THURSDAY, JUNE 6, 1907.

PREHISTORIC ITALY.

Introduction à l'Histoire romaine. By Basile Modestov. Translated from the Russian by Michel Delines. Pp. xiii+473. (Paris: Félix Alcan, 1907.) Price 15 francs.

PROF. MODESTOV'S work, which appeared originally in Russian, with an analysis in French, in the years 1902 and 1904, is a learned if somewhat conjectural attempt to reconstruct by the aid of archæological evidence the history of prehistoric Italy, with the view of elucidating the antecedents of Rome. In his own words (p. 341):—"abordant l'histoire de Rome, il se donne la tâche de discerner toutes les influences qui ont entouré la ville de Romulus dans la première phase de son existence." Basing himself on the work of Italian archæologists, which for the most part lies buried in the pages of periodicals, he begins with the Palæolithic age, and ends with the arrival of the Etruscans, which he dates somewhere about 1000 B.C. His learning is incontestable. It ranges from Rome to Berlin, and from St. Petersburg to London; it includes at once the work of Prof. Conway on Italic dialects and the researches of Mr. Arthur Evans and Mr. J. L. Myres on prehistoric Greece. Every scholar must be grateful for this laborious and exhaustive synthesis of the knowledge accumulated, during the last forty or fifty years, with regard to the history of primitive Italy.

Yet the critic may be pardoned if, in some respects, he ventures to criticise Prof. Modestov's work. For one thing, the author seems to exaggerate unduly the value of archæological research and archæological results. Etruscan pot-sherds and the débris of *terramari* are valuable in their way, but our sense of their value must not allow us to pooh-pooh, as Prof. Modestov too readily does, the work of a great constructive historian like Mommsen. The spade of the archæologist is, after all, a meaner tool than the pen of the historian, and the failing of the Pharisee is one to which the archæologist is so readily liable that it behoves him to be on his guard. It must be admitted, however, that the polemics of Prof. Modestov are directed against brother archæologists still more vehemently than against Mommsen. He wastes not a few pages, and exhausts not a little the patience of the reader, by continual diatribes and disproofs, which may cause a flutter in the dovecots of Italian archæology, but end by annoying the uninitiated scholar. There is something of a barbarous zest in such a sentence as:—

"Only the reasoning of M. Helbig, which M. Marthe has elected to follow, can vie, in its inconsistency and lack of scientific profundity, with that of its imitator."

And this suggests, what the reviewer has again and again noticed, that the author lets us too much into the workshop, and shows us too much rude workmanship and too little finished work. These argumentations represent the scaffolding of a book, which ought to be taken down when the building is finished, instead of remaining to spoil the view. Prof. Modestov has been so much interested in his matter that he has forgotten its form. He repeats himself, for instance, again and again, and one comes to notice, as a running refrain, the information (some four times repeated) that Pliny narrates the capture of 300 towns from the Umbrians by the Etrurians (though, by the way, at the fourth time of mentioning, p. 448, the captors are the Proto-Pelasgians).

The author is somewhat too prone to *risqué* conclusions, which he is not averse to supporting by dubious arguments. Though he is ready, upon occasion, to controvert Sergi, he accepts without reluctance the most hazardous of his conclusions, and believes in a "Mediterranean race" originating from Northern Africa. This is, he thinks, the earliest Italian race, and its representatives are the so-called Ligurians and Sicels, who came into Italy by way of the Straits of Gibraltar, and formed the basis of Italian population during the Stone age. To attain this conclusion, Prof. Modestov follows Sergi in exalting the evidence of skulls far above the testimony of language; to support it he is willing to accept the most dubious of linguistic evidence, and to connect the language of the Basques with that of the Berbers, or, indeed, with that of the hieroglyphics of Egypt. Is it for this, one asks, that Mommsen and Ihne are rejected in scorn? But the conclusions of Prof. Modestov on which he would himself wish most stress to be laid are not those which relate to the Stone age or to the Mediterranean race, but those which are concerned with the age of Bronze and the age of Iron (the *civiltá Villanovana*), and with the races by which these ages were introduced; while still more important, perhaps, in the eyes of the author is the part of his book in which he attempts to solve the problem of the origin of the Etruscans (pp. 341–468).

We may conclude by a brief indication of the conclusions which the author reaches on these important points. The age of Bronze came in two ways. Partly it came by way of commerce, from Cyprus—more especially in southern Italy; partly it came through immigration of an Aryan stock from the valley of the Danube. The first entry of this Aryan stock is represented by the *terramari* of the lower valley of the Po, as is proved more particularly by the Aryan custom of incineration (instead of burial), which can be shown to have been practised in the *terramari*. The first Aryan stock left the lower valley of the Po owing to the pressure of a second Aryan immigration, and, forced gradually southward, it settled in Latium, and became the parent of the *populus Romanus*. The second Aryan immigration is that of the Umbro-Sabellians, who came about 1000 B.C., and introduced the age of Iron, the so-called civilisation of Villanova, which they had derived from the Greeks by way of the Adriatic. The first Aryan stock, which had settled in Latium, borrowed from these new-comers something of their civilisation (their use of iron, their methods of decor-

ating in bronze, and their rudimentary writing), while it also absorbed certain elements from the primitive Neolithic civilisation of the original "Ligurians" of the Tiber valley. Finally (*tantae molis erat Romanam condere gentem*), there came the Etruscans, at about the same date as the Umbro-Sabellians. The Etruscans, according to Prof. Modestov, who accepts, and fortifies by archæological evidence, the testimony of Herodotus, were a people from Asia Minor, who came by sea to Tuscany, bringing, *inter alia*, Eastern methods of divination which they had borrowed through the Hittites from Chaldæa. To corroborate this view, Prof. Modestov alleges the conclusions of a Danish scholar, who seeks to connect the mysterious Etruscan language with the dialects of the southern Caucasus. Here Prof. Modestov seems somewhat inconsistent, for while he compares the archæological relics of the Etruscans with those of south-western Asia Minor, he compares their language with the dialects of the north-east.

We should be ungrateful if we did not mention the many illustrations, for the most part original, with which the author has ornamented his book and sought to aid his readers. The Etruscan illustrations are particularly interesting.

ERNEST BARKER.

THE FUNCTIONS OF THE BRAIN AND SPINAL CORD.

The Integrative Action of the Nervous System. By Dr. C. S. Sherrington, F.R.S. Pp. xvi+411. (London: Archibald Constable and Co., Ltd., 1906.) Price 16*s.* net.

THE unravelling of the arrangement and complications of the nervous system has always been of great interest, not only to physiologists, but also to mankind in general. The specially human attributes which distinguish our species from the rest of the Mammalia have at least an intimate connection with the superior development of the central nervous system, and we have therefore a peculiar interest in tracing the methods by which this complexity is of advantage to the individual.

The central idea of the book under review is the action of the nervous system in connecting the various cells composing the body into one individual, as distinguished from a mere collection of separate items. While there are other agencies that work to this end, mechanical as well as chemical, still the nervous system is preeminently effective in this respect from the delicacy and speed with which the intercommunication is effected. The unit reaction, to which all the complex phenomena of nervous activity are referable, is recognised to be the "simple reflex action."

The recognition of this definite unit, in place of the vague generalities too often quoted, marks the first important step in the study of the subject.

Prof. Sherrington then goes on to show that the anatomical basis underlying this simple reflex consists of three parts:—(1) the *receptor*, the sensitive organ which receives the impression; (2) the *conductor*; (3) the *effector*, the organ which effects the reflex act.

The various details of the apparatus are then considered. By an arrangement of this kind the threshold is lowered for one kind of stimulus and heightened for others, so that the reflex becomes selective. The phenomena called out by these stimuli are then considered, namely, the irreversibility of the direction of the impulse, the long latent period, and the rhythm of the action. By the method of "successive degeneration" it is possible to examine the conductor apparatus, and the conclusion is arrived at that the simple reflex arc is at least *disynaptic*, that is, composed of three separate neurones as a minimum, that the "effector" part of the arc is a "final common path" for all the reflexes using the particular end organ attached to it, and that somewhere in the "conductor" (the part of the arc connecting receptor and effector) there is some mechanism which gives a refractory phase. The importance of this is seen when such a phenomenon as the scratch reflex is examined, as this consists of a rhythmic series of movements the rate of which is governed by the purpose for which the reflex acts, and not by the rapidity of the successive stimuli. Further, as such a reflex is a coordinated action, there must be rhythmic *inhibition* of a series of muscles as well as rhythmic *contraction* of the opposing set, and by a series of well-devised experiments and careful consideration of the results the author again makes an important advance. This becomes more evident when the next chapter of the story is considered, namely, the compounding of reflexes, and the method by which one reflex becomes prepotent over another which would use antagonistic muscles.

The limited space at a reviewer's disposal will not permit the further description of Prof. Sherrington's account of the functions of the cerebral cortex and the very ingenious experiments on sensual fusion, but it will be found that the later chapters of the book possess the same wealth of information and lucid reasoning as the earlier. The only criticism that might be gently urged is that occasionally the language in which the reasoning is conveyed becomes nearly as complicated and abstruse as the subject-matter of the discourse. Sometimes, however, this recondite phrasing hides gems of humour as well as knowledge, as in the sentence on p. 317:—

"Into that sequestered nook the organism by appropriate reactions gathers morsels of environmental material whence by chemical action and by absorption it draws nutriment,"

which by careful examination of the context appears to mean "Tommy ate a piece of cake!!!"

But, jesting apart, we have in this book the most valuable contribution to the comprehension of the functions of the nervous system that has appeared up to the present time, not only from the records of the experiments quoted, but also from the logical and orderly way in which the due inferences from the experiments are put forward, and the volume stands out as a landmark in our knowledge of the subject.

PHYSIOLOGICAL CHEMISTRY.

Practical Physiological Chemistry; Junior Course; Senior Course. By R. H. Aders Plimmer. Pp. 55 and 83. Privately printed. n.d.

"THIS book has been compiled as a handbook for practical work in Physiological Chemistry at University College. Much use has been made of the books by Milroy, Cole, Halliburton, Hofmeister and others, from which some pages have been adapted almost in their entirety."

