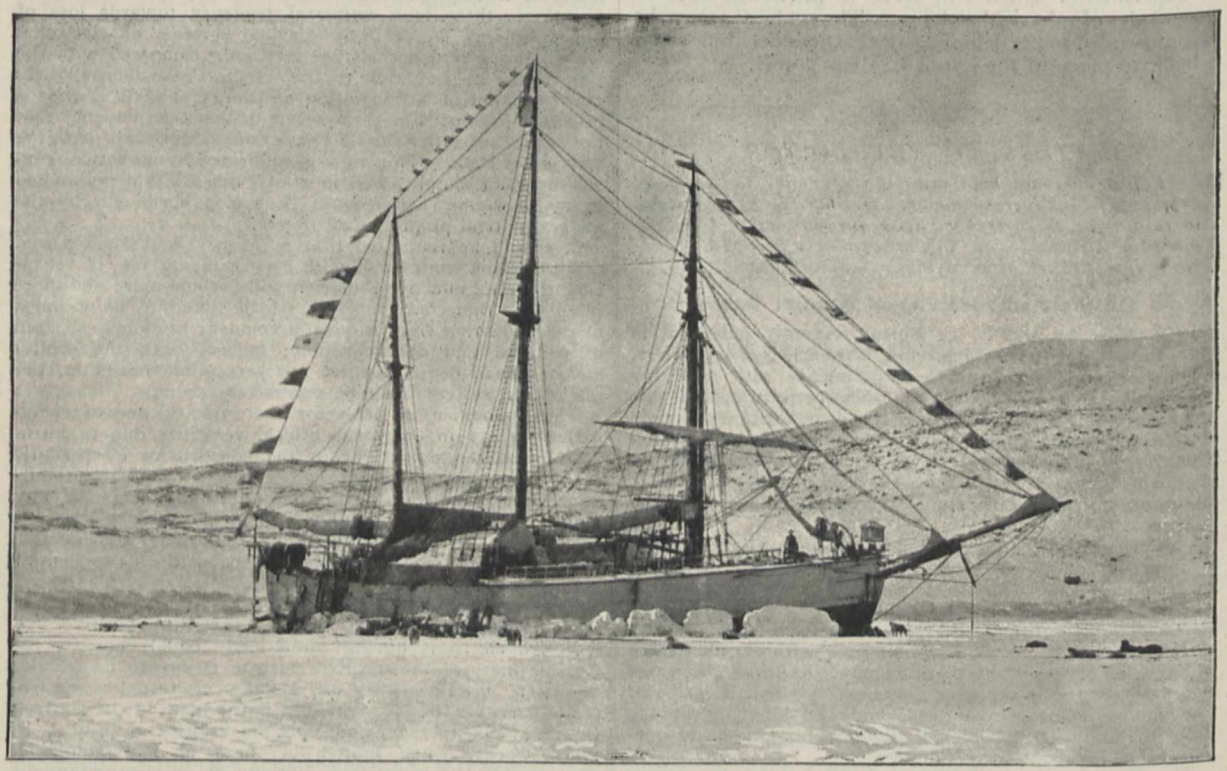


FIG. 1.—Seventeenth of May, 1899. From "New Land," by Otto Sverdrup.

[1] "New Land. Four Years in the Arctic Regions." By Otto Sverdrup. Translated from the Norwegian by Ethel Harriet Hearn. 2 vols. (London: Longmans, Green and Co., 1904.) Price 36s. net.

"A few days after our return from the first Norwegian Polar Expedition, we were lying in Lysaker Bay unloading the *Fram* when Dr. Nansen came on board. 'Do you still wish to go on another expedition to the North?' he asked me.' 'Yes, certainly,' I answered, 'if only I had the chance.' He then told me that Consul Axel Heiberg,[1] and the firm of brewers Messrs. Ringues Brothers,[1] were willing to equip a new scientific expedition with myself as leader."

The Norwegian Government, realising the value of the work it was proposed to carry out, in a truly patriotic spirit well worthy of emulation, placed the *Fram* at the disposal of the promoters of the enterprise, and generously added the sum of 1100*l.* to assist in defraying the cost of the expedition. The main object was the exploration of the north coast of Greenland by way of Smith Sound and Robeson Channel, in fact, to follow in the footsteps of Nares's expedition in 1875; on reaching the highest point attained by our countrymen on the north coast of Greenland, the explorers were to continue along the coast, and as far to the east as it was possible to reach—in other words, to determine by actual exploration the insularity of Greenland.

There was to be no question of trying to reach the North Pole!

In the event of unforeseen difficulties interfering with the successful accomplishment of this project, Captain Sverdrup was at liberty to use his own judgment and discretion in formulating a revised programme that would, in his opinion, be the best to further the interests of geographical exploration and other scientific investigations.

The liveliness of the little *Fram* during the first few days in the Atlantic, when somewhat stormy weather was encountered, is thus jocosely alluded to by the author:—

"The members of the expedition, who were not much used to the sea, turned very white, and looked extremely serious. They trooped to the doctor and complained of various symptoms; some had headache, some shivering fits, and some pains in the stomach, which they had contracted, they knew not how; but none of them mentioned the malady by its right name. The doctor, however, came to the conclusion that the complaint with the many different aspects, had a single and fairly simple name, to wit, sea sickness; and for it there was but one and an equally simple remedy, dry land. Unhappily we had forgotten to bring any with us in our otherwise so well equipped Expedition, but it was hoped it might be found somewhere north in the Arctic Ocean, and this appeared to console the sufferers."

FIG. 2.—Sledging expedition ready to start. Spring, 1901. From "New Land," by Otto Sverdrup.

Time, however, as is usual in similar cases, soon restored the ailing ones to their customary health and the free use of their sea-legs! The complement of the little ship was, exclusive of the captain, only fifteen souls. In this small number was included two deck officers, a doctor, cartographer (who, by the way, was a cavalry officer), botanist, geologist, zoologist, two engineers, a steward, and four others who made themselves generally useful in carrying out any duties that might at any time be apportioned to them. All, it is almost unnecessary to add, assisted in the working of the ship when at sea or in the ice.

On reaching Smith Sound, their further progress north was effectively barred by an impenetrable ice pack. After several unsuccessful attempts to push through, they were at length compelled to go into winter quarters, on the west side of Smith Sound, not very far from its entrance, in a small partially

[1] These gentlemen had contributed largely in assisting to defray the expenses of Nansen's expedition!

sheltered bay, which they appropriately named Fram's Haven.

The winter passed pleasantly. They were fortunate in securing abundance of fresh meat in the shape of musk oxen, hares and ptarmigan, while they were also lucky enough to kill several walruses, which afforded them an excellent opportunity of laying in a large stock of food for their dogs, of which they had about seventy on board.

It is a pity that Captain Sverdrup in his narrative should have considered it desirable to alter the nomenclature of that animal which has so long, and so universally, been known as the musk ox. Its scientific name is the *Ovibos moschatus*, and it was so called in consequence of the musky odour which has always been associated with its flesh. Captain Sverdrup, simply because he failed to detect this strong scent in any of the beasts killed in his expedition, somewhat arbitrarily alters the name by which they have hitherto been known to that of "polar ox." This is a misnomer, for although the animals have been found in a fairly high northern latitude, they are also inhabitants of sub-Arctic climes, and are frequently seen as far south as latitude 54° in North America.

It is an established fact, although not, apparently, coming under the personal cognisance of Captain Sverdrup, that unmistakable traces of the odour of musk, which have had most unpleasant effects on those who have partaken of the meat so tainted, have on many occasions been observed by travellers and explorers, who, however, also report that their flesh when not tainted is excellent eating.

It is therefore to be regretted that Captain Sverdrup should have so completely ignored the experience of others, and substituted another name for an animal that is so well known, and one which has been in general use for so many years.

During the winter and following spring, several sledging expeditions were undertaken, having for their object the exploration of Ellesmere Land.

On one of these excursions Captain Sverdrup was unlucky enough to break one of his teeth, which incident is thus somewhat facetiously alluded to.

"When dinner was at last served, I fell to on a biscuit with such ardour that I managed to break off a front tooth. Fosheim (his companion) thought we ought not to waste our teeth so far away from people, and implored me not to go on in that way. I followed his advice, and was about to throw away the tooth, when he again observed, that there was no knowing how useful it might be; so I put it in my pocket to serve as a remembrance and a warning. I have since had it put in again."

Fosheim was evidently a man of a practical turn of mind, thoughtful, sensible, and of great perspicacity!

Although the Eskimos have never yet been found living on the western side of Smith Sound, vestiges of a previous occupation of the country by these nomadic tribes were discovered. They consisted chiefly of little heaps of stones and the ribs of whales placed in circular formations, presumably so arranged as to form their summer encampments. Similar traces, it may be remembered, were found by Sir George Nares's expedition on the west side of Smith Sound.

During one of his sledging expeditions in the late autumn, Sverdrup was startled by the altogether unexpected arrival at his camp of a sledge with two men on it. They proved to be the American explorer, Commander Peary, with an Eskimo dog driver. They had driven over from the ship *Windward*, which was beset in the ice about a mile from the shore in the neighbourhood of Cape Hawks.

This meeting on the silent shores of the Arctic Ocean seems to have been as surprising and as unexpected as the equally strange one between Nansen and Jackson in Franz Josef Land only a couple of years earlier. At that time they were probably the only two expeditions in the Arctic regions engaged on geographical discovery. They had been absent from home for a long period; they were several miles from their respective ships, yet we read, with something akin to surprise, that Peary only remained in their company for a few minutes, and would not even wait while a cup of coffee was being prepared for him, or, as Captain Sverdrup tersely puts it, "his visit was so short that we had hardly time to pull off our mittens"!

In the spring of 1899 the *Fram* was visited by several Eskimos from the east side of the Sound who were on their way to Peary's ship. They were so pleased with the warm reception that was accorded them, and with the kindness they received at the hands of the Norwegians, that they appear to have overstayed their welcome, for we read that:—

"We began to be heartily sick of them all. They spread all over the vessel a peculiar rank odour of blubber and train oil with indefinable additions. We tumbled over them wherever we went, while their shock heads of hair looked as if they might accommodate a legion of animals of which we stood in far greater fear than of either the polar ox or the bear"!

The wandering Eskimo is not altogether the most agreeable or the most savoury companion to associate with for an indefinite period.

It was not until the end of July that the *Fram* succeeded in extricating herself from the icy bondage in which she had been held for eleven long months. Attempts were at once made to work to the northward, but the ice was found so tightly packed that Captain Sverdrup abandoned all further efforts to proceed in that direction, and turned his attention to Jones Sound, a route that had always been regarded by Arctic authorities as one very favourable for exploration. On September 1 the *Fram*, having reached a position (in this sound) in the neighbourhood of Admiral Inglefield's furthest in 1852, was secured in her second winter quarters, in a small and almost land-locked harbour which was named Havnefjord.

From this position much useful and important geographical work was accomplished by boat in the autumn, and by sledges during the following winter and spring. Many musk oxen were fallen in with, and a large number of seals also were shot. The cold during the winter was so great that the brandy in a flask was frozen solid. The following little episode will show that inconveniences arising from intense cold were not regarded in a very serious manner by the travellers:—

"While Fosheim was taking his turn at running, being as warm as possible, he forgot all about his nose, which took this opportunity of freezing. He knew nothing about it, until it was frozen so stiff that it looked like a piece of white bone in the middle of his face, and he might easily have broken it off. Had it gone on freezing a little longer, he would have been noseless.

"However with general assistance and careful treatment that member was saved at the last moment, but it wore mourning for a long time afterwards, and looked more like a dab of pitch which had got into the wrong place than anything else in the world."

When released in the summer of 1900, the *Fram* steamed to the west and went up Cardigan Strait; after being beset in the ice for some weeks they succeeded in reaching the head of Goose Fjord, where they passed their third winter. They confidently expected that this would be their last winter from home; but, alas! the Fates ordained otherwise, and they were compelled to pass a fourth one, having only succeeded in

advancing during the summer a distance of nine miles, which brought them within five miles of the open water and freedom! It was, indeed, tantalising to know that such a short but impenetrable barrier intervened between them and the open sea. It will be remembered that it was exactly this distance of land ice that prevented our own ship, the *Discovery*, from being liberated after her first winter in the Antarctic regions.

In spite of their disappointment, the brave Norwegians did not in any way relax their efforts to carry out the important work entrusted to them, and much valuable information in various branches of science was obtained during their long sojourn in Goose Fjord, one of the sledging expeditions having attained the high latitude of 80° 30′, almost succeeding in reaching and joining hands with Aldrich's furthest in lat. 82° 16′ and long. 85° 30′ W. on the north coast of Grinnell Land.