The foregoing quotation from the preface shows that the work makes no attempt at originality. It is mainly a compilation from various sources of what a teacher considers most suitable in his own classes. Every teacher has his own ideas as to what a student in physiological chemistry should perform for himself; if any other teacher were to adopt Dr. Aders Plimmer's book as a guide in his practical classes, one anticipates that he would modify the arrangement, adding here, omitting there, and in still other places transposing parts from the junior to the senior course, and *vice versâ*. The line between a junior and senior class is always difficult to draw, and every teacher has his own ideas as to what should be placed on either side of the line.

The book, from another point of view, is, however, different from all others hitherto published, for it includes the pure organic chemistry necessary for the understanding of the chemical problems of the physiologist and medical man. One of the difficulties of medical education to-day is the ever-increasing scope of the preliminary sciences, and the deciding as to how much of each is to be crowded within the few years of the curriculum. Science grows, but the years devoted to its study still have only 365 days each. The question is becoming an acute one as to which parts of each science the pruning knife must be applied. In the University of London, chemistry always has been, and still is, specially insistent on its claims; it has, moreover, been successful in obtaining an additional six months in the time devoted to it over and above the year that physics and biology are satisfied with. It is for this reason that so many teachers are anxious to see chemistry as a preliminary science cut down to the single year's work which suffices for the other subjects. Unfortunately, in many instances lecturers on chemistry, not having themselves had a medical training, know but little of what the students of medicine really need, and teach the subject as though their pupils hoped to be expert chemists. Such teachers point out the importance of chemistry as a groundwork of much that follows later in the course, but lose sight of the fact that a student has not done with chemistry when he passes his preliminary examination in science; he has later on in his studies to consider chemistry in its applications to both physiology and pathology.

In these circumstances it is not to be wondered at that the teachers of other subjects which have a more direct bearing on the study of medicine are urging that if the work of the pure chemist is limited to the one year, which they regard as ample for the learning of the groundwork, the superstructure will later on have to include more physiological chemistry diluted to a suitable degree with those parts of organic chemistry which are absolutely necessary for its comprehension. As an earnest of what can be done with this object in view, Dr. Plimmer's book should meet with a hearty welcome.

W. D. H.

CEMENT AND CONCRETE.

(1) *Portland Cement: its Composition, Raw Materials, Manufacture, Testing, and Analysis.* By Richard K. Meade. Pp. viii+385. (Easton, Pa.: The Chemical Publishing Co., 1906.) Price 14*s.* 6*d.* net.

(2) *Reinforced Concrete.* By C. F. Marsh and W. Dunn. Third edition, revised and enlarged. Pp. vii+654. (London: Archibald Constable and Co., Ltd., 1906.) Price 31*s.* 6*d.* net.

(1) THE author is chemist to the Dexter Portland Cement Co., and the analytical methods described have all been used to some extent in his laboratory. The treatise is a second edition of a small manual, published some four years ago, on the chemical and physical examination of Portland cement. In preparing this new edition, a considerable amount of fresh matter dealing with the manufacture of Portland cement has been added. The first two chapters, which form an introduction to the book, are devoted to the history of the development of the Portland cement industry in America; the growth in the total consumption, and the growth in the consumption per head of population, have both increased in a remarkable degree during the last sixteen years—in 1890 the total production in the United States was 335,000 barrels, and by 1904 this had increased to more than 26½ million barrels; but even in that year the consumption was in excess of the domestic production, and more than two million barrels had to be imported.

In the next section of the book, chapters iii. to viii., a comprehensive and complete account is given of the processes of manufacture; the raw materials are described in detail, and much information is given as to the localities in the States in which they are found, and one of the chapters is devoted entirely to the subject of quarrying and excavating the raw materials. In dealing with kilns and the burning of the raw materials, modern rotary kilns are described; this chapter will be found a very valuable one for reference purposes; the thermochemistry of the calcining is discussed in a very exhaustive manner. In connection with the description of the process of grinding, Mr. Meade not only explains the construction and working of the various ball and tube mills, which are now generally employed, but he gives plans and sections of the complete equipment of a modern Portland cement plant on the wet process plan and also on the dry process plan, with notes as to the cost of plant and manufacture.

The next section treats of the analytical methods

which are, or should be, employed in determining the quality both of the raw materials and of the finished product. This portion of the book will be very useful to chemists engaged in Portland cement factories, and to every analyst who may have to deal with the problem of determining whether or not a given sample of cement is up to the standard of some particular specification. The different methods employed are explained with great clearness, and the apparatus necessary is shown in well-drawn illustrations; so explicit are the instructions that an engineer who has had a fair training in the elements of chemical analysis could, should necessity arise, make many of these determinations for himself after procuring the necessary apparatus.

The last section of the book is devoted to the physical testing of Portland cement, and this section will be invaluable for reference purposes to the civil engineer and to other users of Portland cement. The author describes in turn all the ordinary physical tests, and his comments upon the various tests and their value in enabling a conclusion to be drawn as to the quality of any given sample are of much practical value.

(2) The first edition of this work appeared in the autumn of 1904, and since that date there has been such great progress in the employment, and in our knowledge, of reinforced concrete that a new edition was rendered imperatively necessary; much new matter has been added in addition to a general revision of all the portions of the book dealing with calculations. Reinforced concrete is still not used in this country to anything like the extent to which it has been employed both in America and on the continent of Europe, but much of the opposition to its use is now steadily declining.

The first three parts of the book are devoted to a general description, with excellent illustrations, of the various systems which have been employed up to the present date, and give a brief account of the materials, including both concrete and the reinforcing metal. Great stress is laid on the absolute necessity of employing only the best material in connection with the concrete, and of ensuring that the materials shall be of uniform quality and the concrete well and carefully made.

Part iv. deals with the practical construction of reinforced concrete for various purposes, and the construction of the necessary moulds for beams, floors, arched ribs, chimney shafts, pipes, sewers, and reservoirs. The next two sections are devoted to a very full and complete account of the experimental researches, and the data deduced therefrom, which form the basis of all calculations necessary in designing reinforced concrete; the authors are to be congratulated on the admirable way in which they have brought together, in a most convenient form for reference, information scattered through a very large number of publications, and on the complete way in which they have brought up to date all the data obtained in experimental investigations. The chapter devoted to calculations necessary in design work has been almost entirely re-written and very considerably simplified, with great advantage to the designer who may desire to consult this work, the method of treatment adopted for the case of singly reinforced rectangular and T-beams being entirely new.

The last section of the book, as in the earlier editions, is devoted to a descriptive account of various buildings and structures which have been erected up to the present time in reinforced concrete; this chapter contains a series of most admirably reproduced photographs of many large buildings and handsome arched bridges built entirely on this system.

The regulations which have been laid down by the Prussian Government for the employment of reinforced concrete in buildings are printed *in extenso* in appendix ii., and another appendix contains the report of the experiments carried out by the United States Geological Survey Department on the permeability of reinforced concrete pipes.

The present edition is a great improvement on previous issues, and every engineer and architect who utilises reinforced concrete on anything like a large scale in his constructional work will find this book an indispensable addition to his reference library.

T. H. B.

BOOKS ON ELEMENTARY BOTANY.

(1) *Principles of Botany.* By J. M. Bergen and B. M. Davis. Pp. ix+555. (Boston, U.S.A., and London: Ginn and Co., n.d.) Price 6*s.* 6*d.*

(2) *Introduction to Plant Ecology for the Use of Teachers and Students.* By Rev. G. Henslow. Pp. x+130. (London: E. Stanford, 1907.) Price 2*s.* 6*d.*

(3) *An Introduction to Practical Botany.* By E. H. Davies. Pp. x+127. (London: J. M. Dent and Co., 1906.) Price 2*s.*

(4) *The School Garden. A Handbook of Practical Horticulture for Schools.* By J. E. Hennesey. Pp. 155. (London: Blackie and Son, Ltd., 1906.) Price 1*s.*

(5) *Flowers Shown to the Children.* By J. E. Kelman and C. E. Smith. Pp. xii+154. (London and Edinburgh: T. C. and E. Jack, n.d.) Price 2*s.* 6*d.* net.

(1) IN the "Principles of Botany" the authors have introduced an innovation that offers definite advantages, and promises to be as suitable for practical work as for lecturing. The book is apportioned into three sections; the first comprises the morphology and physiology of the seed-plant taken in combination; classification and comparative morphology of cryptogams and phanerogams are treated in the second portion; and ecology, with a short reference to economic botany, forms the final section. As a result, only those morphological facts are noted in the first section that are required to explain the construction of the plant as a living entity, and much detail is appropriately transferred to ecology. Whilst most favourably impressed with the book in its entirety, the taxonomic portion, that more particularly demands judicious selection and

compilation, has been ably presented by Dr. Davis. He keeps the evolutionary sequence constantly before the student, and directs special attention to the significance of alternation of generations, heterospory, and the evolution of the sporophyte. Under ecology, chapters are devoted to recent work on the origin of species and plant breeding.

The book can be confidently recommended to students and teachers, and the latter will find the arrangement well worthy of consideration.

(2) Having devoted special attention to the ecological aspect of botany, Prof. G. Henslow has prepared an introduction to the subject. The earlier pages contain a discussion of methods of teaching botany, and in subsequent chapters the nature of plant associations, modifying factors, and plant surveying are considered. The information is mainly suggestive, and will therefore be found too diffuse for the ordinary student. On the value of ecology as an educational study the author advances arguments with which one is in accord, but with regard to certain criticisms on anatomy and physiology it can only be inferred that he has not had the opportunity of observing what an excellent training is provided by a judicious laboratory course.

(3) The main object of the course planned by Mr. E. H. Davies is to enable the learner to obtain his information by his own observation, so that the lessons, except in so far as they give instructions, consist of a series of questions. The assistance required to furnish the answers is contained in a glossary at the end of the book. The detail is well thought out, and if the exercises selected are a trifle too elementary, more difficult ones can be easily substituted. The author very rightly insists on the necessity of making outline drawings of all objects examined.

(4) The advantages of a school garden where children may acquire practical knowledge are sufficiently obvious, and in country schools there should be no difficulty in securing the necessary ground. For teachers who have not the requisite horticultural experience, Mr. Hennesey provides in "The School Garden" just the information required for directing their operations. The laying out of the garden, trenching, propagation, and the cultivation of fruit trees, vegetables, and flowers are rationally and practically expounded; to these are appended suggested courses of work and general hints as to ways and means.

The book provides a concise manual of elementary horticultural instruction that may be profitably consulted, not only by teachers, but generally by those who grow their own fruit and vegetables.

(5) A coloured picture-book of flowers arranged for children, so that they can distinguish them and find out their names, describes the nature of the last book under notice. Arranged according to colour, the illustrations furnish the means of determination. The type and general form of the book are pleasing, and the short descriptions, referring mainly to the flower, are expressed in simple language.

OUR BOOK SHELF.

Ballooning as a Sport. By Major B. Baden-Powell. Pp. xx+135. (Edinburgh and London: William Blackwood and Sons, 1907.) Price 3*s.* 6*d.* net.

Flying Machines: Past, Present, and Future. By Alfred W. Marshall and Henry Greenly. Pp. 128. (London: Percival Marshall and Co., n.d.) Price 1*s.* net.

MAJOR BADEN-POWELL himself, in a chatty introduction, describes his book as a *réchauffé* of a few magazine articles mostly written some years ago. The essays deal with the past of ballooning pure and simple, but their bright conversational style will commend them to a wide circle of readers.

The second little volume provides a popular account of flying-machines, dirigible balloons, and aëroplanes. Mathematical formulæ and calculations for designs have not been included, though the authors say they intend their information to "assist the reader with serious intention of making an attempt to produce a flying-machine, or air-ship." The book is fully illustrated, and should prove of interest to the general reader.

Principes de Géologie stratigraphique, avec Développements sur le Tertiaire parisien. By G. Courty. Pp. xiv+78. (Paris: A. Hermann, 1907.)

THOSE who look on Lyell's "Principles of Geology" with a filial regard, and those who keep by them Dr. Marr's scientific introduction to stratigraphy, will be disappointed with the title of this little book, which deals with elements rather than with what we know in this country as principles. Prof. Stanislas Meunier contributes a preface, in which he dwells on the constantly changing character of the earth's crust; and the author also holds that his work contributes towards the realisation by the reader of this "vitalité tellurique." But we are given little else than a summary of what is to be found in an ordinary text-book, and no attempt is made at generalisation. For a French work this is remarkably void of inspiration.

Outlines of Practical Sanitation. By Dr. H. B. Bashore. Pp. vi+208. (New York: J. Wiley and Sons; London: Chapman and Hall, 1906.) Price 5*s.* 6*d.* net.

THE scientific principles of public health and personal hygiene are explained in a simple and attractive style in this volume. Though the author refers particularly to conditions in rural and urban districts of the United States, his descriptions are concerned in the main with considerations of causes affecting health in general, both of the community and the individual. Familiarity with the principles described ought to be regarded as an essential qualification of every member of a sanitary committee of a public body. The book should be found useful as a means of imparting sound ideas of the laws of healthy living to teachers and citizens.

Essay on the Creative Imagination. By Th. Ribot Translated from the French by Albert H. N. Baron. Pp. xix+370. (Chicago: The Open Court Publishing Co.; London: Kegan Paul, Trench, Trübner and Co., Ltd., 1906.)

THE translator, enumerating some of his reasons for translating M. Ribot's essay, summarises the results at which it arrives by stating the author has shown clearly that "imagination is a function of mind common to all men in some degree," and that it is as highly developed in "practical inventors as in the most bizarre of romantic idealists." The chapter on the scientific imagination will appeal especially to the student of science.

LETTERS TO THE EDITOR.

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

The Origin of Radium.

IN a previous letter to NATURE (January 17) I gave an account of some experiments which I had made upon the growth of radium in preparations of actinium. The results obtained were in substantial agreement with the earlier observations of Boltwood in this Journal (November 15, 1906), but it was pointed out that there was no definite evidence that actinium itself was the true parent of radium. The experimental results could be equally well explained by supposing that the parent substance of radium was ordinarily separated from radio-active ores with the actinium, but had no direct radio-active connection with the latter.

Observations have been continued upon the growth of radium in the actinium solution prepared in the manner indicated in my first letter. The rate of growth was found to be uniform over a period of 120 days, and to agree closely with the rate of growth observed in the solid preparation of actinium which had been set aside for a period of two and a half years. Another sample of actinium was then taken and successively precipitated with ammonium sulphide in order to remove the radium from the solution. In this way a solution of actinium was obtained initially almost entirely free from radium. By examination of the α-ray activity, it was found that the actinium after this chemical treatment contained an excess of radio-actinium. This was shown by the rise of the activity to twice its initial value in about twenty days, and then a gradual decay to a steady value. Special care was taken to measure accurately the rate of growth of radium in the solution at short intervals in order to see whether it depended in any way upon the variation of the activity. No such connection was observed, for the radium was produced at a constant rate over the whole period of examination, viz. 111 days.

For equal quantities of actinium, the rate of growth of radium observed in this solution was 1·5 times greater than the normal. This indicated that only a portion of the actinium had been precipitated, while the radium-producing substance had been precipitated with the actinium in excess of the normal amount. This conclusion was confirmed by an examination of the filtrates, which were found to contain more than half the actinium. After suitable chemical treatment, a small precipitate of actinium was again obtained which was about one hundred times as active, weight for weight, as the original preparation. This actinium precipitate was dissolved in hydrochloric acid, and observations of the amount of radium in it were made at regular intervals. *No appreciable growth of radium was observed over a period of eighty days.* If there were any growth at all, it was certainly less than one two-hundredth part of that normally to be expected. In order to make certain that the absence of apparent growth of radium in this solution could not be ascribed to the precipitation of the radium in some non-emanating form, the solution was again chemically treated. The actinium was precipitated with ammonia and re-dissolved in hydrochloric acid. Again no growth was observed over the period of examination, viz. twenty days. The solution in its present state contains a just measurable quantity of radium, viz. about 2×10^{-12} gram.

From these observations I think we may safely conclude that, in the ordinary commercial preparations of actinium, there exists a new substance which is slowly transformed into radium. This immediate parent of radium is chemically quite distinct from actinium and radium and their known products, and is capable of complete separation from them.

It is not possible at present to decide definitely whether this parent substance is a final product of the transformation of actinium or not. It is not improbable that it may prove to be the long-looked-for intermediate product of slow transformation between uranium X and radium, but with no direct radio-active connection with actinium. If this be the case, the position of actinium in the radio-active series still remains unsettled.

It is intended to continue observations on the growth of radium in the solutions described above. Experiments are also in progress to isolate this new substance in order to examine its chemical and radio-active properties.

Manchester, May 30. E. RUTHERFORD.

The Structure of the Ether.

I WELCOME the interesting and helpful letter from Dr. O. W. Richardson, of Princeton, in NATURE of May 23, in which he adduces arguments against an ether flow along magnetic lines of force, and in favour of a flow in the direction of the Poynting vector EH. The result comes out much the same, but it is probably a better way of regarding the matter. Prof. Hicks also has given a simple geometrical proof that a magnetic field cannot consist solely of ether flow; and I am referring to this in a note, already printed, in the *Phil. Mag.* for June.

We shall doubtless hear in due course from the mathematical physicists to whom the first idea of a magnetic ether flow is due, whether they are satisfied with the modification of their original conception now introduced. Meanwhile, I doubt if integration of momentum, without regard to direction, can be sound. OLIVER LODGE.

Birmingham, May 28.

Root Action and Bacteria.

THE remarkable and all but fatal effect of growing grass over the roots of freshly planted apple trees has been studied at the Woburn Experimental Fruit Farm since 1894, and formed the subject-matter of the third report of that station (1903). No satisfactory explanation of the action was obtained. Experiment showed that it could not be attributed to the abstraction of food or moisture from the soil by the grass, nor to the influence of the grass on the soil temperature or on the gaseous contents of the soil, and subsequent experiments have excluded the formation of acid or alkali from the possible causes. The conclusion drawn was that the action was probably that of a poison produced either directly by the grass or indirectly through the agency of bacteria. Since the publication of this report, further work has been done on the subject, and the view that bacterial agency is concerned has become much strengthened. The action is not confined to any particular grasses, nor to apple trees, but different grasses and different kinds of trees act and suffer, respectively, to different extents. The difference in the results, however, produced by different soils are much more conspicuous, especially in cases where trees are not grassed over until a few years after they have been planted. Though the deleterious action of grass may generally be noticed throughout the country, many notable exceptions have been met with, and these cannot be explained by any of the patent characteristics of the soils in question. Various pot experiments have been made which emphasise these observations. Trees grown in earth in pots are affected by grass in just the same way as they generally are in the field, the grass reducing the growth and vigour of the tree by at least 50 per cent.; but if the trees are grown in sand instead of earth (suitable nourishment being supplied), the grass has very little effect on them, reducing their vigour by about 5 per cent. to 10 per cent. only.

Following up this and other observations, twenty-six similar trees were planted in pots last February under various conditions; seventeen of them were in soil or sand which had not been heated, and nine of them in soil which had been sterilised, or partially sterilised, by heating to about 200° C. and to 82° C. respectively, the water lost in the process being made good. Of the seventeen in unsterilised material, all started into growth uniformly at the same time, whereas of the nine in sterilised soil two started about two days later, six did not start until at least fourteen days later, and one has not started yet.

The heating of the earth, especially to the low temperature of 82°, cannot have appreciably affected its chemical composition, and, indeed, the starting of a tree into growth is independent of nourishment supplied to it, as is shown

by the behaviour of trees in sand; the only alteration produced in the soil by the heating must have been an alteration in the living organisms present in it. That bacteria are connected with root action has, of course, been established in certain special cases, but in these the connection consists of the bacteria being the means of augmenting the food supply of the plant; the present case is altogether different, for it appears as if the mere functioning of the roots was dependent on bacterial action. Such a conclusion would be one of far-reaching significance. Of course, the facts require much more examination and confirmation, but, even in their present state, they are sufficiently evident to warrant notification.