It was August, 1902, before the little *Fram* was released from her imprisonment, reaching Norway the following month, where the gallant explorers received after their long absence that hearty welcome, not only from their own countrymen, but from the civilised world at large, which they so richly deserved.

On the whole the expedition achieved a great success. It added very materially to our geographical knowledge of the Arctic regions, especially in the neighbourhood of the Parry Archipelago. Captain Sverdrup cleared up satisfactorily the debatable question as to whether Hayes Sound had an outlet to the west, or whether it was, as many thought, only a large bay. The western limits of Ellesmere Land, Grinnell Land, and Grant Land were determined, a matter of some geographical importance, as illustrating the archipelagic character of the land on the western side of Smith Sound and Robeson Channel.

The scientific work accomplished by the expedition is contained in four appendices at the end of the second volume. Appendix i. relates to the geological investigations made during the voyage, and is of great interest. Appendix ii. is a summary of the botanical work of the expedition and its results. Appendix iii. refers to the fauna of the different localities visited by the explorers. The scarcity, it might almost be said the extinction, of the reindeer is ascribed to wolves; these voracious animals are the great enemies of all Arctic quadrupeds, except, perhaps, the polar bear and the musk ox. Four species of butterflies were found, as well as some moths and a few wasps.

Appendix iv. refers to the meteorological observations regularly taken during the whole four years.

Much literary skill is exhibited by the author in the compilation of this work. It is written in a popular manner, and imparts valuable information in an interesting and pleasing way.

It is a book that will certainly take its place among other standard works on the Arctic regions.

An excellent map of the regions explored will be found in a pocket at the end of the second volume.

AN IMPORTANT ARCHÆOLOGICAL DISCOVERY IN EGYPT.

THE most important archæological event reported from Egypt during the last excavation season (1903–4) is the discovery by Prof. Naville, of the University of Geneva, and Mr. H. R. Hall, of the British Museum, of the most ancient temple at Thebes. The excavations were carried on by Messrs. Naville and Hall on behalf of the Egypt Exploration Fund, which is to be congratulated on having made this important discovery. The services which have been rendered by the Egypt Exploration Fund to Egyptological science since its foundation, some twenty years ago, have indeed been innumerable.

One of the most important works carried out by the fund was Prof. Naville's complete excavation of the great temple of Deir el-Bahari, in the western hills of Thebes. The excavation came to an end in 1899, after the main temple had been entirely cleared and the necessary works of conservation and restoration had been carried out, but before the environs of the temple had been completely explored. To the south of the temple lay a wilderness of rubbish heaps, which might conceal a necropolis or even another temple, placed between the great shrine built by Queen Hatshepsut and the southern horn of the *cirque* of cliffs which rise behind and around Deir el-Bahari. Means for further excavation failed, however, and the exploration of the unexcavated tract to the south of the temple was postponed until the present season, when Prof. Naville again took up the spade and very soon discovered that underneath the heaps of rubbish (Fig. 1) lay the not inconsiderable remains of a smaller temple, of high archæological importance on account of its age.

FIG. 1.—Excavators at work on the Mounds.

It is the funerary temple or mortuary chapel of the most distinguished monarch of the eleventh dynasty, Nebkherurā Mentuhetep, who reigned about 2,500 B.C., according to the best authorities. A temple of this date is a great rarity in Egypt. Remains of even older ones (of the same funerary character) have been found by the German excavators, Messrs. Borchardt and Schäfer, at Abusir, near Cairo; these belong to the fifth dynasty and are at least five hundred years older than Prof. Naville's new temple; they are the most ancient temple remains in Egypt. The new temple, however, comes next to them in age, and if it is surpassed by them in peculiarities of architecture, it appears to fully equal them in general architectural interest and to surpass them in the point of artistic interest and importance, since it has added considerably to our knowledge of the history of Egyptian art.

The artistic triumphs of the Old Empire are well known; but our knowledge of the condition of art at the beginning of the Middle Empire under the eleventh dynasty was, until the present discovery, scanty. The general impression has been that the work of the

eleventh dynasty was rough and crude in style. The discovery in the new temple at Deir el-Bahari of hundreds of fragments of coloured relief sculptures of the eleventh dynasty compels us to modify this impression, and we see from them that, side by side with the somewhat crude and awkward productions hitherto considered characteristic of this dynasty, work of the highest excellence was also turned out. This is an important result, and it is by no means improbable that this improved artistic style is the work of a sculptor who, we know, lived in the reign of Nebkherurā, Mertisen by name, and his school.

These reliefs originally formed part of the decoration of the walls of the main pillared hall of Nebkherurā's temple. This hall, only a part of which has as yet been uncovered, stands upon an artificially squared platform of rock, immediately to the south of the Hathor shrine of the great temple of Deir el-Bahari, and separated from it by a small open court about sixty feet across. The platform is about fifteen feet high. Its sides were masked by a magnificent wall of finely-squared and fitted limestone blocks, built in bonded courses of

FIG. 2.—The Granite Threshold and Pillared Hall.

broad and narrow blocks alternately, one above the other, as may be seen from the photograph. In the extreme south-west corner of the court this wall is perfect. It is without doubt one of the finest specimens of Egyptian masonry yet brought to light. Entrance to the main hall on the platform was gained, as in the great temple, by means of an inclined ramp, which led up to an entrance gate, no doubt, like that of the main temple, a trilithon of red granite; the threshold of finely-polished red granite still remains *in situ* (Fig. 2). The socket in which the door turned (in the usual ancient manner before the invention of the hinge) is clearly seen, and also the small side run, or channel, by which the door could be bodily removed from the socket and replaced when necessary.

To the north of the ramp a colonnade of small, square sandstone pillars has been discovered, placed on a stone pavement immediately before and below the platform. It can hardly be doubted that a second similar colonnade originally existed to the south of the ramp. Thus we have the main portion of the temple, consisting of a pillared, or "hypostyle," hall of octagonal pillars placed on a platform of rock, approached by an inclined ramp, flanked by colonnades on the lower ground level. It will be noticed by all who have visited Deir el-Bahari that, so far as platform, ramp, and colonnades are concerned, this is precisely the arrangement of the great temple of Queen Hatshepset, or Hatasu, to the north. This opens up a new field of possibilities. The curious plan of the great temple has puzzled archæologists and architects from Wilkinson's time to the present day. Whence this curious arrangement of platforms, inclined planes, and colonnades, so totally unlike anything else in Egypt? Various theories have been propounded, but it is only now that the solution has been found, owing to the discovery of the temple of Nebkherurā. Colonnades, platforms, and ramps are then a feature of the older temple-architecture of Egypt; they were, at the time of the eighteenth dynasty, when the great temple of Hatshepset was built, old-fashioned, archaic, but it is evident that the great temple is, as far as its main arrangements are concerned, a mere enlarged copy of the thousand-year older temple at its side; it is simply a "magnificent archaism."

When it was built the older and smaller temple was still used as a temple, apparently, and both existed side by side for some time; this is shown by the fact that the later temple is not placed in the centre of the *cirque*, but is crammed up against the northern cliff-face; it could not be placed in the exact centre because the southern portion of the space at Deir el-Bahari was already occupied by the older temple. It was built roughly parallel to the older temple; it is oriented 24° S. of E. (Lockyer, "Dawn of Astronomy," p. 212), and this must be more or less the orientation of Nebkherurā's temple also. This fact is of interest, as the question might be mooted whether the orientation of the main temple is also an archaism, imitated from that of Nebkherurā's temple (B.C. 2500), or not. Sir Norman Lockyer has already postulated ("Dawn of Astronomy," p. 218) the existence in the western hills of Thebes of a temple of Hathor older than the shrine of the goddess at Deir el-Bahari, "built to observe the rising of the star [Hathor-Sothis, *i.e.* Sirius] at a time perhaps somewhat later than that given by Biot (3285 B.C.)." Nebkherurā's date is about 2500 B.C., but we have as yet no proof that in his funerary temple the reverence paid to his spirit was conjoined with a worship of Hathor. We may find this proof in the course of the further excavations, or the older temple of Hathor may have existed further to the southward, perhaps on the site of the present little temple dedicated to Hathor of the Waste at Deir el-Medîna, which was originally founded in the reign of Amenhetep III., B.C. 1450. Certain it is that the worship of Hathor in the western hills is far older than the time of Amenhetep III. and Hatshepset, and the foundation of the oldest temple built in her honour at Deir el-Bahari or Deir el-Medîna may well go back to very near the date propounded by Biot for the first systematic observation of the heliacal risings of Sothis-Hathor (Sirius). It is to this very period—between 3285 B.C. and 2400 B.C.—that the beginnings of the Theban Empire and of the Theban temples must be placed. To the student of the astronomical orientation of Egyptian temples the new discovery will, therefore, be of the highest interest.

Among the large number of smaller objects discovered in the course of the excavations, the most interesting will probably prove to be the series of small *ex-votos* of devotees of Hathor, found in the court between the two temples. These consist of small cows (the sacred animal of the goddess), and female figures in earthenware and blue faïence, votive eyes and ears

in bronze and faïence, broken blue vases with representations of the holy cow emblazoned with stars, &c. These votive offerings, which nearly all date to the eighteenth dynasty, were undoubtedly originally devoted in the Hathor shrine of the great temple, and when the shrine became too full were thrown down by the sacristans into the space between the two temples, which thus became a dust-heap. And from this dust-heap many interesting objects have been recovered, including a copper chisel with hardened edge, which should be of special interest to metallurgists, and specimens of palm-fruit, nuts, reeds, and shells, dating to about 1500 B.C. One of the most remarkable objects found is a perfect three-cornered loaf of unleavened bread, of the same date. All these smaller objects, together with a number of specimens of the eleventh dynasty reliefs already described, will, we understand, be exhibited at the annual exhibition of the Egypt Exploration Fund at University College, Gower Street, in July next.

Subscriptions for the work of the Egypt Exploration Fund are much needed, and should be sent to the Secretary, 37 Great Russell Street, W.C. We are indebted to Mr. Hall for the photographs here published.

NOTES.

THE achievements of the Japanese in the war are causing increased attention to be given to the influence of brain-power on history. National enlightenment, and the scientific spirit which welcomes every increase of knowledge, are the two chief factors of progress in these days, and the Japanese successes have shown the power of both these attributes. An important article in the *Neue Freie Presse* of Vienna lays emphasis upon the use which Japan has made of its brain-power; and the following extract from a summary published in Monday's *Times* shows how the prediction made by Sir Norman Lockyer in his address to the British Association last year is being fulfilled:—"Japan has adopted modern civilisation with soul and body. She has not merely copied those externals of modernity which rob an uncivilised people of originality without giving any real value in exchange, but she has assimilated eagerly the ideas of modern culture. Modern are her schools, in which the children of all creeds are taught morals, but not religion, in order to avoid all ecclesiastical intolerance. Modern is her view that priests should refrain from political struggles, and should reserve themselves for the leading place in pious exercises. Modern is her wish, despite many a hard rub during the time of transition, to respect without prejudice all free-minded criticism of public affairs and not to crush opposition by brute force, or, worse still, to intimidate it by a system of crafty calumny. Modern also are her sincere respect for freedom of research, her joy in a conception of the universe which makes intelligence, not superstition, the regulating power of human acts, and greets with gladness every new discovery and every new thought; and modern is a policy which incites minds to development instead of fettering them, which favours instead of suppressing the sheer delight in material production."

A CONVERSAZIONE of the Institution of Electrical Engineers will be held at the Natural History Museum on the evening of Tuesday June 28.

THE death is announced of Dr. Max Kaech, officer in charge of the geological collections of the national museum of natural history and ethnography—the Museu Goeldi—at Para, Brazil.

A MEETING of members of council of the South African Association for the Advancement of Science was held at Johannesburg on May 19, Mr. T. Reunert presiding. The chairman reported that he had been in communication with the German, French, Austrian, and Italian Consuls, and was hopeful of the cooperation of these gentlemen in connection with the visit of Continental delegates to South Africa with the British Association next year. Dr. Pakes, referring to the impending departure of Mr. Reunert for England, mentioned that he would represent the South African Association at the forthcoming Cambridge meeting of the British Association.

THE Antarctic ships *Discovery* and *Morning* have sailed from Lyttelton for Plymouth.

THE Institution of Electrical Engineers visited Colchester on Saturday on the occasion of the formal reception and unveiling of an historical picture presented by the institution to the town of Colchester in commemoration of the tercentenary of Dr. William Gilbert, the "father of electrical science," who was born in Colchester.

IN connection with the St. Louis Exposition, an International Electrical Congress has been arranged from September 12 to 17. It will be divided into eight sections, for which the following have been appointed chairmen and secretaries respectively:—A, general theory, Prof. E. L. Nichols, Prof. H. T. Barnes; B, general applications, Prof. C. P. Steinmetz, Prof. Samuel Sheldon; C, electrochemistry, Prof. H. S. Carhart, Mr. Carl Hering; D, electric power transmission, Mr. C. P. Scott, Dr. Louis Bell; E, electric light and distribution, Mr. J. W. Lieb, jun., Mr. Gano S. Dunn; F, electric transportation, Dr. Louis Duncan, Mr. A. H. Armstrong; G, electric communication, Mr. F. W. Jones, Mr. B. Gherardi; H, electrotherapeutics, Dr. W. J. Morton, Mr. W. J. Jenks. It is at present intended to limit the number of papers to 150, and the transactions are expected to fill three octavo volumes. Mr. Elihu Thomson is president, and Dr. A. E. Kennelly, of Harvard University, general secretary of the congress.

THE annual general meeting of the Ray Society was held on June 9, Lord Avebury, president, being in the chair. The report announced the attainment of the society's sixtieth year; the death of two vice-presidents, Dr. C. H. Gatty, F.R.S., and Mr. R. McLachlan, F.R.S.; the completion of Newstead's "British Coccidæ" and of Michael's "British Tyroglyphidæ." The volumes to be issued during this year and next were stated to be:—Vol. i. of the "British Desmidiaceæ," by Mr. W. West and Prof. G. S. West; vol. i. of the "British Tunicata," by the late Joshua Alder and the late Albany Hancock; vol. i. of the "British Freshwater Rhizopoda and Heliozoa," by James Cash; and vol. ii. of the "Desmidiaceæ." The officers and council elected for the ensuing year were:—President, Lord Avebury, F.R.S.; vice-presidents, Dr. R. Braithwaite, Mr. A. D. Michael, and Lord Walsingham, F.R.S.; treasurer, Dr. DuCane Godman, F.R.S.; and secretary, Mr. John Hopkinson.

THE use that is being made of wireless telegraphy in connection with the war is shown by the following extract from a private letter received from the *Times'* operator at Wei-hai-wei, and published in Wednesday's issue:—"All the British warships, from the third-class cruisers up, are equipped with Marconi, about twenty-four in all; nearly all the Japs have wireless equipment; the Russian ships are equipped, and several German vessels. One or another of them can be heard any time, day or night. The Japs are

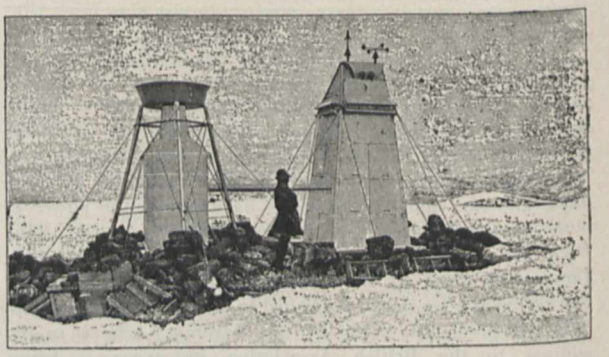
particularly numerous, and we are at it all the time. We laugh at them, for we have struck some good points in tuning, which settle them very nicely. On the boat, when receiving our stuff, two of the four wires are grounded directly, which gives best results. Any resistance between those wires and the ground weakens the signals. If we want to hear the Japs call, disconnecting ground wire entirely from syntoniser of the receiver brings them in strong; while with the ground wire on, as in receiving our stuff, the Japs come very faintly. On the shore station it is different. Three wires are best in receiving up to 100 miles, with the other two wires free, at which time the Japs come in weakest. By grounding the other two wires the Japs come in very strong and our stuff weakest. Above 100 miles our stuff comes best with two wires grounded directly. That, of course, allows others to come in, but they are not strong enough to prevent my reading through. So far, that tuning is best, and certainly gives very satisfactory results."

A REUTER message from New York states that Mr. Marconi's effort to supply news daily on board the Cunard liner *Campania* has been entirely successful. The daily news bulletin was issued to the passengers at breakfast. The *Campania* had not long started when news was received from the Seaforth station, and later in the evening from Poldhu. Touch was kept with the latter station until a distance of 2300 miles had been reached on June 9. At 2 a.m. on that date communication was established with Cape Breton, 2000 miles distant, and was maintained until the end of the trip. On June 8 Cape Cod station, 1030 miles distant, was picked up, Cape Breton and Poldhu being also in communication with the ship. On the following day news bulletins were received from the American stations. Communication was begun with Nantucket at 3 p.m. on June 10, news being received from that place as well as from Cape Breton and Cape Cod. In addition to the shore stations, communication was established with the *Etruria* and the *Aurania*. The *Lucania* exchanged news with the *Campania*, and a number of private messages were sent at intervals. Touch with both sides of the Atlantic was continuous for three days in mid-ocean.

WE learn from the *Pioneer Mail* that, through the initiative of Mr. E. H. Aitken, a zoological society is about to be founded in Sind with the object of promoting the study of animal life. The society will not aim at making collections of its own, but rather at improving those already existing in the municipal gardens and museum, and turning them to the best account for scientific purposes.

AT the suggestion of Prof. W. F. Barrett, Royal College of Science, Dublin, Mr. P. E. Belas described in NATURE of May 12 (p. 31) a simple method of showing vortex motion by allowing aqueous fluorescein to flow from a capillary tube with its point just below the surface of water in a tall cylinder, and then tapping the stand supporting the tube. Mr. Robert E. Doran, of Queen's College, Cork, writes to direct our attention to the fact that he has performed a similar experiment in his demonstrations for the past six or seven years. Mr. Doran recommends that a bulb be blown at one end of a glass tube, and that the open end be contracted to slightly less than 1 mm. bore. The bulb and tube are filled completely with a 1 per cent. solution of common salt to which fluorescein has been added to produce a liquid almost free from fluorescence. The tube is clamped vertically over the centre of a tall cylinder filled with water. When the water is at rest the tube is lowered until its aperture just touches the surface. This starts the experiment, and no tapping is necessary. Several photographs showing the vortex rings resulting from his method of procedure accompany Mr. Doran's letter.

IN *La Nature* of May 28, Dr. A. Hamberg, of Stockholm, gives an interesting account of his successful establishment of meteorographs on two mountains in Swedish Lapland. One set of apparatus, that shown in the accompanying illustration, is on the Portitjokko, at an altitude of 1850 metres, and has been working satisfactorily since July, 1902, with the exception of occasional interruptions of the anemometer owing to hoar-frost. The second apparatus is installed on the Sähkok, at an altitude of about 1080 metres. The barograph and thermograph were constructed by M. Richard, of Paris; the other instruments were made by Dr. Hamberg, with the aid of M. Linderoth, clockmaker, in Sweden. Each set of apparatus weighs 1000 kilograms, and the separate parts had to be conveyed by men and reindeer. The clocks go for a year, each "weight" being 300 kilograms. The recording portions of the meteorograph are encased in screens of sheet iron, inside which pans of calcium chloride are placed. The apparatus on the left of the diagram is the pluviograph. Instead of using ink,



which was found to be unsatisfactory, punctures are made every twenty minutes in the papers covering the drums of the instruments, and occasionally in the autumn the deposit of hoar-frost has to be cleared away by Laplanders. The great difficulties of the problem have only been overcome by Dr. Hamberg after persistent and tedious experiments, both as to position and methods of registration.

WE have received from the secretary of the Meteorological Office an excerpt paper containing some of the principal meteorological subjects dealt with in Section A of the British Association meeting at Southport. Among these is a paper on the general circulation of the atmosphere, by Dr. H. H. Hildebrandsson, being a summary of a report to the International Meteorological Committee (Upsala, 1903), which will attract attention. The author points out that while, thanks to the labours of Maury, Brault and others, the system of winds prevailing at the surface of the earth is well known, our knowledge of the motions of the upper currents gained from general publications is mostly based upon theoretical considerations. The late Rev. W. C. Ley commenced observations on the upper clouds in 1872, and in the following year the author established a series of cloud observations in Sweden with the object of determining the movements of the air at different altitudes in areas of high and low barometric pressures. These observations have been supplemented during recent years by experiments with balloons and kites. The result of these investigations, the author states, will render it necessary to abandon once for all the theory hitherto adopted of a

vertical circulation of the atmosphere between the tropics and the poles, and he expresses the hope that the terms "polar" and "equatorial" currents, which have hitherto caused so much confusion in dynamical meteorology, will disappear completely from meteorological science. In his important paper he shows, for instance, that in all parts of the temperate zone of the northern hemisphere an upper current from west to east prevails in all months of the year, while in the tropical zone the currents at all heights are almost without exception from east to west. Another important contribution, by M. L. Teisserenc de Bort, on barometric depressions at various altitudes, is contained in the excerpt above referred to, which corroborates the conclusions arrived at by Dr. Hildebrandsson.

THREE papers on terrestrial magnetism from the reports of the U.S. Coast and Geodetic Survey for 1902 and 1903 have just been received. In a paper on "Magnetic Observatories of the United States Coast and Geodetic Survey," Dr. L. A. Bauer and Mr. J. A. Fleming describe very fully the various points which have to be considered in determining suitable sites for magnetic observatories, and the question whether the elimination of magnetic material in the construction of observatories is essential when used only for observations of variations and not absolute values is discussed. A description of three observatories is given, and the paper is illustrated with maps of the selected sites and with views of the observatories and of the instruments used. A paper on "Magnetic Dip and Intensity Observations (January, 1897, to June 30, 1902)," by Mr. D. L. Hazard, gives full details of the magnetic elements determined at 800 stations—about one-fifth of the total number proposed for the general magnetic survey. In addition to the field observations, the variations of declination and of the horizontal intensity are recorded photographically at four observatories, at each of which the absolute values of the elements are determined at least once a week. Much difficulty was found in obtaining concordant results with different dip circles; subsequently an earth-inductor was selected as a standard dip instrument. In the third paper —"Results of Magnetic Observations made by the Coast and Geodetic Survey between July, 1902, and June, 1903" —Dr. L. A. Bauer describes the method of taking field observations, and gives tables of the results and a full description of each station used for the observations. It is evident that every precaution is taken that each station may be accurately located at any future date.

AMONG our weekly budget of pamphlets, we may refer to a copy of the *Proceedings* of the South London Entomological and Natural History Society for 1903, and also to one of the *Proceedings* of the Philadelphia Academy for April. The latter contains an important paper, by Dr. D. B. Castell, on the cell-lineage and larval development of the nudibranch mollusc *Fiona marina*.

MR. W. E. CLARKE has favoured us with a copy of a paper from the *Proceedings* of the Royal Physical Society of Edinburgh (vol. xv., part ii.) in which he describes, under the name of *Mus musculus faeroensis*, a new form of house-mouse from the Færöes. Large size and certain peculiarities in colour are the distinctive features of this race.

THE medusas of the Bahamas form the subject of the first issue of a new serial (vol. i., No. 1)—the *Memoirs of Natural Sciences*—published by the Brooklyn Institute. Compared with that of the Tortuga Islands, off Florida, the medusa-fauna of the Bahamas has been found by the author—Mr. A. G. Mayer—to be comparatively poor. This is accounted for by the circumstance that the Tortugas stand in "blue water," whereas the Bahamas are surrounded with shallow flats of coral-mud, very sterile in animal life generally.

AN important discovery with regard to the breeding of the cod is recorded by Mr. T. W. Fulton in the *Publications* (No. 8) of the International Council for the Exploration of the Sea. As a rule, cod spawn from January to June—chiefly in March—but some of these fish recently taken on a patch of rocky ground in the North Sea lying to the north-east of Aberdeen, off the coast of Norway, were found to be spawning in September and October. It was already known that the herring has a spring and an autumn spawning season, and now we have proof that, in one area at any rate, the same holds good for the cod. An interesting point for determination is whether there is any difference between the spring and the autumn fry.

DR. C. W. ANDREWS, of the British Museum, has recently returned from Cairo, where he had been studying the fine series of vertebrate remains from the Fayum district. A number of specimens have, we understand, been acquired by exchange for the British Museum, while the series in the museum of the Egyptian Geological Survey at Cairo has been arranged and developed by Mr. Barlow, jun., of the formatori's staff at the Natural History Museum, who went out some months ago for that purpose. Among the more important specimens at Cairo is a young skull of *Arsinoitherium zitteli*, exhibiting the cranial sutures, and thus permitting the identification of the bones from which the huge front horns arise.