That two out of the nine trees in sterilised soil showed very little retardation in activity is not surprising, as there were many opportunities for the re-inoculation of the soil, the pots containing the trees having been exposed in the open since February 4, and no attempt having been made to sterilise the trees themselves before planting, though the roots were washed free from soil. The two exceptional trees were in earth which had been heated to the higher temperature; they were two out of six planted under these conditions. It may also be mentioned that heating to the lower temperature does not destroy all soil bacteria, indeed, it may increase the total bacterial contents; it is probably, therefore, a question of killing some particular bacteria which are connected with root activity.

SPENCER PICKERING.

The Astronomical and Archæological Value of the Welsh Gorsedd.

FROM the very interesting communication of the Rev. John Griffith (May 2, p. 9) it would at first sight appear that the modern "Druids" had indeed preserved a tradition of the May year as well as of the solstitial year in connection with the circles set up by them for the performance of their ceremonies. I should be glad to think that this was the case, but I find considerable difficulty in connecting the modern circles with the ancient ones; there is no ancient circle which shows any sign of ever having possessed such an array of outlying stones as appears in the plan given by Mr. Griffith, and the outlying stones that remain do not always conform to it either; nor is there any ancient circle, except those in which a sepulchral cist forms the central point, and Stonehenge, which has a flat stone in the centre. The late "Myfyr Morganwg, Archdruid of Wales," set up a circle round the rocking stone at Pontypridd in the middle of the last century, but in place of the eight outlying stones figured by Mr. Griffith it has curved avenues forming the head and tail ends of a serpent, so it does not appear that modern "Druidic" authorities are agreed upon this important subject. "Myfyr Morganwg" also published a book in Welsh, the principal illustration to which represents a Druid standing on a flat stone (sometimes it is a three-legged dolmen), surrounded by a circle of twelve others, on which converge three rays of light coming from the north-east, east, and south-east, and forming, no doubt, the original model of the "broad arrow" and of the "Y cross," but without any outlying stones, though three smaller stones are represented in those lines inside the circle; three stones which may represent these, or may, with others there, be intended for an inner circle, also exist in his Pontypridd circle. The central stone for sitting or standing on seems to be a *sine quâ non* with the modern "Druids," but it is not found in ancient circles. There are upright stones in the middle of the circles at Callernish, Boscawen-un, the Stripple Stones, and the Marshpool or Hoar-stone circle (Shropshire), and there was one in the middle of the southern inner circles at Avebury, where also the middle of the northern inner circles was occupied by a "cove," or open shrine of three stones, as again was the case at Arborlow, but at none of these places, except perhaps in the Shropshire circle, could any man stand or sit on these stones, though he might stand in front of them. In the other great British circles (Stonehenge, which occupies a place by itself amongst them, excepted) there is nothing in the centre nor any appearance of there ever having been anything, although there is reason to believe that whatever was done in them was done at or about the centre.

I am therefore inclined to think that the type of circle represented by Mr. Griffith, and probably much of the ritual connected with it, were evolved during the process of "re-codifying or otherwise dealing with the bardic traditions," which, as he says, took place between the twelfth and nineteenth centuries, when, as he also says, a "voluminous body of traditions grew up," and that whatever old ideas may be preserved amongst those traditions have got there rather in an accidental sort of way than by continuous use or direct descent. The traditions, however, though of no real authority in matters of detail, are not without value as indications of an opinion of very great antiquity as to the use of the ancient circles.

The number nineteen occurs at Stonehenge, Dawns Maen, Boscawen-un, the Cosdon circle (Dartmoor), and in the proportionate measurements of Stanton Drew. It probably refers to the cycle of nineteen years in which the sun and moon were thought to return to the same relative place in the heavens, and which was known in the fourth century B.C., if not, indeed, much earlier, in the island described by Hecatæus, usually identified with Great Britain.

A. L. LEWIS.

35 Beddington Gardens, Wallington, Surrey.

I AM glad that a brief summary of the evidence for the antiquity of the Welsh Gorsedd has interested Mr. A. L. Lewis.

(1) The name "Druids" for the Welsh bards should be dropped. It is retained at the Gorsedd as the name of one of the three classes of members. There is very little authority for calling the presiding bard archdruid. The proper name is Priv-vardd, Chief Bard. Let "Druids" and "Druidism" remain as general terms for the use of the "pre-historian." The Welsh bards insist on a grander name, *Gorsedd Beirdd Ynys Prydain*, the high court of the bards of the Isle of Britain.

(2) As to the May year, it has not become obsolete in Wales. There is practically no other in our ancient literature. Its omission from the conventional Gorsedd instructions, while it is everywhere present in the bardic traditions with that exception, is, I think, due to monastic influence. The Church year became solstitial. The bards fraternised with the monks, and Gorsedds were held in chapter-houses and churches. One result was that the bards adopted the festival year as fixed by the Church, so that the favourite time for a Gorsedd was neither solstitial nor agricultural, but such a time as Whitsuntide. This, the only serious meddling with the traditions that I can find, was done, say, about the twelfth century, when the Cistercian monks of Margam, Glam., where the Gorsedd traditions were chiefly preserved, found a new use for the Gorsedd, as a model for the round or polygonal chapter-house.

(3) It is not likely that a stone circle can be found exactly like a Welsh Gorsedd. In the earliest traditions, like those of the oldest Mabinogion, we seem to find the temple observatory in actual use, say, by the Druids; but, speaking generally, in the Gorsedd traditions themselves it is only a matter of minor importance, preserved as well as such a comparatively useless thing could be for the sake of some sacred associations. Modern bards do not understand the plans they have preserved. When a new Gorsedd is set up, no account is taken of the height of the horizon in the direction of the sunrise stones, a matter of much importance to the builders of the megalithic monuments. The bards have religiously preserved the general plan. At some point of time, when it was deemed necessary to preserve such a thing after it had ceased to be of practical use, the bards did better than copying any individual monument, which, as a rule, gives only one decisive sight-line to sunrise or sunset. They set up a complete almanac in stone. The perfect plan I have directed attention to (NATURE, May 2) presents sight-lines to the quarter days of both the solstitial and May years. As the individual monument is usually oriented to some one festival day, uniformity in detail is not to be looked for. The Gorsedd presents in one plan the combined sunrise sight-lines of all the circles in fair preservation that have been astronomically surveyed.

(4) The form of the central stone is immaterial in discussing the plan. At a temple observatory, what was chiefly necessary was to mark the exact centre of the circle. Where no "cove" was erected, an upright stone would suit well. Where neither was present, the priest-astronomer would simply stand on the spot to make his observations. The present fashion of placing a large boulder on the flat in the centre of the Gorsedd seems reminiscent of both the "cove" and the later kist.

(5) "Myfyr Morganwg" is only to be followed so far as he can produce some earlier authority. He tried to mix the contents of the "Asiatic Researches" with those of Welsh tradition. I have before me a plan of the Pontypridd circle, published in the second quarter of the last century, in which the three station stones, or sunrise stones, form alignments to the equinox, May, and November.

(6) The bards were not allowed to sit in a Gorsedd; they were to stand uncovered, head and feet.

(7) I did not mean that the process of "re-codifying or otherwise dealing with the bardic traditions" was in operation only from the twelfth to the nineteenth century. It seems very likely that there was a larger body of Gorsedd traditions known in the twelfth century than we find at any subsequent period. Again, I applied the epithet "voluminous" to the whole stock of printed and manuscript materials on the subject still extant. They have "grown," not to any large extent by addition or accretion, but by the multiplication of versions or recensions of what was recited at the Gorsedd meetings, as was the fixed rule. There is much work to be done by way of collating these recensions. I have an impression that the recital of the Gorsedd traditions proper would not have occupied a longer time than an old-time sermon. The only considerable additions concern the rules of poetry. There is no evidence, except the indirect evidence respecting the solstitial year, that the conventional instructions about the Gorsedd circle itself have been subjected to any revision. This is distinctly stated to be a matter of minor importance—the circle with its ceremonies. The following words, translated from a Welsh extract from an old book at Raglan Castle, before that place was destroyed by Cromwell's forces, shows the attitude of the bards towards the subject here under discussion :—

"Now follows an account of things that appertain to institutional ceremonies, and that accord with the reason and inherence observable in the reminiscence and customs of the bards of the Island of Britain; but which, nevertheless, are not considered as indispensably requisite parts of the system; because every truth and knowledge—every recollection and intention—as well as every art and science, may be acquired without them :—still they corroborate and illustrate reminiscences and primary regulations; for which reason, it is deemed laudable to perpetuate them in memory and usage; especially as they comprise the ancient forms transmitted, by the retentive memory of Gorsedd" ("Iolo MSS.," p. 445).

Then the scribe begins the list of non-essentials as follows :—"It is an institutional usage to form a conventional circle of stones, on the summit of some conspicuous ground," and he gives complete details. This is not the tone of a scribe who was conscious of any weakness in the traditional account.

I take no serious exception to anything that Mr. Lewis says. He has himself furnished very valuable data for this inquiry. But a better theory than an "accidental sort of way" must be found to explain highly finished and polished statements which, like pebbles in glacial drift, speak of the remotest origin.

JOHN GRIFFITH.

Llangynwyd, Glam.

MARINE ZOOLOGY AT THE CAPE.[1]

THE third volume of reports on the Cape marine fauna contains ten papers published between 1904 and 1905. Of these memoirs, two, dealing with eighteen new species of fish and the development of South African fishes, are by Dr. Gilchrist, to whose enterprise and ability these sustained and extended investigations of the resources of the Cape seas are largely due. In this work he has been ably seconded by European colleagues. Prof. McIntosh contributes two papers on the polychæt annelids; Prof. Hickson a second report on the Alcyonaria; Prof. Jeffrey Bell three contributions, dealing respectively with the echinoid, asteroid, and ophiuroid echinoderms; Mr. Stanley Gardiner publishes a careful study of the turbinolid corals; and Prof. Cleve submits a first instalment of a study of the South African marine plankton.