FOR nearly twenty years Mr. F. M. Webster, of the Illinois Natural History Laboratory, has been endeavouring to find a means of mitigating the plague of "buffalo-gnats" (*Simulium invenustum*), which of late years have proved so disastrous to cattle-owners in the districts bordering the lower course of the Mississippi. The remedy is a simple, although somewhat expensive one, namely, to prevent the great river from overflowing its banks, for it is in such overflows that these noxious little flies breed, and thus overrun the country. That their ravages are no trifling matter may be gathered from the statement that in 1882 a farmer in Louisiana lost 3200 head of stock from their attacks. Wild animals are terribly tormented by these pests, and a white-tailed deer has actually been known to rush into a blacksmith's forge to obtain relief in the smoke from their bites.

A PAPER on "Fertility in Sheep," by Mr. F. H. A. Marshall (*Trans.* Highland and Agric. Soc., Scotland), directs the attention of stock breeders to certain points of practical interest which are discussed in a recent memoir by the author on the œstrous cycle in the sheep, published in the *Philosophical Transactions*, and noticed in NATURE of September 3, 1903 (vol. lxviii. p. 429). The paper concludes with suggestions for future investigations on fertility in the ewe.

MR. THOMAS BURLEIGH has published a second edition of Mr. E. F. Chidell's "Africa and National Regeneration" (pp. 78). The preface to the new issue occupies more than half the pages of the book.

THE list of spectroscopes and spectroscopic accessories just issued by Messrs. Adam Hilger, Ltd., is conveniently arranged, and supplies useful information concerning a great variety of instruments for general work and for special purposes. Among other interesting apparatus described we notice film replicas of Rowland's diffraction gratings with 14,438 lines per inch, and the Michelson echelon diffraction gratings with the number of plates ranging from ten to forty.

A SECOND revised edition of "An Elementary Geography of India, Burma, and Ceylon," by Mr. Henry F. Blanford, F.R.S., has been published by Messrs. Macmillan and Co., Ltd. The important changes which have been made in Indian geography since the appearance of the first edition of the book have caused the author to re-write several portions, and to add new chapters on the North-west Frontier Province and on the Laccadive and Maldive Islands.

WE have received from the Wentworth Publishing Co., of Surrey Street, W.C., a copy of their new "Seaside and Inland A.B.C. Holiday Guide." The book runs to 311 pages, and contains concise descriptions of all health and pleasure resorts and places of interest in the United Kingdom. Lists of all the golf links throughout the kingdom, of all British spas, of the principal angling stations, and of the coaching centres are also provided. This useful guide costs one shilling net.

ACCORDING to a communication of J. Knett which appears in the *Sitzungsberichte* (No. 11) of the Vienna Academy of Sciences, the thermal springs of Karlsbad deposit small yellow tabular crystals of barium sulphate which are distinctly radio-active, and show all the phenomena characteristic of the presence of an active element.

THE May number of the *Physical Review* contains interesting papers on "Potential Phenomena in Vacuum Tubes during the Production and Interruption of Electrical Discharge," by S. N. Taylor, and "Observations on the Radiation produced in an Alternating Condenser Field," by F. Sanford.

THE investigation of certain complex cerium compounds by Prof. B. Brauner, an account of which appears in the current volume, No. 39, p. 261, of the *Zeitschrift für anorganische Chemie*, throws considerable light on the nature of certain cerium compounds which have been the subject of discussion for several decades. The red coloured salt which separates from the solution obtained by the action of water and sulphuric acid on oxide of cerium is shown to be the acid cerous salt of the complex cerisulphuric acid, and is represented by the formula

$$Ce^{iv}(SO_4)_4Ce^{iii}H.12H_2O.$$

Perfectly similar compounds, in which the trivalent cerium is replaced by lanthanum, neodymium and praseodymium, have also been obtained.

SOME interesting facts relating to the influence of the application of potash salts on the agricultural production of Prussia are contained in a recent address by Dr. Carl Ochsenius to the Philadelphia Academy of Sciences. In 1893 the consumption of potash in German agriculture was 60,000 tons, in 1903 it was 150,000 tons. The following numbers give the yields per hectare in kilograms of different kinds of produce for the two years in question :—

	Summer wheat	Summer rye	Summer barley	Oats	Clover and Lucerne	Hay
1893	1477	872	1517	1067	2249	2275
1903	2304	1023	1988	1837	5250	4056

THE existence of a urea-forming enzyme has recently been demonstrated by Kossel and Dakin (*Zeit. physiol. Chem.*, xli., 321, &c.). The enzyme occurs principally in the liver, but is also present in the thymus gland, mucous membrane of small intestine, kidney and lymphatic glands. It possesses the property of causing the rapid decomposition of arginine (δ-guanido-α-amidovaleric acid), which is one of the end products of tryptic digestion, into ornithine (αδ-diamidovaleric acid) and urea. The enzyme may be roughly isolated by precipitation of extracts of liver with alcohol and ether, or with ammonium sulphate, and may be preserved in the solid form for many months with but little change. The conversion of arginine into urea and ornithine illustrates a new type of enzyme reaction. The enzyme has been named "arginase," and is the first representative of the class of urea-forming enzymes capable of being isolated and of acting outside the body.

OUR ASTRONOMICAL COLUMN.

COMET 1904 *a*.—A new set of elements and an ephemeris for this comet are published in No. 3947 of the *Astronomische Nachrichten* by Prof. Strömgren. These vary but slightly from those previously published by Herr Ebert. Observations made on May 19 gave corrections of −41s. in R.A. and +2′·2 in declination to the positions, for that date, derived from Prof. Strömgren's elements, thereby showing the latter to be fairly correct. From this fact it follows that the object which appeared on the Harvard photographs of March 11 and 15, which was thought to be this comet, must have been some other body, for its position is about 6° from the comet's position on that date as deduced from these elements.

The comet's orbit is probably parabolic, and is noteworthy for its large perihelion distance, somewhat similar to that of Giacobini's comet of 1902–3 (the *Observatory*, No. 345).

DURATION OF THE PERSEID SHOWER.—In a letter to the *Observatory* (June), Mr. Denning directs attention to the long duration of the annual shower of Perseids. He states that the shower is certainly active by July 19, and that it has not entirely ceased on August 16; there is some evidence that traces of it have been observed as early as July 7 and as late as August 25, a period of fifty nights.

Mr. Denning also gives a list of radiants for various stages of the shower, derived from the collected observations made during the period 1877–1903 inclusive.

Moonlight will not interfere with the observation of either the earlier stages (July 8–19) or the maximum and latest phases (August 6–19) of this year's shower.

FOUNDATION OF A NEW ASTROPHYSICAL OBSERVATORY.—A letter from Dr. C. Nordmann to the *Revue générale des Sciences* (No. 10, May 30) describes the aims and equipment of a new astrophysical observatory which has just been built near to Tortosa, in Spain, in latitude 40° 48′ N. and longitude 1° 47′ E. of Paris.

The general idea of the work to be prosecuted is to obtain information regarding the relations between solar and terrestrial phenomena, relations the existence of which has of late years been abundantly confirmed by all workers in solar physics.

Two magnetic houses have been equipped, the one for absolute measures of terrestrial magnetism, the other for obtaining records of the regular variations in the elements and of the extraordinary disturbances which appear to coincide, in point of time, with solar disturbances.

The observatory is also to be furnished with an equatorial for observing sun-spots, an Evershed photo-spectroheliograph, and an instrument for determining the radial velocities of solar prominence eruptions.

Another building has been set apart for meteorological observations and the study of atmospheric optics, and seismological observations have also been provided for.

THE TOTAL SOLAR ECLIPSE OF 1905.—In an article published in the *Popular Science Monthly* for June, Prof. W. W. Campbell gives an interesting *résumé* of what has already been achieved by eclipse expeditions, and indicates the present state of our knowledge regarding eclipse phenomena. He then suggests a number of observations which might be profitably made during the eclipse of May, 1905. Amongst these he considers the search for an intra-mercurial planet to be of prime importance. The observations of Perrine in 1900 seemed to negative the idea of such a planet's existence, but no *definite* conclusions could be formed owing to the intermittently cloudy state of the

sky at the time when the photographs were taken. Prof. Campbell suggests that cameras similar to those used by Perrine should be used in Labrador, Spain, Tunis, and Egypt. He also insists upon the necessity for setting up coronagraphs at each of these widely separated stations in order to determine whether or not any real changes take place in the corona during the eclipse.

The determination of the correct wave-length of the chief corona line is also suggested as being of great importance. Finally, he urges upon observers the vital importance of thoroughly testing all their instruments before leaving home, and of allowing themselves plenty of time to make the final adjustments whilst in the eclipse camp.

ACTUAL DISTANCES BETWEEN STARS.—By simple trigonometrical calculations, Mr. J. E. Gore has deduced some interesting facts regarding the probable actual distances between certain stars the parallaxes of which are known with some degree of certainty. Thus he has determined that Sirius and Procyon are separated by about half the distance between the former star and our own system, therefore Sirius as seen from Procyon would appear as a star of magnitude −3·08. In the case of η and μ Cassiopeiæ, the actual distance between them is probably about one-fifteenth their distance from the sun, and their apparent brilliancies would therefore be about 225 times as great as they appear to us. In the case of double stars, these figures become much greater; for example, if we take 61 Cygni, the distance separating the components is about 55 astronomical units, and, as they are probably situated at some 515,662 astronomical units from the earth, their apparent brightness would be increased about 88 million times, or by 19·8 magnitudes, if seen at the distance which separates them. Similarly, the brightness of each of the components of α Centauri would be increased by 19·7 magnitudes (the *Observatory*, No. 345).

THE SUCCESSION OF CHANGES IN RADIO-ACTIVE BODIES.[1]

IT has been shown by Rutherford and Soddy that the radio-activity of the radio-elements is always accompanied by the production of a series of new substances possessing some distinctive physical and chemical properties. These new substances are not produced simultaneously, but arise in consequence of a succession of changes originating in the radio-elements. The radio-activity of these products is not permanent, but diminishes in most cases, according to an exponential law with the time. Each product has a distinctive rate of decay of activity, which has not, so far, been altered by any physical or chemical agency. The law of decay has been explained on the supposition that the product undergoes change according to the same law as a mono-molecular change in chemistry. The change occurs in consequence of the expulsion of an α or β particle, or both, and the activity of a product is thus a measure of its rate of change. While the products, like the emanations, and UrX, lose their activity according to an exponential law, the matter emanation X, which gives rise to the phenomena of excited activity, does not lose its activity according to a simple law. The experiments of Miss Brooks and the author, and of Curie and Danne, have shown that the decay of the excited activity of radium is very complicated, and depends upon the time of exposure to the exciting cause, viz. the emanation. The author has shown that the excited activity produced in a body by a short exposure in the presence of the thorium emanation increases at first for a few hours, passes through a maximum value, and then decays with the time according to an exponential law.

In the paper the curves of decay of excited activity of radium and thorium are given for both short and long exposures to the emanations, and it is shown that the law of change of activity with time can be completely explained on the theory that emanation X of thorium and radium is complex, and undergoes a series of successive changes.

The mathematical theory of successive changes is given in detail, and a comparison is made of the theoretical and experimental curves obtained for the variation with time of the excited activity. In the case of thorium, two changes are found to occur in emanation X. The first change is a "rayless" one, *i.e.* the transformation is not accompanied by the appearance of α, β, or γ rays. The second change gives rise to all three kinds of rays.

The decay of activity of emanation X of radium depends greatly on whether the α or β rays are used as a means of measurements. The curves obtained by the β rays are always identical with those obtained by the γ rays, showing that the β and γ rays always occur together and in the same proportion. The complicated decay curves obtained for the different types of rays, and for different times of exposure, can be completely explained on the supposition that there are three rapid successive changes in the matter deposited by the emanation, viz. :—

(1) A rapid change, giving rise only to α rays, in which half the matter is transformed in about three minutes.

(2) A "rayless" change, in which half the matter is transformed in twenty-one minutes.

(3) A change giving rise to α, β and γ rays together, in which half the matter is transformed in twenty-eight minutes.[1]

A similar rayless change is shown to occur in the "emanating substance" of Giesel.