Dr. Gilchrist's second contribution to a knowledge of the life-histories of the Cape fish contains several matters of interest, although he has only succeeded in referring nine of the eighteen stages or eggs he describes to known species. The development of the saury-pike (*Scombresox saurus*) is worth noticing for

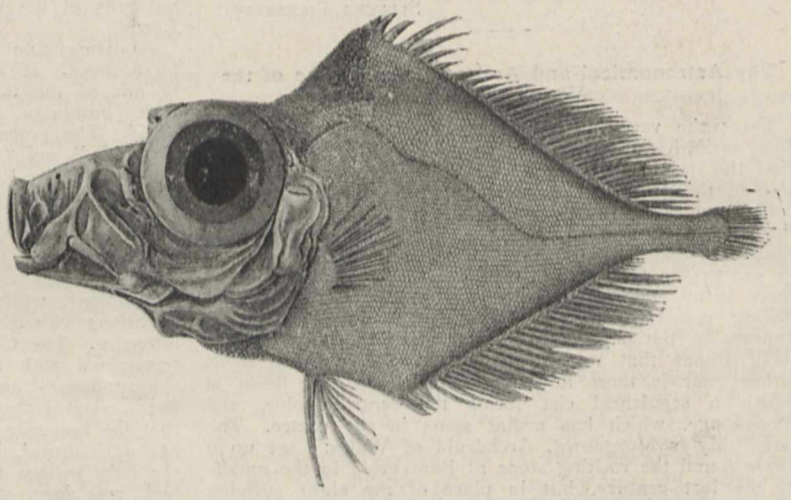


FIG. 1.—*Cyttosoma Boops*, ng. eb sp. From "Marine Investigations in South Africa."

two reasons. In the first place, the young fish before hatching keeps up a rapid and almost constant movement of one pectoral fin, and when hatched, keeping its tail well submerged, it skims the surface with its mouth as if in search of food. The second peculiarity of the saury, if well founded, is of greater interest, and consists in the presence of blue pigment arranged in chromatophores, massively developed on the dorsal surface and sparsely below. The presence of an indubitable blue pigment concentrated in cellular elements is probably a new fact in animal coloration, and one that suggests how wide a field of investigation is afforded by the phenomena of pigmentation in fish. Another noteworthy feature of this article is the account of cannibalism prevalent among the unborn young of *Cataetyx messieri*. It appears that this deep-sea fish is viviparous. In the one case described, the right ovary consisted of a mass of undeveloped bright red eggs with a single larva coiled up in a dense mucous substance, whilst the left ovary contained seven larvæ also strongly flexed and embedded in mucus. When these were detached it

[1] Cape of Good Hope, Department of Agriculture. "Marine Investigations in South Africa." Vol. iii. Pp. 269+45 plates. (Cape Town: The *Cape Times*, Ltd., 1905.)

was found that in one case the larva had swallowed a smaller one, and that the others had partially digested their younger fellows. Further details of this habit are promised.

The papers on Polychæts are of interest, chiefly as affording further confirmation of the prevalence of European forms, and even of their parasites, in South African waters. The luminous Chætopterus, for example, that occurs on the Devonshire coast and among the Channel Islands, is found between tide-marks in False Bay and Simon's Bay at the Cape. Many of our commonest littoral annelids are found under similar conditions on the shores of these bays. Fifteen out of the thirty-eight species here described are British, and the majority of the remainder are closely allied replacing forms. Where the agreement is so close it is rather curious to note that no mention is made of the presence of the common lugworm or of its allies.

Prof. Hickson's paper on the Alcyonaria is a continuation of his previous work on this branch of the Cape fauna. It contains, amongst other matter, descriptions of a new family, two new genera, and four new species. The new family, Malacogorgiidæ, is remarkable as comprising Gorgonians, or sea-fans, without any calcareous structures. Of more general interest is the combination of local and of widely diffused corals that occur in the Cape waters. At least six peculiar Cape species, belonging to four genera, are now known, one of which, *Alcyonium purpureum*, is impregnated by a soluble purple pigment which deserves fuller investigation. On the other hand, the affinities of the members of the group in this region with Atlantic, Indian, and even Antarctic Alcyonaria are clearly indicated. We may expect a further investigation of these difficult problems of distribution from the distinguished author of this work.

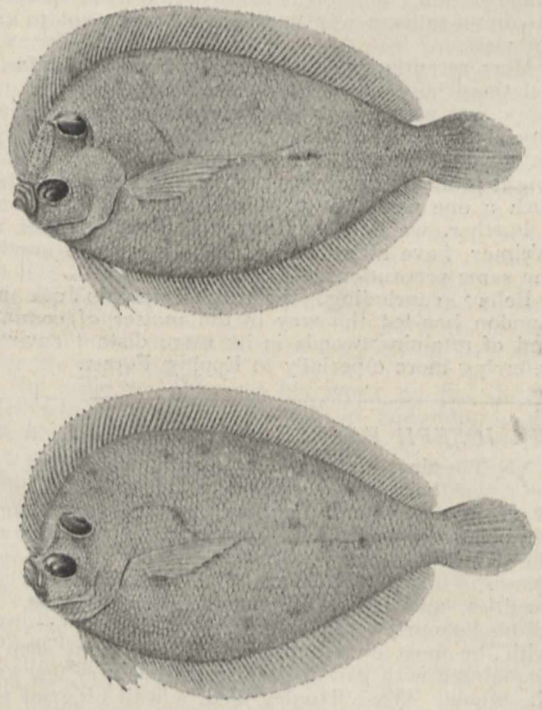


FIG. 2.—*Platophrys dimorphus*, n. sp. Upper figure, male; lower, female. From "Marine Investigations in South Africa."

The remaining papers can only be briefly summarised. Mr. Stanley Gardiner's work on corals is of that high standard to which his previous papers have accustomed us. It is based on a large series of comparisons, and is executed in the most careful and thoughtful manner, both as regards the skeletal and malacological characters. Prof. Jeffrey Bell reports the discovery of the echinid Palæolampas in a living state.

The plankton investigations by Cleve is a most useful summary of the distribution of the Copepoda found in South African seas, and also gives the percentage of this fauna that extends northwards, the result showing that in Mediterranean waters the percentage reaches more than 70, thus supporting the view enunciated by Cleve that the waters of the north temperate Atlantic "originate not from the Gulf Stream, but from the Benguela current, which is supposed to pass as an under-current below the waters of the Tropical Atlantic." Finally, a word of praise must be added for the forty-five excellent plates that adorn this work.

REFORM IN RURAL EDUCATION.

THE Gloucester conference on rural education in 1904 directed public attention to the need for adapting rural education to rural requirements. Several county education authorities have since instituted inquiries into the subject, chambers of agriculture have passed resolutions, and now the County Councils Association, through its Rural Education Sub-committee, has published a "Memorandum as to certain subjects suitable for the upper standards of elementary schools, and for evening schools in rural districts." This memorandum is worthy of careful examination. The case for reform may first be briefly stated.

It is a disturbing thought that during the past half-century scientific method has largely disappeared from rural elementary education. The child, whose education chiefly consisted in learning from what he saw and did in the field, sheepfold and farmstead, grew into a man who, though his range of view was limited, possessed a remarkable store of accurate first-hand knowledge upon those things which concerned his work in life. With the introduction of a system of compulsory schooling, in which knowledge was principally gained from the lips of the teacher, the scientific method of basing knowledge on individual experience largely disappeared. Now faculties, while easily developed in children, as easily become atrophied through disuse, and, under the present system, it is too often the case that lads as they leave school have neither the power of intelligent observation which is essential to success in rural industry, nor have they acquired an interest in country things. In the absence of such interests, the amusements of a town prove an irresistible attraction, and this, it is believed, has been one of the factors in bringing about rural depopulation and the scarcity of skilled men on the farms, while at the same time we meet in every London street with able-bodied out-of-works.

In the memorandum of the County Councils Association, nothing is said about less schooling, but the guiding principle in all the subjects of the curriculum is to be to *let surroundings teach*, and thus to put back scientific method into rural education. Geography and history are to be based on the physical features of, or the events associated with, the neighbourhood. In arithmetic, out-of-door measurement of land, crops, stacks, and cisterns is to be introduced. School-gardening is to be regarded not merely as instruction in the operations of gardening, but as a study of the growth of crops in relation to the soil.

Thus, although no teaching of agriculture is to be introduced, partly perhaps because the teachers are not qualified to teach it, partly because it would be waste of time to those boys who do not afterwards follow agricultural pursuits, still knowledge of surroundings is being acquired, habits of intelligent observation are being cultivated, and every subject of the school curriculum is acquiring a reality which no oral teaching could ever give it, and which must render the education a better training for life, whatever the after careers of the lads may be.

But while agriculture is not taught, it is noticeable that in the study of surroundings such subjects are suggested as will yield knowledge that is useful to the farmer or farm-hand. For example, the boys are to collect the field and garden weeds, and study their root systems and time of seeding with the view of learning the reasons for their abundance and the best means of dealing with them. From the point of view of cultivating intelligent observation, such an exercise is as good as one that has no utilitarian bearing, and it has this additional value, that the boys learn to apply their knowledge to the practical purposes of rural life.

This idea of *purpose* is kept prominently in view in all the subjects named in the memorandum. Manual work naturally takes an important place, for it is as necessary to cultivate the habit of manual work in childhood as it is the habit of intelligent observation, and its neglect has been another factor in the preference shown by lads after leaving school for non-rural employment, and therefore in rural depopulation. But, again, the manual work is to have purpose. The woodwork is to be directed to making useful things, the gardening to growing useful vegetables, and thus the boys' hearts, as well as their heads and hands, become impressed into their education.

One omission is noticeable—that the teaching of science finds no place in the suggestions. But to acquire a scientific habit of mind, the study of a science is certainly not necessary, nor even perhaps desirable, for children of twelve and thirteen. It is nature-study rather than the study of a natural science that is advocated, for while the correlation of a number of facts or phenomena of the same kind is likely to weary children, the coordination of one fact or phenomenon with others of a different order stimulates their interest and widens their outlook, and permits more readily of application to the purposes of daily life.