The occurrence of a rayless change in the three radio-active bodies is of considerable interest. Since the change is not accompanied by rays, it can only be detected by its effect in the change or changes which follow. The matter of the rayless change is transformed according to the same law as the other changes. The rayless change may be supposed to consist either of a rearrangement of the components of the atom or a disintegration of the atom, in which the products of the disintegration are not set in sufficiently rapid motion to ionise the gas or to affect a photographic plate. The significance of the rayless changes is discussed, and the possibility is pointed out that similar rayless changes may occur in ordinary matter; for the changes taking place in the radio-active bodies would probably not have been detected if a part of the atom had not been expelled with great velocity.

The radiations from the different active products have been examined, and it is shown that the β and γ rays appear only in the last rapid change of each of the radio-elements. The other changes are accompanied by the emission of α particles alone.

Evidence is given that the last rapid change in uranium, radium, and thorium, which gives rise to β and γ rays, is far more violent and explosive in character than the preceding changes. There is some evidence for supposing that, in addition to the expelled α and β particles, more than one substance is produced as a result of the disintegration.

After the three rapid changes have taken place in emanation X of radium, there remains another product, which loses its activity extremely slowly. Madame Curie showed that a body, which had been exposed for some time in the presence of the radium emanation, always manifested a residual activity which did not appreciably diminish in the course of six months. A similar result has been obtained by Giesel. Some experiments are described, in which the matter of slow decay, deposited on the walls of a glass tube containing the emanation, was dissolved in acid. The active matter was found to emit both α and β rays, and the latter were present in unusually large proportion. The activity measured by the β rays diminished in the course of three months, while the activity measured by the α rays was unaltered. The active matter was complex, for a part which gave out only α rays was removed by placing a bismuth plate in the solution. The radio-active matter deposited on the bismuth is closely allied in chemical and radio-active properties to the active constituent contained in the radio-tellurium of Marckwald. The evidence, as a whole, is strongly in support of the view that the active substance present in radio-tellurium is a disintegration product of the radium atom. Since the radium emanation is

[1] Bakerian Lecture delivered at the Royal Society on May 19 by Prof. E. Rutherford, F.R.S.

[1] A statement of the nature of the three changes occurring in emanation X of radium was first given in a paper by Rutherford and Barne (*Phil. Mag.*, February). A brief account of the theory from which th results were deduced has been given in my book "Radio-activity" (Cambridge University Press). Later, Curie and Darne (*Comptes rendus*, March 14) arrived, in a similar way, at the same conclusions.

known to exist in the atmosphere, the active matter of slow dissipation produced from the emanation must be deposited on the surface of all bodies exposed to the open air. The radio-activity observed in ordinary materials is thus probably, in part, due to a thin surface film of radio-active matter deposited from the atmosphere.

A review is given of methods of calculation of the magnitude of the changes occurring in the radio-elements. It is shown that the amount of energy liberated in each radio-active change, which is accompanied by the emission of α particles, is about 100,000 times as great as the energy liberated by the union of hydrogen and oxygen to form an equal weight of water. This energy is, for the most part, carried off in the form of kinetic energy by the α particles.

A description is given of some experiments to see if the α rays carried a positive charge of electricity, with the view of determining experimentally the number of α particles projected from one gram of radium per second. Not the slightest evidence was obtained that the α rays carried a charge at all, although it should readily have been detected. Since there is no doubt that the α rays are deflected in magnetic and electric fields as if they carried a positive charge, it seems probable that the α particles must in some way gain a positive charge after their expulsion from the atom.

Since, on the disintegration theory, the average life of a given quantity of radium cannot be more than a few thousand years, it is necessary to suppose that radium is being continuously produced in the earth. The simplest hypothesis to make is that radium is a disintegration product of the slowly changing elements uranium, thorium, or actinium present in pitchblende. It was arranged that Mr. Soddy should examine whether radium is produced from uranium, but the results so far obtained have been negative.

I have taken solutions of thorium nitrate and the "emanating substance" of Giesel (probably identical with the actinium of Debierne) freed from radium by chemical treatment, and placed them in closed vessels. The amount of radium present is experimentally determined by drawing off the emanation at regular intervals into an electroscope. A sufficient interval of time has not yet elapsed to settle with certainty whether radium is being produced or not, but the indications so far obtained are of a promising character.

RECENT PUBLICATIONS IN AGRICULTURAL SCIENCE.[1]

THE United States Department of Agriculture has issued the fourth annual instalment of the great work upon which its Division of Soils has embarked, the detailed survey of the soils of the whole of the country. The area covered by the present report is little less than 18,000 square miles, which have been surveyed at a total cost of 12*s.* per square mile. The work is being carried on simultaneously in many parts of the States; the counties dealt with embrace some of the old settled eastern States like New York and New Jersey, the Carolinas and Virginia, the rich lands of Ohio, Kentucky and Illinois, also the recently settled districts in the Dakotas, Texas, Colorado and other areas of deficient rainfall, the Walla Walla wheat area on the Pacific slope, and the lately acquired dependency of Porto Rico.

The method adopted follows that of the earlier reports; a field party maps the distribution of the soils in each section and collects information as to the crops grown and their average yields, the conditions of labour and transportation, at the same time indicating the suitability of the land for new crops and systems of farming. Mechanical analyses of each type of soil are made at Washington and are set out in the report; occasionally chemical analyses are included; statistics of rainfall and mean temperature are also added.

The whole work is based upon the facts that different types of soil can be recognised and the areas which they occupy can be approximately mapped, and that particular crops and systems of farming can be associated with the various soil types, so that the agriculture of each area can be directed along the most appropriate lines and its farmers saved from many unprofitable experiments. While the volume contains no striking novelty, it is full of interest and instruction to the English student of agriculture or economics.

M. Tribordeau gives an account of the agricultural condition of the Pas-de-Calais, dividing it into regions based upon geological considerations of the nature of the subsoil. A description of each soil is given, generally accompanied by several analyses by M. Pagnoul; then follows an account of the agriculture, with reports in considerable detail of the system pursued on one or more farms of different sizes in the area. The varieties of each crop generally grown, the races of live stock, the yield, the conditions of labour, even the implements in use on each farm are carefully set out. The latter half of the volume deals more generally with the agricultural economics of the district, and discusses the position both financial and moral of the labouring class, the conditions of tenure, the societies and other means adopted for the encouragement of agriculture, particularly the spread of the movement for credit banks and cooperative associations. The work is liberally illustrated with maps, photographs and diagrams, and presents a valuable picture of the present critical condition of agriculture in western Europe.

The current volume of the *Journal* of the Royal Agricultural Society, which now appears annually only, is somewhat more exclusively occupied than usual with the work of the society. In addition to the usual prize lists there is a general account of the show held at Park Royal last June, another article on the machinery exhibited there, and a full discussion of the trials of wind pumping engines conducted by the society in 1903. Reports of committees and of the scientific officers of the society also bulk largely, including Dr. J. A. Voelcker's account of the experiments in progress on the farm at Woburn and at the Hills pot-culture station. Turning to the general articles, the interest that is being manifested in forestry is seen in the two opening papers; in one Mr. C. E. Curties treats generally of the management of British woodlands, and in the other Mr. R. Anderson deals with the utilisation of home grown timber and its bye products. Mr. Spencer Pickering describes his experiments at the Duke of Bedford's fruit farm at Woburn, which he has repeated on a different soil at Harpenden, on the ill effects produced by growing grass round apple trees.

The volume is completed by one or two statistical papers and an article by Mr. A. D. Hall on the manuring of grass land, in which he takes the Rothamsted experiments upon grass land as his starting point, and then proceeds to discuss the many other manurial experiments upon hay or pasture which are now in progress in various parts of the country.

[1] "Field Operations of the Division of Soils, 1902." By Milton Whitney. Pp. 842; with a case of maps. (Washington: U.S. Department of Agriculture, 1903.)

"Monographie Agricole du Pas-de-Calais." By M. Tribordeau. Pp. 296. (Paris: Société d'Encouragement pour l'Industrie Nationale, 1904.)

"The Journal of the Royal Agricultural Society of England," vol. lxiv. Pp. 420+clxxxviii. (London: John Murray, 1903.)

MAIDSTONE MEETING OF THE SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE ninth annual congress of the South-eastern Union of Scientific Societies opened on the evening of June 9, when Sir Henry Howorth, the outgoing president, resigned his seat to Mr. Henry Rudler, who delivered the annual address at the Town Hall, Maidstone.

Mr. Rudler alluded to his address as a string of commonplaces, but in it some very important topics were touched upon. He considered, for instance, the constitution of scientific societies, and the matters to be discussed at their meetings in these days of great specialisation. He divided the members of such societies as constitute the union into those (few in number) who do the work and those (the majority) who like to see what is being done. Mr. Rudler was of opinion that the latter should have their wants realised as well as the specialists, for to put it on the lowest plane, the societies generally depended upon the financial support of those intellectual people who take a general interest in the progress of science without aiding in it themselves. Mr. Rudler's advice was to hold sectional meetings for the specialists, where the matters to be considered might be as technical as occasion required, and to

arrange general meetings where scientific subjects were dealt with in a popular manner. The fact had to be remembered that many of the members came to the meetings after working hard all day, and with their brains more or less exhausted and in need of recreation.

Mr. Rudler also dealt with the craze for athleticism, which tended to lessen the ranks of the local societies and even of the British Association itself. He said that a party on a field excursion would get more physical benefit than a crowd of spectators watching competitions between professional athletes. He contended that the taste for "sport" of to-day was only a part of a large subject, the excessive love of pleasure. He said that different people had different ideas with regard to recreation, but that those who turned to natural history were exceptionally wise in their choice. Parents, and especially ladies, would, he suggested, do well to join a natural history society, if only as an example for the young, and to introduce them to a healthy atmosphere. Now that nature-study was successfully edging its way into our schools, there should be a fine crop of young naturalists in the making, and Mr. Rudler told the societies not to wait for the students to grow up, but to found branches for junior members.

After saying a word as to the secondary place that the results of the camera and the magic lantern should take in popular lectures, Mr. Rudler passed on to speak of the scientific work done by Maidstone men in the past, and to congratulate the town upon its museum.

On the morning of June 10 business was transacted, and officers and committee elected "For the Photographic Record and Survey of Kent," after a report of the work of the provisional committee had been read by Mr. H. Snowden Ward, who had acted as organising secretary.

Mr. F. J. Bennett, in a short paper, pointed out that the Kentish megaliths, like those in Wiltshire, follow lines which run from north to south, and this is also true in the case of earthworks and churches. A paper on the Lepidoptera of mid-Kent, by Captain Saville G. Reid, was taken as read, and the meeting concluded with some excellent suggestions by Mr. Bennett with regard to the utilisation of the twenty-five inch Ordnance maps by farmers. On these a plan of the drainage, the arrangements for which are often completely forgotten, could be entered, together with details of the work carried on from year to year. Mr. Bennett urged that such work should be secured by legislation, and the suggestion met with cordial approval. On the afternoon of June 10 there were two excursions; the first—geological and archæological—was to Aylesford, under the leadership of Mr. Whitaker and Mr. W. H. Benstead. The second was of a botanical and entomological character to the North Downs, under the leadership of Prof. Boulger, Captain Reid, and Mr. Elgar. In the evening the Mayor and Mayoress (Alderman and Mrs. Morling) held a reception in the Museum, Art Gallery and Technical Schools, which adjoin one another in a very convenient way. Afterwards the visitors had an opportunity of examining the Congress Museum, which consisted of specimens sent by members of affiliated societies, and arranged by Mr. E. W. Swanton. There were also on view nature-study exhibits from Kent schools to illustrate the paper to be read on the following morning. During the evening Mr. A. B. Harding read a paper on "Ice Streams and Ice Caves," and Mr. Paul Matthews described the possibilities of an artificial language, and gave an explanation of that which is known as "Esperanto."

On June 11 the election of officers took place. Prof. Flinders Petrie was elected president, and Dr. Abbott, to whom the union owes its origin, exchanged his office of honorary secretary with the Rev. R. Ashington Bullen for that of treasurer, which the latter occupied. The two vacancies on the council were filled with Miss Lawrence, of Reigate, and Mr. Wilfred Mark Webb.

When the last paper, which was on "The Teaching of Nature-study," was read by Mr. Wilfred Mark Webb, a number of teachers and pupil teachers were present through the efforts of the Kent County Education Committee and the local committee of the congress. Considerable discussion took place afterwards. Sir Henry Howorth supported the aim that the pupil should be made to ask why and to find out the answer for himself, and dwelt for some time on the advisability of studying animals in captivity. Prof. Boulger thought that nature-study should, in the case of young children, be correlated with poetry. Mr. Tutt pointed out the difficulties that occur in town schools, and urged the claims of more formal work than had been outlined, which savoured somewhat of science teaching. Mr. J. B. Groom, of St. Paul's Schools, Maidstone, who has made a speciality of rambles, begged the young teachers present to follow informal lines rather than those advocated by Mr. Tutt.

The number of societies now affiliated is forty-three, with upwards of five thousand members, while the funds of the union are in a satisfactory condition, and an invitation has been accepted to visit Reigate during 1905.

EDUCATIONAL CONFERENCE AT THE HORTICULTURAL EXHIBITION.

ON June 7 a conference was held at the Royal Botanic Gardens, Regent's Park, in connection with the educational section of the Horticultural Exhibition, which was open during the whole of last week.

Sir William J. Collins, chairman of the Education Committee of the London County Council, and president of the section, took the chair, and Mr. F. W. Verney read a paper on "Allotment Gardens and Working Men." In the course of this a good deal of stress was laid upon the need for teaching which would prepare country boys to work on the land, and a scheme for their education was mapped out. It seems to be generally recognised that if a boy is ever to do much good on a farm he must become acquainted with its working at an early age, and the compromise desired by Mr. Verney that a boy should be allowed to do some practical work on a farm before his school days are over would not only satisfy practical requirements, but would also probably keep the pupils under the influence of the schoolmaster for a longer period than is at present the case.

Miss Lilian Clark afterwards read a paper upon "Direct Methods of Studying Nature," such as are employed at the James Allen School for Girls, Dulwich. The papers which Miss Clark has read in the past at various science conferences have made us familiar with her work in garden and classroom, where real plants and not books are studied. It is interesting to be able to chronicle that a special room, which is a combination of laboratory and greenhouse, has been built as an aid to the experiments and observations which she directs.

Later in the morning Sir George Kekewich, who is president of the School Nature Study Union, gave an address on "Nature-study and its Cognate Educational Subjects." He made a special point of nature-study as a part of general education, saying that he would like to see it taught in every school in this country. The kind of training outlined was that now generally recognised as being really nature-study, and as Sir George Kekewich is one of those who think that the work, to be done properly, should be carried on out of doors, he spoke of the great difficulties which must exist in the case of most town schools. These difficulties would be all the greater if teachers felt, as Sir George Kekewich seems to do, that to keep animals in captivity (Sir George afterwards excepted canaries) is calculated to teach cruelty.

In the discussion the speakers were practically unanimous in disagreeing with the contention last alluded to. Mr. Hedger Wallace (honorary secretary of the section), Miss Kate Hall, and Miss Von Wyss were among those who thought that many animals could be properly studied "under control." The present writer expressed his opinion that as children see plenty of cruelty in their everyday life, it would be advisable to teach them kindness by keeping pets, and that if this were not done in nature-study, a great power for good would be thrown away.

Sir William Collins summed up nature-study; he said that it was not a new subject, though its recognition and the enthusiasm for it were new, and he emphasised the fact alluded to by Sir George Kekewich that it was not science teaching.

The opinion expressed by Sir George Kekewich that nature-study would not stay the rural exodus, and that its far-reaching effects would not be felt until other means

had been taken to stem the tide of emigration into towns, was not endorsed by the Rev. Claud Hinscliff, who, from his experience in Derbyshire, had come to a different conclusion.

Mr. J. Weathers, instructor in horticulture to the Middlesex County Council, read a paper on "Horticultural Teaching among Adults." His remarks referred mainly to the practical side, though in touching upon laboratory work he said that he believed in practice first and theory afterwards. Mr. Weathers also considered the question of allotments, and in the discussion which followed, Earl Carrington tellingly described from his own experience the advantages derived from small holdings by the tenants, by the landlords, and by the country at large. Mr. J. Martin White thought that a little theory was sometimes good to begin upon, and he pointed out the need for more attention to be paid in general to methods of cutting and keeping flowers for decorative purposes.

Mr. E. Caesar, headmaster of Hale School, Farnham, outlined in a paper "On School Gardens" the scheme of the Surrey County Council, and the work which had resulted in his own school holding premier place for four years running.

The last paper, on "School Nature-study," was by Miss Violet James, of Heidelberg College, Ealing. Miss James has tested the value of nature work, and not only has she discovered its powers for good, but has recognised the opportunities that exist for evil if the teacher pursues wrong lines. WILFRED MARK WEBB.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

OXFORD.—In convocation on June 2 the honorary degree of M.A. was conferred on Mr. F. A. Bellamy, first assistant at the university observatory.

Junior Scientific Club:—The ninth Robert Boyle lecture was delivered on June 3 by Prof. J. J. Thomson, F.R.S., on the subject of "The Structure of the Atom." On June 10 Dr. G. Mann, New College, read a paper on "The Importance of Salts in our Economy."

CAMBRIDGE.—In the mathematical tripos, part i., the senior wrangler is Mr. A. S. Eddington, Trinity. The second place is taken by Mr. G. R. Blanco-White, Trinity, and the third by Mr. F. J. M. Stratton, Caius.

PROF. J. W. GREGORY, F.R.S., professor of geology in the University of Melbourne, has been appointed to the chair of geology in the University of Glasgow.

THE following honorary degrees were conferred by Dublin University on June 11:—Doctors in Science, Prof. J. Dewar, Prof. J. H. van 't Hoff, Prof. Felix Klein, Major Ronald Ross, C.B., Mr. J. J. H. Teall, F.R.S., and Prof. W. H. Thompson.

DR. T. MARTIN LOWRY has been appointed lecturer in science at the Westminster Training College. Dr. Lowry will have charge of the whole of the science work of the college, and will also supervise the scientific instruction at the Southlands Training College.

MR. R. BLAIR, secretary in respect of technical instruction for the Department of Agriculture and Technical Instruction in Ireland, has been appointed executive officer for the performance of duties in connection with the administration of the Education Acts by the London Education Committee.

MR. JOHN D. ROCKEFELLER has, says *Science*, given to the Case School of Applied Science 40,000*l.* to be used for building and equipping laboratories for physics and mining engineering. Yale University will receive as residuary legatee more than 50,000*l.* from the estate of the late Mr. W. B. Ross, of New York City. The will of the late Prof. Maxwell Sommerville provides 4000*l.* for the preservation and care of the collection of engraved gems and ethnological collections given by him to the University of Pennsylvania some years ago.

AMONG recent appointments to professorships in American colleges announced in *Science* are the following:—Prof. C. Baskerville, of the University of North Carolina, to be professor of chemistry in the College of the City of New York. At Cornell University, Mr. D. S. Kimball to be Sibley professor of mechanic arts, in charge of the Sibley shops. Dr. R. Burton-Opitz to be adjunct professor of physiology in Columbia University, with a seat in the faculty of pure science. At the University of Nebraska, Mr. G. E. Condra to be professor of geology, and Mr. H. S. Evans to be an adjunct professor of electrical engineering.

IN the thirtieth general assembly of Iowa, it is stated by *Science*, an appropriation of 10,000*l.* was made for erecting either the first of a new series of engineering buildings or the wing of a single large engineering hall at the State University at Iowa City. An additional appropriation was made for constructing a dam in the Iowa River which will yield on the average more than three hundred horse-power. This power will be used for lighting and ventilating the university buildings, besides supplying power to the various engineering shops and laboratories. An additional 1000*l.* was appropriated for the better equipment of the bacteriological laboratory. Ground will at once be broken for a new museum building to cost about 25,000*l.* The present natural science building, completed in 1885 at a cost of 9000*l.*, will be moved bodily to a new site to make room for the proposed structure. The total income of the university for the next biennium will exceed 192,000*l.*, about one-third of which must be used for building.

THE Education Committee of the Essex County Council has decided to continue, during the course of the present summer, the Saturday afternoon demonstrations on field botany and other branches of nature-study which have proved highly successful in previous years. Two rambles will be held each Saturday during the remainder of June and throughout July. While these demonstrations are organised exclusively for school teachers, they are not intended only for those who have already studied botany; any teacher is eligible who takes an interest in general natural history. The same committee has decided to hold a holiday course in the principles and practice of horticulture at the biological laboratories and garden at Chelmsford for two weeks beginning on August 8. The object of the holiday course is to assist Essex teachers to gain a knowledge of the gardening operations necessary for the successful working of school gardens. The Essex Education Committee will defray travelling expenses once to and from Chelmsford, and will, in suitable cases, make a special allowance of 12*s.* 6*d.* per week towards the maintenance of teachers fulfilling the necessary conditions.

THE annual report of the council of the City and Guilds of London Institute for the year 1903 is a gratifying record of continued progress. The high standard of the work at the Central Technical College, at the college in Finsbury, as well as at the other special schools in different parts of London subsidised by the institute, has been well maintained. From the report of the examiners in the department of technology, it would seem that there is a decided improvement in the general character of the work presented, both in the written answers and the practical exercises; the most evident faults in the written parts of the examinations being due to the candidates' imperfect knowledge of the elements of physical science and of drawing, and to their inability to express their ideas in written language. It is certain that no great improvement in the intellectual character of the answers can be looked for until the teaching in elementary schools is made more practical, and further attention is given to training in drawing and scientific method and English composition. The large percentage of failures in all the preliminary examinations is an indication of the unprepared condition of the candidates on commencing their technological instruction. What the examiners in paper manufacture say is applicable to other subjects: "Without a previous attainment to a fair standard of mental training it is impossible either that a student can do justice to the technology of the subject, or have a ready habit of reducing his knowledge to expression."

It is to be hoped that the new code for the regulation of public elementary schools recently issued by the Board of Education, containing as it does a much broader and more scientifically planned curriculum, will remedy this defect, which has for many years hampered technical education in this country. It should be added that the report contains the inaugural address to the students of the Central Technical College, by Sir Guilford Molesworth, and also the address of Sir William White at the distribution of diplomas, &c., to the students of the institute's colleges and schools.

A CONFERENCE of headmasters and headmistresses, of representatives of midland educational authorities, and others interested in secondary education was held on March 19 last under the auspices of the University of Birmingham and the City of Birmingham Education Committee. The speeches delivered on this occasion have now been published in pamphlet form. The conference discussed two subjects at separate sessions. At the first meeting attention was directed to the training of secondary teachers—to what extent it is to be carried out (*a*) in training colleges, (*b*) in the schools themselves, and how far such training must depend on Government aid. The subject for the second session was the relative weight to be given to the humanities and to science in the various stages of secondary education. The remarks of some speakers in the discussion on the training of teachers for secondary schools showed that the belief in the necessity for training is not yet universal, though much more common than a few years ago. The headmaster of Shrewsbury, criticising the oft-repeated contention that the chief business of the secondary school is to train character, appropriately said :—"Is the day-school teacher—the secondary school teacher, I mean—to devote himself wholly to the formation of character, while at the same time England is falling into the rear in the matter of commerce and in scientific methods? We may concentrate our efforts on the formation of character until we forget how much more we have to do." The discussion on the relative importance of the humanities and of science was instructive as demonstrating the wide divergence of opinion which exists on most educational problems. Men of science will be disposed to agree with Sir Oliver Lodge, who said :—"I do not much care what is taught so long as it is taught well, and so long as the pupils learn what is taught. . . . I do not believe in having schools where boys having an aptitude for science shall learn nothing else, and schools where boys who have an aptitude for letters shall have nothing but a literary education." A complete education recognises the claims both of scientific and literary studies, and gives to each of these branches of knowledge its proper place.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 28.—"On the Changes of Thermo-electric Power Produced by Magnetisation, and their Relation to Magnetic Strains." By Shelford **Bidwell**, F.R.S.

The experiments described were undertaken with the view of investigating an apparent correspondence to which the author directed attention in an article published October, 1902 ("Ency. Brit.," art. Magnetism), between the effects of magnetisation upon thermoelectric quality and upon dimensions. Reference is made to the work of W. Thomson, Ewing, Chassagny, Houllevigue, and Rhoads. Although some of the results previously recorded appear to be erroneous, it is shown that, at least for iron and nickel, there is an intimate relation between the two phenomena.