The memorandum is followed by a series of "suggestions for the encouragement of rural education." These include the establishment of junior naturalist societies and boys' agricultural clubs, nature-study exhibitions, and school museums of local natural history, together with a suggestion that facilities should be provided for the training of teachers in rural subjects.

LANDSCAPE PROTECTION IN GERMANY.

AN abstract of a lecture delivered on October 1, 1906, at Munich, at the annual meeting of the "Heimatschutz" League, by Prof. H. Conwentz, was recently published in pamphlet form. It deals with what has been done in Germany, and more especially in Bavaria, for the preservation of the forests, of bird and plant life, and of the beauty of the landscape in general.

Even so far back as 1803 a private property near the town of Bamberg, in Bavaria, was bought up by the State, and turned into a people's park. At one time the banks of the Danube were gradually becoming disfigured by large quantities of stone being taken away; it was then determined that the stone for public buildings should be obtained from those quarries which did not interfere with the landscape.

In 1841 an order was issued which dealt more especially with the trees. By it it was made almost impossible to remove or alter the existing avenues in the streets; further, oaks, elms, and beeches were specially to be looked after, and also any trees connected with history or legends. By the Bavarian forest-law of 1852, private as well as public forests came under State superintendence.

About 1902 an order was circulated that for the welfare and the increase of birds, hedges and bushes should be planted, or existing ones looked after. Moreover, uncommon birds were to be particularly safeguarded and spared, as complaints had been forthcoming that their number was decreasing.

Similarly, orders were issued for the preservation of certain local plants which were threatened with extinction in the neighbourhood of Garmisch.

In several cases, telephone wires have been laid underground, and in Saxony a certain proposed mountain-railway was not built in order not to spoil the view.

More recently, we find that in Prussia similar regulations have come into existence. There in 1903 a law was passed forbidding the disfigurement of provincial neighbourhoods by advertisements. The author directs attention to the fact that other countries might profit by obtaining such a law. How beneficial such a one would be to this country!

Further, we find that Saxony, Baden, Hesse, and Weimar have all adopted, in one respect or another, the same precautions.

Before concluding, the author points out how London has led the way in the matter of commons and of retaining woods in its more distant environs, referring more especially to Epping Forest.

SIR JOSEPH FAYRER, BART., K.C.S.I., F.R.S.

ON Tuesday, May 21, Sir Joseph Fayrer died. He was born on December 6, 1824, and he died full of years and full of honours, for he was honorary physician (military) and physician extraordinary to the King, honorary physician to her late Majesty Queen Victoria, M.D. and LL.D. of various universities, and fellow of many learned societies. Yet all his honours were richly deserved, and he bore them with the most unassuming modesty. Many men are acquainted with parts of his work, but very few know the whole. When Huxley died, a wail of grief went up from the scientific world, but many people are unaware that but for Fayrer the course of Huxley's life might have been completely different, and a great part of his scientific work might never have been done. They were fellow students together, Huxley being senior by a year, though Fayrer was actually older by a few months. When Huxley had finished his medical studies he was, as he himself says in the autobiographical sketch prefixed to his essays, wondering what he should do to meet the imperative necessity of earning his own bread, when Fayrer suggested that he should enter the naval medical service. He did so, and after a few months at Haslar he went on his famous voyage on the *Rattlesnake*, and thus began his scientific career. The attraction which drew Fayrer and Huxley together and led to their close friendship was the great likeness between them in many respects. It has been said that in every human face a resemblance may be traced to some animal, and this was markedly so both in Huxley and Fayrer. Especially in his later years Huxley's face and head suggested that of a lion,

while Fayrer's large, open forehead and calm expression reminded me of an elephant, and one could hardly look at him without thinking how rightly the Hindoos have chosen an elephant's head for their god of wisdom. Both men were alike in the stern uprightness of their characters, in the extent of their knowledge and the wideness of their interests, in the clearness of their views, the correctness of their decisions, their absolute fearlessness, their prompt and energetic action, their firm determination to carry out what they thought right, in their tenacity of purpose, in a certain impatience of opposition, and in their great success in overcoming it. Associated with these qualities which compelled admiration were an extraordinary kindness and tenderness of heart which gained the affection of all who knew them.

It is not so easy to draw a comparison between their intellectual powers, because their spheres of activity were so very different. Huxley's life was passed in the pursuit and teaching of science and philosophy; Fayrer's scientific work was done in the short intervals of time that he could snatch from the pressure of other occupations. While Huxley was on board the *Rattlesnake*, Fayrer was engaged in amputating limbs and treating gunshot wounds in the insurrection at Palermo, and narrowly escaped death at the siege of Rome by the French. Between such occupations, however, he managed to learn sufficient Italian to pass the examinations and obtain the degree of M.D. in the University of Rome, perhaps the only doctor not a Roman Catholic who ever did so.

Before his friend Huxley had come back from his voyage, Fayrer went out to India, and again saw active service in the Burmese war. During this war he distinguished himself so highly that the Governor-General appointed him residency surgeon at Lucknow, the best appointment at his disposal, as a reward for his services.

In order to carry on his work he had to learn Hindostani and Persian, and in addition to all his medical work he had to conduct a great deal of the correspondence between the British Government and the King of Oude. When the Indian Mutiny broke out, Fayrer's house in Lucknow was one of the most exposed to the enemy's attack, and he himself took an active part in the defence of the town as well as attending to all the medical and surgical work which disease from insanitary conditions, unsuitable food and the wounds by shot and shell caused amongst the besieged.

Broken in health, Fayrer returned to England after the Mutiny, but instead of remaining idle he went to Edinburgh, worked at the university, passed his examinations, and received the degree of M.D. He then returned to India, where he became professor of surgery in Calcutta.

In 1870 he went with the Duke of Edinburgh on his travels in India, and in 1875 accompanied the King, who was then Prince of Wales, to India. He was a keen sportsman, and was fond of zoology, and in 1867, when president of the Asiatic Society of Bengal, he proposed to found a Zoological Gardens in Calcutta, a proposition which, after some years, was carried into effect. He also proposed an ethnological investigation of the races of India, but this was never fully carried out.

Much of his time was taken up by pathological investigation and sanitary work, but the research in which he took the greatest interest was his zoological work on the snakes of India and his physiological investigation into the action of their venom. It was during this investigation that he first tried the effect of various antidotes, one of which, permanganate of potash, is now beginning to be used in such a way as to preserve life in cases of snake bite which would otherwise have been fatal. The difficulties under which his scientific work was carried out are shown by the fact that he had often to leave an experiment of this kind in order to attend to his hospital work, and that while there amputating a limb or performing some other operation his mind would be disturbed by anxiety regarding the condition of his private patients, who were anxiously waiting for him. But for Fayrer's extensive knowledge and firm decision in difficult circumstances, the Prince of Wales, with whom he was travelling, might possibly have been induced by the earnest entreaties of various personages to visit infected places, with the probable result that cholera might have spread over large districts of India, and that our King might never have returned from his visit to that part of his Empire. Not only do scientific men owe a great debt to Fayrer for his own contributions to science and for the bias he gave to Huxley's life, but also for the care which he took of our King's life and the benefits which its preservation has conferred upon the Empire.

At Fayrer's funeral one of the wreaths bore the gracious inscription,

"For Auld Lang Syne from Edward VII."

LAUDER BRUNTON.

SIR DIETRICH BRANDIS, K.C.I.E., F.R.S.

BY the death of Sir Dietrich Brandis, which occurred at Bonn on May 28, a man of world-wide renown has been removed. Brandis was born on April 1, 1824, at Bonn, being the son of Dr. Christian Brandis, professor of philosophy in Bonn University. As a boy he followed his father to Greece, where he spent several years. On his return to Germany he was educated at the Universities of Copenhagen, Göttingen, and Bonn. He became, in 1849, lecturer (*Privat-docent*) on botany at Bonn. In 1854 he married a daughter of Dr. Marshman, of Bengal. This happened to be the turning-point in his career.

After the occupation of the province of Pegu in Burma, Lord Dalhousie was looking for a man to take charge of the important teak forests of that province, when his attention was directed to Brandis by the latter's brother-in-law, General Sir Henry Havelock. Lord Dalhousie wrote to Brandis that if he would come to India he would be appointed superintendent of the Pegu teak forests. The offer was accepted, and Brandis landed at Calcutta in 1856. He explained his views to Lord Dalhousie, who, in taking leave of him, said, "Dr. Brandis, if you carry out the scheme which you have explained to me, you will confer a great benefit upon this country." Brandis never saw Lord Dalhousie again, but his parting words remained with him throughout his service. Brandis set to work to save the Burma teak forests, in which endeavour he had the full support of Major (afterwards Sir Arthur) Phayre. After a long-continued struggle the forests were placed under systematic management, and they, with the forests of Upper Burma, are now the chief supply of teak timber to the world.

In 1862, Brandis was called to Simla, at the suggestion, it is believed, of Dr. Cleghorn, one of the principal pioneers of forest conservancy in India, to advise the Government of India on forest matters in other provinces, and in 1864 he was appointed the first Inspector-General of Forests to the Government of India. He then set to work to introduce systematic forest management throughout India. A regular department was established and a forest law passed. Brandis travelled from one end of the Bengal Presidency to the other, advising and organising the department. He also visited Bombay twice, and

spent two years (1881–3) in Madras. The department thus created has grown until it has now an area of 239,000 square miles, equal to twice the area of Great Britain and Ireland, under its management.

When Brandis first started operations he had to do with what staff he could lay his hands on; but he determined to obtain one fit to deal with the requirements of the case. In 1866, while on sick leave in England, he obtained the sanction of the late Lord Salisbury, then Secretary of State for India, to train young Englishmen in Continental forest schools, and under this scheme a number of highly qualified foresters have been sent to India. The training at Continental forest schools was subsequently supplanted by that at Coopers Hill College, and now at the University of Oxford.

But Brandis went a step further. In 1878 he started a forest school at Dehra Dun for the training of natives of India, which has now been raised to the rank of "The Imperial Indian Forest College," and sends annually from forty to fifty trained executive officers into the service.