In the case of iron, the relation is not disclosed unless allowance is made for the effect of the purely mechanical compression due to magnetisation. The author pointed out in 1888 (*Phil. Trans.*, vol. clxxix. A, p. 216) that a magnetised iron bar must be subject to a compressive stress, the consequent contraction being expressed as a fraction of the original length by the ratio of the lifting power or "tractive force" to Young's modulus. The tractive force was calculated in an earlier paper (*Proc.* Roy. Soc., vol. xlvii. p. 486). If a transverse cut is made in a longitudinally magnetised bar, the magnetic force inside the gap is $B=H+4\pi I$. One portion of the bar being fixed, the force acting upon the face of the other portion is less than B by $2\pi I$, the part due to the face itself; thus the attractive force per unit area $=(B-2\pi I)I=2\pi I^2+HI$. For permanent magnets, when $H=0$, and for the special case in which each half of the bar is surrounded by a tightly fitting coil, when the term $H^2/8\pi$ must be added for the mutual action of the coils, this expression becomes $B^2/8\pi$, which is sometimes said to represent "Maxwell's stress." The stress between any two portions of a magnetised bar divided by an imaginary transverse plane is sustained by the intermolecular springs, whatever their physical nature may be, to which the elasticity of the metal is due. Taking Young's modulus in grams per sq. cm. as 2×10^9, the extrinsic contraction due to magnetisation, expressed as 10-millionths of length, is $(2\pi I^2+HI)/200g$. Curves were plotted showing change of thermoelectric power and change of length in relation to H, and it was found that, if the latter were "corrected" for mechanical stress and the scale of ordinates suitably chosen, the two curves were almost coincident; without such correction there was no correspondence. The change of thermoelectric power due to magnetisation is therefore proportional to the "corrected" elongation, but the factor of proportionality differs for different specimens and for different physical conditions of the same specimen. It is shown in the paper that the two phenomena are analogously affected by tensile stress and by annealing.

For nickel it appeared, contrary to the accepted view, that the direction of the thermoelectric force was the same as in iron—from unmagnetised to magnetised through hot—whereas the "corrected" change of length is opposite in the two metals, iron being extended, nickel contracted. But the curves for change of length and for change of thermoelectric power were, when one of them was inverted, almost exactly coincident, although no correction was made for the mechanical stress. The question then arises, Why should the correction which is indispensable in the case of iron be unnecessary for nickel? The answer is that while for iron the calculated correction is very considerable (generally, indeed, greater than the observed change of length to which the correction is applied), for nickel it turns out to be exceedingly small; thus it happens that the uncorrected and the corrected curves, if referred respectively to slightly different scales of ordinates so chosen that the two curves may be of the same height, are sensibly identical. The absence of any need for the correction in the case of nickel, where, *a priori*, it ought not to be required, tends to show that the success of its application in the case of iron is not a mere accident, and the compressive stress is consequently a *vera causa*. Some years ago the question of stress in a magnetised metal was discussed by several well known physicists in NATURE (vol. liii. pp. 269, 316, 365, 462, 533), and it seems not to be agreed whether there is in fact any such mechanical stress; whether, supposing one to exist, it is compressive or tensile, and whether it is "Maxwell's stress" or some other. The author submits that the results of the new experiments support his original view.

For cobalt no relation between thermoelectric and dimensional changes attending magnetisation could be found; if any such exists, it is disguised by some cause which has yet to be discovered.

May 19.—"On Saturated Solutions." By the Earl of **Berkeley**. Communicated by F. H. Neville, F.R.S.

June 9.—"Notes on the Statolith Theory of Geotropism. I. Experiments on the Effects of Centrifugal Force. II. The Behaviour of Tertiary Roots." By Francis **Darwin**, F.R.S., and D. F. M. **Pertz**.

The facts given in the paper prove that when the primary root is removed and a secondary root assumes its place, the tertiary roots take on the character of normal secondaries. It may be believed, therefore, that the existence of statoliths in normal tertiary roots is a provision enabling them to assume diageotropic growth in case of injury to the primary root. This, though appearing a bold conclusion,

does not involve an adaptive action different in principle from the well known assumption by secondary roots of the characters of the primary root, although it is undoubtedly a more elaborate provision, and one which seems more unlikely to be called for in a state of nature.

Geological Society, May 25.—Dr. J. E. Marr, F.R.S., president, in the chair.—On the occurrence of a limestone with Upper Gault fossils at Barnwell, near Cambridge: W. G. **Fearnsides.** The limestone is variable in thickness, and is largely made up of comminuted shells of Inoceramus. It occurs in flattened lenticles. It contains abundant phosphate-nodules. Foraminifera, fragments of lamellibranchs, brachiopods, small gastropods, echinoids, and Crustacea are abundant. The fauna is not markedly different from that of the underlying clay. A list is given which shows that this fauna has been recorded from the Upper Gault of Folkestone. As these fossils are obtained 40 feet below the upper surface of the Gault seen in the section, it is clear that the whole of the Upper Gault of Cambridge was not used up in the making of the "Cambridge Greensand."—On the age of the Llyn-Padarn dykes: J. V. **Elsden.** The paper suggests that the bulk of the greenstone-dykes of this area belong to an earlier period of eruption than has been generally assigned to them. The greater part, if not actually of Bala age, seem to have been intruded before the post-Bala crush-movements. The evidence does not exclude the possibility that some of the intrusions may be of later date. Petrographical considerations make it impossible to separate these rocks from the diabase-sills of Bala age occurring farther to the south of this area.

Chemical Society, June 2.—Dr. W. H. Perkin, F.R.S., vice-president, in the chair.—The following papers were read:—Imino-ethers and allied compounds corresponding with the substituted oxamic esters: G. D. **Lander.** A description of the ethers obtained by the condensation of various bases with oxalic esters is given.—The action of heat on α-hydroxycarboxylic acids, part i., α-hydroxystearic acid: H. R. **Le Sueur.** The principal product obtained on heating this acid is margaric aldehyde.—Ionisation and chemical combination: J. Wallace **Walker.** The author shows that the assumption now generally made that all chemical action takes place between pre-existing ions is unjustifiable, in view of the fact that reactions such as those of the alkyl haloids with various compounds in presence of aluminium chloride take place under conditions under which ionisation cannot occur. Since ionisation is frequently the result of such reactions, he concludes that, in general, combination, as the result of the operation of higher valencies, precedes ionisation or any other manifestation of the occurrence of chemical change.—Ionisation and chemical combination in liquefied halogen hydrides and hydrogen sulphide: J. W. **Walker,** D. **McIntosh,** and E. H. **Archibald.**—Some compounds of aluminium chloride with organic substances containing oxygen: J. W. **Walker** and A. **Spencer.** These two papers give descriptions of compounds and experiments illustrating the arguments advanced in the first paper of this series.—The constituents of Chaulmoogra seeds: F. B. **Power** and F. H. **Gornall.** These seeds, which are derived from the plant *Taraktogenos Kurzii*, contain a cyanogen compound which is hydrolysed by an enzyme also present in the plant or by dilute acids into prussic acid and glucose, and may be a glucose-cyanhydrin. The fatty oil contained in the seeds furnishes on hydrolysis glycerol and phytosterol, and a number of fatty acids of which the most interesting is chaulmoogric acid $C_{18}H_{32}O_2$, which appears to contain a closed ring and one ethylenic linking.—The constitution of chaulmoogric acid, part i., F. B. **Power** and F. H. **Gornall.** A number of derivatives and oxidation products of this acid are described which have been prepared as a preliminary to the investigation of its constitution.—Gynocardin, a new cyanogenetic glucoside: F. B. **Power** and F. H. **Gornall.** This substance was obtained from the seeds of *Gynocardia odorata*, formerly believed to be the source of commercial chaulmoogra oil. It is crystalline, and is hydrolysed by an enzyme also existing in the plant furnishing prussic acid as one product.—*iso*Nitrosocamphor: M. O. **Forster.** A description of derivatives of this substance.—The basic properties of oxygen. Additive compounds of the halogen hydrides and organic compounds, and the higher valencies of oxygen. Asymmetric oxygen: E. H. **Archibald** and D. **McIntosh.**—The fermentation of the indigo plant: C. **Bergtheil.** It is shown that the fermentation in the indigo vat is produced principally by a specific enzyme.—The union of hydrogen and chlorine. Action of the silent electric discharge on chlorine: J. W. **Mellor.**—Studies on ethylcarboxyglutarate, part ii., action of ethyl bromocarboxyglutarate on ethyl sodiocarboxyglutarate. Formation of ethyl carboxyglutaconate: O. **Silberrad** and T. H. **Easterfield.**—The vapour pressures of liquid mixtures of restricted mutual solubility: A. **Marshall.** The vapour pressures of mixtures of water with various organic liquids have been experimentally investigated, and the results are discussed in the light of theoretical work on the same subject by Ostwald and others.—The influence of solvents on the rotation of optically active compounds, part v., the optical activity of certain tartrates in aqueous solution: T. S. **Patterson.** The rotations of a number of tartrates have been determined in aqueous solution at various concentrations and temperatures, and the influence of the latter on the numerical and sign value of the rotation is discussed.—The nitration products of the isomeric dichlorobenzenes: P. **Hartley** and J. B. **Cohen.** The authors find that the *meta*-law of substitution is followed, except in the case of *ortho*dichlorobenzene.

Linnean Society, June 2.—Prof. W. A. Herdman, F.R.S., president, in the chair.—Mr. A. O. **Walker** exhibited (1) viviparous plants of *Cardamine pratensis*, which phenomenon was unusually manifest this year, probably due to the abnormal rainfall, and (2) a gall on the flower-bud of the same plant, ascribed to *Cecidomyia Cardaminis*.—Mr. W. T. **Hindmarsh** exhibited photographs of the following plants:—*Primula deorum*, Velen., which he had succeeded in flowering, he believed for the first time in this country; *Shortia uniflora*, Maxim., the Japanese representative of the genus, with larger flowers than the original *S. galacifolia*, Torr. and Gray, and showing a tendency to vary in colour according to exposure; and *Rhodothamnus Chamaecistus*, Reichb., noteworthy for the abundance of its flowers.—*Papers*:—On the species of Impatiens in the Wallichian herbarium of the Linnean Society: Sir Joseph **Hooker.** The introduction described the material in question, consisting of 48 ticketed specimens out of 200 known species of the genus; though few in number, these specimens foreshadow the remarkable segregation of the species in the several phyto-geographical regions of India, which has no parallel in any other large genus known to the author. The second part of the paper consists of a detailed review of each sheet of the collection, with a critical determination of the specimens. There is one previously undescribed species, for which the name *Impatiens praetermissa* is proposed.—An account of the Chætognatha collected on H.M.S. *Research* in the Bay of Biscay in 1900: Dr. G. H. **Fowler.** *Sagitta serrato-dentata* was plentiful in the epiplankton down to the zone between 200 and 100 fathoms, with a maximum distribution about 50 fathoms; in daylight it appeared to rise to the surface, independently of the actual light-intensity of the moment; at night it left the surface for rather deeper water; even on bright moonlit nights, or during or after rain, it also deserted the surface, even in light daylight. The distribution of other species was described. In handling the Chætognath population as a whole, the author showed that it was thickest in the epiplankton, that below 100 fathoms there was a sudden drop in numbers, which continued down to the lowest depth studied (2000 fathoms), except for a possible slight local rise about 600 fathoms. This result, obtained by the accurate method of closing nets, directly contradicts the conclusion of Mr. R. T. Günther, deduced from the methods of open serial nets as used on the *Oceana*, that the population is greatest in deep water, the source of error with the open nets being introduced by the specimens captured during the net's upward journey to the surface from the depth nominally studied.—The flow of fluid in plant-stems: Prof. R. J. **Anderson.**

The experiments of the author were devoted to forcing water through woody stems, but references to the work of earlier investigators are not given.

Mathematical Society, June 9.—Prof. H. Lamb, president, in the chair.—The following papers were communicated:—Note on the application of Poisson's formula to discontinuous disturbances: Lord **Rayleigh.** Poisson's solution of the equation

$$\frac{\partial^2\phi}{\partial t^2}=a^2\nabla^2\phi$$

has the form

$$\phi=\frac{t}{4\pi}\int\int\dot{\phi}_0 d\sigma+\frac{\partial}{\partial t}\left(\frac{t}{4\pi}\int\int\phi_0 d\sigma\right),$$

where ϕ_0 and $\dot{\phi}_0$ denote initial values of ϕ and $\partial\phi/\partial t$ on a sphere of radius at, and the integration refers to angular space about the centre of the sphere. When the initial disturbance is continuous at the surface bounding the initially disturbed portion of the medium, the solution may be written in the form

$$\phi=\frac{1}{4\pi}\int\int\left(t\dot{\phi}_0+\phi_0+r\frac{\partial\phi_0}{\partial r}\right)_{r=at}a\sigma.$$

It is pointed out in the paper that, when there is discontinuity, the subject of integration in the latter form becomes infinite, and it is shown by an example how the integral may be interpreted so as to yield the correct result.—Wave fronts considered as the characteristics of partial differential equations: T. H. **Havelock.** It is shown that a wave front can be defined as a surface satisfying the principal equation of the characteristics of the equation of wave motion, and that, owing to the linearity of the latter equation, there is no necessity for the continuity of the first differential coefficients of the function expressing the disturbance, provided the function itself is continuous. The theory is extended to systems of partial differential equations, and, in particular, to the equations of propagation of electric waves. An invariantive property of characteristics is proved, and is applied to the theory of wave fronts and rays in moving media.—Illustrations of perpetuants: J. H. **Grace.** The quantic of infinite order being equivalent to a power series, the perpetuants are expressed as the results of performing certain operations of differentiation upon analytic functions represented by such series. It is shown that certain ones of the known analytic functions, such as the exponential function and the Weierstrassian sigma function, are determined by the vanishing of the simpler perpetuants.—Types of covariants of any degree in the coefficients of each of any number of binary quantics: P. W. **Wood.** A method is given for determining the type forms of the complete system mod $(ab)^{\frac{1}{10}}$. The method consists in carrying out systematically a process indicated by Jordan, and previously applied to perpetuants by Grace.—Some expansions for the periods of the Jacobian elliptic functions: H. **Bateman.**

DUBLIN.