By these means a trained staff of 200 Englishmen have been obtained, who control the operations of the forest department, assisted by about 11,000 native officials of various grades. The results are most gratifying. The supply of timber, firewood, grass, and other produce for the teeming millions of India has been placed on a satisfactory footing, while the net revenue from the forests has risen from 40,000*l.* in 1864 to 660,000*l.* in 1904, although produce valued at a similar sum is given free to the people of the country.

During his career in India Brandis wrote an endless number of reports, and in 1874 he brought out the "Forest Flora of North-west and Central India," a work which was so highly thought of by Sir Joseph Hooker and others that he was made a Fellow of the Royal Society in 1875. It may not be generally known that Brandis was the first who compiled a rainfall map of India; it has been improved since, but as regards the main points it holds good to this day.

Brandis retired from the Indian service in 1883, at the age of fifty-nine years; but he continued to devote himself to the advancement of forest conservancy in India, by articles and letters of advice to his friends in India. From 1888 to 1896 he superintended the practical instruction in Germany of the Coopers Hill forest students.

The last eight years of his life he devoted to the writing of a general Indian forest flora, which he published in 1906 under the title of "Indian Trees," a monumental work, which is likely to be the standing book of reference on the subject for another generation. Scarcely had he completed this when he fell ill, and he never rose from his sick bed. He was made a C.I.E. in 1876, and a K.C.I.E. in 1887.

It should not be omitted to mention that Brandis had a great share in the development of forest conservancy in the United States. He guided the studies of quite a number of young Americans, who have since established a great department in the United States. His influence in this respect has been so great that President Roosevelt presented him with his picture and the following dedication:—"To Sir Dietrich Brandis in high appreciation of his services to forestry in the United States, from Theodore Roosevelt."

Apart from India and the United States, Brandis's action has been felt in almost all parts of the British Empire, including these islands. He has left his mark upon every continent of the earth; at any rate, his name will go to posterity as the father of systematic forest management in the British Empire.

W. SCHLICH.

NOTES.

WE regret to learn that Dr. Maxwell T. Masters, F.R.S., whose writings on botanical and horticultural subjects are familiar to many readers of NATURE, died on May 30 at seventy-four years of age.

THE annual conversazione of the Institution of Electrical Engineers will be held at the Natural History Museum, Cromwell Road, on Tuesday evening, June 18.

DR. W. S. BRUCE and the remainder of his staff, who are starting on an expedition to the Arctic, have left Edinburgh for Spitsbergen. The expedition will finally be relieved and brought back to Europe by the Prince of Monaco on board his yacht the *Princess Alice*.

PROF. PAUL EHRLICH will deliver the second and third of his series of Harben lectures of the Royal Institute of Public Health on Friday, June 7, and Tuesday, June 11. The subject of the lectures is "Experimental Researches on Specific Therapeutics," and they will be delivered at the Royal Medico-Chirurgical Society, 20 Hanover Square, at 5 p.m. on each day.

GILBERT WHITE'S autograph manuscript of his "Natural History and Antiquities of Selborne," in the form of letters to Thomas Pennant and Daines Barrington, and arranged in a folio volume, will be sold by Messrs. Sotheby on July 1. The MS. remained in the possession of the author's descendants until 1895, when it was sold at Sotheby's and acquired by the present owner, Mr. Stuart M. Samuel, M.P.

THE council of the Society of Arts, with the approval of His Royal Highness the Prince of Wales, its president, has awarded the Albert medal of the society for the current year to the Earl of Cromer "In recognition of his pre-eminent public services in Egypt, where he has imparted security to the relations of this country with the East, has established justice, restored order and prosperity, and, by the initiation of great works, has opened up new fields for enterprise."

AT a meeting of the Corporation of the City of London on May 30, the Lord Mayor presiding, it was decided unanimously to present the freedom of the City to Lord Lister and the Earl of Cromer. Mr. Alderman Alliston, in moving that the honorary freedom of the City be presented to Lord Lister in a gold box, in recognition of his eminence as a surgeon and the invaluable services he has rendered to humanity by the discovery of the antiseptic system, remarked that more than one hundred years have elapsed since the Court bestowed the freedom of the City on a member of the medical or surgical profession. The last was that given to Edward Jenner, the discoverer of vaccination, in 1803. Since then the Corporation has welcomed Royal personages, great warriors, eminent statesmen, and others, but the still small voice of the personal ills that flesh is heir to—their amelioration and remedy—have, Mr. Alliston pointed out, somewhat escaped the City's notice. The deficiency is now to be rectified, and the City Lands Committee has been empowered to make the necessary arrangements for the presentation of the freedom to Lord Lister at an early date.

ON August 15, weather permitting, the international laboratory for Alpine investigations, at the Col d'Olen, on Monte Rosa, will be formally opened. In two articles contributed by the late Sir Michael Foster to NATURE (vol. lxv., p. 568, and vol. lxxi., p. 443), he described the laboratory established on the Gnifetti peak of Monte Rosa, at

an altitude of 4560 metres, and referred to the valuable researches at high altitudes carried on in connection with it. The supplementary laboratory shortly to be opened is at an altitude of 3000 metres, and will therefore permit work to be carried on for longer periods and under less difficult conditions than at the higher Gnifetti laboratory. The new building provides accommodation for work in botany, bacteriology, zoology, physiology, terrestrial physics, and meteorology, including material and instruments usually required for investigations at high altitudes. Eighteen investigators can find places in the laboratory, and two of these places are for British men of science. Prof. A. Mosso, Turin, to whose zeal and activity the laboratories largely owe their existence, will give further particulars concerning the conditions under which places in them can be secured by investigators desiring to study physiological and other problems in the High Alps.

PLANS have been perfected recently, we learn from *Science*, for a detailed and systematic investigation of the Atlantic and Gulf Coastal Plain stratigraphy and palæontology. Several State surveys, including those of North Carolina, Georgia, Alabama, and Mississippi, will act in cooperation with the United States Geological Survey. The aim of the work is to determine the extent of the subdivisions recognised in New Jersey and Maryland on the north and Alabama on the south, to determine their relations to one another, and in general to establish satisfactory correlations throughout the district between the Potomac and the Mississippi River. Economic studies, especially on the phosphates, will also be made. The supervision of the work rests with a board of geologists, consisting of the State geologists in the Coastal Plain districts and the chief geologist and chief hydrographer of the national survey, Dr. W. B. Clark being chairman. The field work is in charge of Mr. M. L. Fuller, who will put seven parties into the field during the summer. It is hoped to complete the investigation in Virginia, North Carolina, South Carolina, and Florida within a year, while the work in the remaining States will be finished in 1908 and 1909.

THE closing sitting of the International Association of Academies was held on June 2. An article upon this third general assembly appeared in last week's NATURE (p. 105); and the Vienna correspondent of the *Times* gives, in Tuesday's issue, a short account of the proceedings, from which the following report of progress has been derived:—The next meeting will be held in Rome three years hence, and the management of the association during the interval will devolve upon the Accademia dei Lincei. The association has agreed to the issue of a complete and authentic edition of the works of Leibnitz, both the mathematical and the philosophical departments of the association recognising its desirability. Notable progress was reported in the preparation of the great Encyclopædia of Islam, of which Prof. de Goeje, of Leyden, laid before the meeting the first section in three languages—English, French, and German. The ideas of forming a Corpus of Greek documents and a Corpus Medicorum Antiquorum are taking practical shape. The Belgian Government has announced its intention of subsidising the scheme for an international bibliography of historical and philosophical subjects, and it is hoped that support will also be forthcoming from England and America. The proposal that the association should choose an international auxiliary language, such as Esperanto, for use in the communications between members was negatived by twelve votes to eight. The members of the association are gratified by the reception accorded to each of them personally by the Emperor Francis Joseph, and express warm gratitude for the hospitality extended to them by the Vienna Academy and by the Austrian authorities.

THE accounts which have been published in the Press, through Reuter's Agency, of the expedition of Dr. A. F. R. Wollaston to the Ruwenzori region give a terrible picture of the ravages of sleeping sickness. In the Manyuema country the sights are described as being fearful, with people dead and dying on the roadside, as it is the custom of those people to turn out stricken natives to die. A similar custom prevails in Uganda, and is inspired by the belief, firmly held by the natives, that persons affected with sleeping sickness are infectious to others living with them. Scientific investigations into the mode of transmission have so far demonstrated, however, only one means of conveying the infection, namely, by the intermediary of tsetse-flies (*Glossina palpalis*, also *G. fusca*, *fide* Koch). But since the fly has only been shown to transmit the disease by the direct method, that is to say, by taking up into its proboscis from sick persons the parasites which cause the disease, and inoculating them directly into healthy subjects, it seems at least within the bounds of possibility that other biting parasites, such as fleas or lice, might be able to do the same thing. Moreover, in a paper read before the Royal Society last November, Prof. E. A. Minchin suggested the possible occurrence of a mode of infection which he has termed *contaminative*, to contrast it with the ordinary *inoculative* method (see NATURE, December 27, 1906, vol. lxxv., p. 214). These suggestions, if confirmed, would account for the native theory of infection. On the other hand, no patient has ever yet been found to be infectious when removed to a healthy region from one where sleeping sickness is rife. It is evident, however, that the etiology of sleeping sickness is a subject which has not been exhausted, since there are several possibilities which require definite proof or disproof.

THE first part of vol. xxix. of Notes from the Leyden Museum is entirely devoted to descriptive zoology, and therefore mainly interesting to specialists. Reference may, however, be made to the description, by Dr. Jentink, of a new bat of the genus Taphozous from Batavia, which, in the possession of a wing-pouch and a gular sac, approximates to the rare *T. longimanus* of India.

IN the course of an editorial note in reference to the photograph of the skull of a hippopotamus which forms the frontispiece to the April number of the (*Haslemere*) *Museum Gazette*, it is stated that "the hippopotamus has its nearest British alliance in the pig, but unlike the latter, it has four toes." We are led to wonder how many digits the editor considers a pig to possess. We are also surprised to learn (p. 564) that Proechidna takes the place in New Guinea of Echidna in Australia, seeing that zoologists recognise a local race of the latter from Port Moresby. As to the list of mammalian names on p. 569, perhaps the less said the better.