Royal Dublin Society, May 17.—Prof. J. A. McClelland in the chair.—Mr. J. H. **Pollok** read a paper on the extraction of glucina from beryl by fusion with caustic soda, solution in hydrochloric acid and saturation with hydrogen chloride to precipitate the alumina, the glucina and iron being afterwards separated by ammonium carbonate and sulphide. Analyses of carbonates, sulphates, and chlorides were also given that differed somewhat from theory.—Mr. F. E. **Hackett** read a paper on the *n*-rays. Some estimations of the magnitude of the subjective effects in the dark-adapted eye are given in this paper. It was found that bodies under strain produced an effect on a phosphorescent screen which could not be assigned to eye effects or the emission of heat.

PARIS.

Academy of Sciences, June 6.—M. Mascart in the chair.—On the parallax of the sun: Bouquet **de la Grye.** An account of the mode of working up the data from the photographic plates obtained in the French expedition for the observation of the transit of Venus in 1882.—On the photography of the superposed layers which constitute the solar atmosphere: H. **Deslandres.** A discussion of the work done with the large refractor at the Yerkes Observatory in relation to earlier results, together with some suggestions as to future work.—The accidental production of an intraliberian generating layer in the roots of Monocotyledons: Gaston **Bonnier.** A wound may provoke in the roots of certain Monocotyledons the commencement of secondary formations organised in the same manner as in a root of a Dicotyledon.—The physiological action of the emanation of radium: Ch. **Bouchard,** P. **Curie,** and V. **Balthazard.** The introduction of the radium emanations into the lungs of animals gives rise to toxic effects, the dominant lesion observed on *post mortem* examination being an intense pulmonary congestion. The tissues of the animals which have died under the action of the radiations are radio-active.—The radium emanation, *exradio*, its properties and changes: Sir William **Ramsay.** The emanation which escapes from radium bromide possesses the properties of a gas; it obeys Boyle's law, can be condensed at low temperature, and possesses an appreciable vapour pressure at the temperature of liquid air. The quantities available were extremely minute, about 0·0254 cubic millimetre, but this was found sufficient to prove the relation between volume and pressure, and also to obtain the spectrum. The gas is strongly luminous, but this grows weaker with time, and at the end of a month disappears. The gas appears to belong to the argon group, and has a density of about 80. If the molecule is monoatomic, the atomic weight would be 160, from which it would follow that one atom of the emanation is produced from one atom of radium.—The action exercised by the *n*-rays upon the intensity of the light emitted by a small electric spark, and upon some other feeble sources of light: R. **Blondlot.** A discussion of the views of M. Jean Becquerel as to the action of the *n*-rays upon the luminosity of a calcium sulphide screen, and an extension to the cases of a small electric spark and of a piece of platinum foil at a dull red heat.—On the emission of the *n*-rays and the n_1-rays: E. **Bichat.**—On the emission of the *n*-rays and n_1-rays by crystallised bodies: E. **Bichat.**—On the fifth scientific campaign of the *Princesse Alice*: Prince Albert of **Monaco.**—On expressions formed of superposed radicals: Paul **Wiernsberger.**—On the movements of solids with spherical trajectories: Jules **Andrade.**—On a variant of the universal joint: L. **Lecornu.**—On the critical velocity of directable balloons: Ch. **Renard.** It is shown that a balloon of the Santos-Dumont type must become ungovernable when the velocity approaches a certain critical value.—On the kathode rays: P. **Villard.** It is shown that the properties of the magneto-kathodic rays are inverse to those of the Hittorf rays; an electric field acts on the first like a magnetic field does on the second.—On a method of measuring coefficients of self-induction: M. **Iliovici.**—On the phenomena which accompany the contemplation in a dark room of feebly luminous surfaces illuminated by special kinds of light. The case of spots of phosphorescent sulphide; the effects of anæsthetics: F. P. **Le Roux.**—On the anæsthesia of metals: Jean **Becquerel.** Aluminium and copper lose their transparency to the *n*-rays when the surface which receives the radiation is submitted to the action of an anæsthetic; quartz appears to possess the same property. Glass, wood, and cardboard, on the other hand, always allow the radiation to pass through.—A method for the continuous registration of the state of ionisation of a gas: Ch. **Nordmann.**—The influence of the frequency in electrolysis by alternating currents: André **Brochet** and Joseph **Petit.** The electrolytic properties of alternating currents appear to be altogether different from those of continuous currents. The results obtained depend on the frequency of the alternations.—On the use of the *n*-rays in chemistry: Albert **Colson.**—On the reduction of *o*-nitrobenzyl alcohol. General remarks on the formation of indazyl derivatives: P. **Freundler.** The principal reduction products of *o*-nitrobenzyl alcohol are indazyl-*o*-benzyl alcohol, indazyl-*o*-benzoic acid, and anthranilic acid.—A new method for the preparation of anilides: F. **Bodroux.** The alkyl-magnesium compound is treated with an amine, and to the product an alkyl ester is added. From this, hydrochloric acid gives the anilide in a nearly theoretical yield. Details

are given of the cases in which the method has been successfully applied.—On humic manures: J. **Dumont.**—Study of the reaction brought about by an indirect oxidising ferment (anæroxydase): E. **Bourquelot** and L. **Marchadier.**—The destruction of the chrysalis of the silk cocoon by artificial cold: J. **de Loverdo.** The destruction of the chrysalis can be effected with greater certainty by cooling than by the usual method of heating.—On the apparatus for the collection of plankton: T. **Richard.**—On the Acarophytes: M. **de Wildeman.**—On barium sulphate from Lozère: M. **Guédras.**—On the platform of the higher summits of the Transylvanian Alps: E. **de Martonne.**—On seismic phenomena in northern Africa: F. de Montessus **de Ballore.**—On a volcanic eruption which took place in Arabia near the town of Medina on June 30, 1256: M. **Houdas.**—On the fossil flora of the Antarctic regions: A. G. **Nathorst.**—On the ergastoplasmic formations of the nephridial cells of sangsue (*Hirudo medicinalis*): Louis **Fage.**—Relation between the intensity of the reflexes and the nervous organisation: Ed. **Toulouse** and Cl. **Vurpas.**—Respiration in an atmosphere the oxygen of which is considerably rarefied is not accompanied by any modification of intraorganic combustions, as measured by the respiratory exchanges: T. **Tissot.**—The injection of phloridzine in the milch-cow: Ch. **Porcher.** The effect of the injection is to increase the amount of lactose in the milk.—Researches on the causes of natural immunity of snakes: C. **Phisalix.** The natural immunity of snakes is to be attributed to the presence of a free antitoxin in the blood which neutralises the poison as it penetrates into the circulation.—The agglutination of the red blood corpuscles by colloidal ferric hydrate, sodium chloride, and by different serums: Madame **Girard-Mangin** and Victor **Henri.**

GÖTTINGEN.

Royal Society of Sciences.—The *Nachrichten* (physico-mathematical section), parts i. and ii. for 1904, contains the following memoirs communicated to the Society:—

January 9.—P. **Drude**: The theory of light in "active" bodies.

January 23.—O. **Wallach**: Researches from the university chemical laboratory, xiii. (1) A new instance of optical isomerism. (2) The splitting of camphorphorone. (3) On 1:2: methylcyclopentanone. (4) On isoximes. W. **Biltz**: The relation of certain inorganic colloids to fibre with reference to the theory of dyeing.

February 20.—F. **Krüger**: The theory of electro-capillarity and of drop-electrodes.

March 5.—D. **Hilbert**: Principles of a general theory of linear integral equations (part i.). O. **Blumenthal**: Remark on the theory of automorphous functions. A. **Sommerfeld**: Contributions to the theory of electrons. (1) General investigation of the field of an electron moving in any manner. V. **Hensen**: The graphical process for deriving correct curves from the results of observations. W. **Biltz**: An attempt towards the interpretation of agglutination.

March 19.—W. **Nernst** and F. **von Lerch**: On the employment of the electrolytic detector in Wheatstone's bridge.

DIARY OF SOCIETIES.

THURSDAY, JUNE 16.

ROYAL SOCIETY, at 4.30.—The Origin and Growth of Ripple-Mark: Mrs. H. Ayrton.—On the Seismic Effect of Tidal Stresses; R. D. Oldham.—On Flame Spectra: C. de Watteville.—An Experiment Illustrating Harmonic Undertones: H. Knapman.—A Probable Cause of the Yearly Variation of Magnetic Storms and Auroræ: Sir Norman Lockyer, K.C.B., F.R.S., and Dr. W. J. S. Lockyer.—On the Relation between the Spectra of Sun-spots and Stars: Sir Norman Lockyer, K.C.B., F.R.S.—On the Action of Wood on a Photographic Plate in the Dark: Dr. W. J. Russell, F.R.S.—The Retardation of Combustion by Oxygen: Prof. H. E. Armstrong, F.R.S.—(1) The Specific Heat of Diamond, Graphite and Ice between the Ordinary Temperature and the Boiling Point of Hydrogen. (2) The Absorption and Thermal Evolution of Gases Occluded in Charcoal at Low Temperatures. (3) Direct Separation of the most Volatile Gases from Air without Liquefaction: Prof. J. Dewar, F.R.S.—On the Influence of the Time Factor on the Correlation between Barometric Heights at Two Stations 1000 Miles Apart: Miss F. E. Cave-Browne-Cave.—The Decomposition of Ammonia by Heat: Dr. E. P. Perman and G. A. S. Atkinson.—On the Action of Radium Emanations on Diamond: Sir William Crookes, F.R.S.—*And other papers.*

LINNEAN SOCIETY, at 8.—Variations in the Arrangement of Hair in the Horse: Dr. Walter Kidd.—An Account of the Jamaican Species of Lepanthes: W. Fawcett and Dr. A. B. Rendle.—On the Blaze-currents of Vegetable Tissues: Dr. A. D. Waller, F.R.S.—British Freshwater Rhizopoda: James Cash.—Notes on the "Sudd" Formation of the Upper Nile: A. F. Brown.—The Place of Linnæus in the History of Botany: P. Olsson-Seffon.

INSTITUTION OF MINING AND METALLURGY, at 8.—The Causes and Prevention of Miners' Phthisis: Dr. J. S. Haldane, F.R.S., and R. Arthur Thomas.—Note on an Exhibit of an Emergency Set for First-Aid Treatment of Acute Cyanide Poisoning: H. C. Jenkins.—On the Assay of Tin, and on the Solubility of Cassiterite: J. H. Collins.—Iron Ore Mining in Scandinavia: W. Fischer Wilkinson.—Note on the Crib-Setting of a Deep Level Shaft: H. D. Griffiths.

MONDAY, JUNE 20.

SOCIOLOGICAL SOCIETY, at 5.—On the Relation of Sociology to the Socia Sciences and to Philosophy: Prof. E. Durkheim and V. Branford.

TUESDAY, JUNE 21.

ROYAL STATISTICAL SOCIETY, at 5.

WEDNESDAY, JUNE 22.

GEOLOGICAL SOCIETY, at 8.—The Caernarvon Earthquake of June 19, 1903, and its Accessory Shocks: Dr. C. Davison.—The Igneous Rocks of Pontesford Hill, Shropshire: W. S. Boulton.—The Tertiary Fossils of Somaliland, as Represented in the British Museum (Natural History): R. B. Newton.

FRIDAY, JUNE 24.

PHYSICAL SOCIETY, at 5.

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