THE structure and physiology of the male generative organs of the dibranchiates forms the first part of a critical study of cephalopod molluscs in general, by Mr. W. Marchand, of Leipzig, now in course of issue in the *Zeitschrift für wissenschaftliche Zoologie*, this instalment appearing in vol. lxxxvi., part iii. As the result of his investigations, the author concludes that modern pelagic dibranchiates, in which the sexes are distinct, are the descendants of non-pelagic hermaphrodite forms, with

longer bodies and "shells." The question as to whether these hypothetical ancestral types are represented by the belemnites is discussed towards the close of the paper.

JUDGING from the annual report for 1905–6, affairs have not been working quite smoothly at the Indian Museum. A proposal has been made that the museum should be divided into several sections (including one devoted to art), and that the whole establishment should be presided over by a director, who should not be a zoologist. Exception is taken to this proposal by the superintendent of the natural history section, who also expresses himself somewhat strongly with regard to the uses to which some of the galleries under his charge have recently been put. "I feel it my duty," he writes, "to record that this section has of late been seriously embarrassed and discouraged by a series of sudden evictions from its galleries and by constant schemes of Museum reorganisation in which its well-established claims, and the interests of zoology in general, have not received sufficient consideration." The zoological collections, with the exception of the insects (which suffer from the climate), are in the main in satisfactory condition, and have largely increased during the period under review.

THE annual return of experiments performed under the Vivisection Act has just been issued. In all, 46,073 experiments were performed by 279 licensees, of which 43,287 were of the nature of simple inoculations, hypodermic injections, &c. Nearly 6000 experiments were performed for Government departments, county councils, municipal corporations, and other public health authorities; 2144 experiments were performed for the Royal Commission on Tuberculosis, 8659 for the Imperial Cancer Research Fund, 4732 for the preparation and testing of therapeutic sera and vaccines, and 1079 for the testing and standardising of drugs. Irregularities occurred in the case of four licensees, the result of inadvertence or misunderstanding. The inspectors report that they have made the usual visits of inspection of registered places, and found the animals suitably lodged and well cared for, and the licensees attentive to the requirements of the Act.

A NUMBER of excellent illustrations of Maoris and others at the New Zealand International Exhibition are given in the *Weekly Press* (Christchurch, N.Z.) for December 12, 1906. One series shows the "Canoe dance," in which an elaborate story is told in pantomime by means of the *poi*, a small ball of *raupo*, at the end of a string of flax. Another series deals with the Fijian fire-walkers, whose performances were discussed in NATURE some years ago, and were the subject of a paper in the Proceedings of the Victorian Branch of the Royal Geographical Society of Australasia in 1892. There is also an excellent full-page plate of a Fijian dancing party.

THE Journal of the Anthropological Institute, vol. xxxvi., part ii., contains Prof. Petrie's Huxley lecture, illustrated by twenty-eight maps, mainly of Central Europe, with an appendix on the interpretation of curves. Mr. Torday continues his excellent series of papers on the tribes of the Congo, and, in collaboration with Mr. Joyce, deals with the Bahuana. Dr. C. S. Myers publishes two parts of his anthropometric survey of modern Egypt, treating of the Mohammedans and comparing them with the Copts and the "mixed" group. Mr. G. U. Yule attacks the validity of Dr. Karl Pearson's statistical methods in cases where ill-defined qualities, such as shades of colour, are in question. MM. Frič and Radin deal with the Bororo of central Brazil; a great part of their paper is devoted to ornaments, weapons, and music. Other papers in this part are by Miss Layard on the Ipswich Palæolithic site, and by Mr. Parkinson on the Ibos; Major Sykes publishes a second vocabulary of the Gipsies of Persia, giving words from three districts for comparison with Prof. de Goeje's Armenian and Egyptian lists. The number contains twenty plates, which, as usual, are of a high standard, both as regards interest and workmanship.

THOSE mysterious prehistoric excavations—the dene-holes—are found in great numbers in the neighbourhood of Bexley, some five miles from Woolwich, and in smaller numbers near Grays, in Essex, and numerous other localities in east, south-east, south, and south-west of England. Some recent explorations have unearthed a few more interesting evidences of their antiquity, and thrown a little more light on the problem of their origin. In sinking a shaft at Gravesend lately, the workmen discovered the nether cavity of a dene-hole, which had been almost entirely filled in by subsidences. The shaft was quite filled up, but the bee-hive chamber at the bottom is now being cleared of rubbish, and in the sand and earth a number of partially worked axe-heads of flint have been found, together with the bones and skull of an animal, probably a wolf, which are now being identified. The walls are covered with pick-marks, which seem to have been made with an instrument of either wood or bone, possibly a pick made of an antler.

IN the *Biologisches Centralblatt* (May 1) Prof. Haberlandt returns to his theory that the leaves of certain plants are enabled to perceive the stimulus of light because their epidermal cells are domed and function as lenses, whence he calls them "ocelli," since they resemble a primitive eye. He has somewhat modified his previous explanation, as follows:—If the light falls obliquely on the leaf, the rays act as a "tropic" or directive stimulus on the plasma-lining of the cell, causing the leaf to turn until it lies at right angles to the incident rays. In support of his theory, Prof. Haberlandt demonstrated that the cells can be prevented from functioning as lenses if the leaves are immersed in water, because the convexity is nullified by the water having a refractive index almost equal to that of the cell sap; to meet the arguments of critics he now shows that a continuous film of water on the surface is sufficient to prevent the leaf from turning.

AN article on the hybridisation of wild plants was contributed by Prof. D. T. MacDougal to the *Botanical Gazette* (January). The principal subject of examination was the oak tree, *Quercus heterophylla*, characterised by the veining and indentation of its leaves, that has generally been accepted as a hybrid. The author adduces evidence from the cultivation of seedlings in favour of regarding the species as a hybrid between *Quercus Phellos* and *Quercus rubra*. The article is, however, more important on account of the general remarks as to the methods of tracing supposed hybrids. Occasionally a hybrid may be synthetised from its supposed parents; sometimes evidence may be obtained from anatomical examination of the hybrid and parents, or, as in the present case, from cultures of the seedlings. These methods are, however, fraught with pitfalls that are better understood since the elaboration of the Mendelian principles.

IN connection with the silting up of Karachi harbour, Mr. G. K. Betham advances the opinion, in the *Indian Forester* (March), that much advantage might be derived from calling in the services of the forestry department.

The source of the enormous deposits of sand is traced partly to the sediment brought down by the Indus and partly to the drift from the littoral of Mirpur Sakro lying to the south-east of Karachi. While the control of the waters of the Indus is primarily the work of the irrigation department, it is urged that it would be possible to reduce materially the sediment if the banks and certain deposits, "kachas" in the upper waters were protected by planting with such grasses as *Typha elephantina*, *Eragrostis cynosuroides*, and *Eleusine aegyptiaca*. The problem of checking the sand drift from Mirpur Sakro is essentially one for the forester, and Mr. Betham maintains that, despite the want of water, it would be possible to develop plantations of Casuarina, tamarisks, and Agave.

DR. N. M. STEVENS, in Publication No. 36 of the Carnegie Institute of Washington, has given an interesting account of his investigations on the so-called heterochromosomes in a number of insects, especially the beetles. These chromosomes commonly form a pair differing in size from the rest of these nuclear bodies. One of the pair is smaller than the other, and this may go so far as to culminate in its entire suppression. The special point of interest attaching to these heterochromosomes lies in their different behaviour in the male and female animal respectively. The female always possesses an *equal* pair, and in those forms in which the small one has entirely disappeared from the cells of the male its surviving counterpart is still preserved in the female. A comparison of the eggs and sperms brings out the remarkable fact that half the eggs contain, and half quite lack, the large chromosome, whilst similarly the sperms, four of which are produced from each mother cell, divide the big and little ones between them when both are present, or they lack them altogether when they are absent from the somatic cells of the species. Thus it comes about that on fertilisation, on the average, half the offspring possesses, and half are destitute of, the large chromosome. Stevens correlates these remarkable nuclear characters with the differentiation of sex, but exercises a judicious restraint in forcing his conclusions. The paper contains full details, and should be consulted by those interested in these matters.

AT the annual meeting of the American Antiquarian Society on October 24, 1906, Dr. A. Lawrence Rotch read a paper entitled "Did Benjamin Franklin Fly his Electrical Kite before he Invented the Lightning Rod?" It is generally supposed that the kite experiment led to the invention of the rod, but Dr. Rotch's researches seem to show that the experiment was probably performed later than has been supposed (June, 1752), and that before then certain buildings in Philadelphia were provided with "points," probably as lightning conductors, and, further, that prior to Franklin's first account of the kite experiment he had drawn up precise directions for the erection of lightning rods. These directions were printed in "Poor Richard's (Improved) Almanac" for 1753, which was advertised in the *Pennsylvania Gazette* of October 19, 1752, as being then in the press. It is admitted that Franklin suggested the possibility of the lightning rod as early as 1750, but the directions referred to by Dr. Rotch and reprinted in his paper show that it was probably invented about a year earlier than has been supposed.

THE twenty-ninth report of the work of the Deutsche Seewarte, Hamburg, for the year 1906, shows that, in common with other national meteorological organisations, the scope of its operations is constantly increasing, with the result that some important investigations necessarily fall into arrear, *e.g.* the publication of the valuable "Daily Synoptic Weather Charts for the North Atlantic Ocean," undertaken in conjunction with the Danish Meteorological Office, which had commenced its twentieth year at the time of the issue of the Hamburg report for 1906. With regard to the necessary collection of trustworthy observations at sea, we observe that the Deutsche Seewarte received in 1906 some 1592 logs of different kinds from Imperial and mercantile vessels, containing 3627 months' observations. The observers are encouraged by the award of medals and diplomas, as well as by liberal presentation of publications. The department dealing with agricultural meteorology has greatly enlarged the area of its work, and issues special weather forecasts and charts in connection with that service. The important investigation of the upper air by means of kites and balloons is continued whenever practicable; 206 kite ascents were made in the year.

IN the *Geological Magazine* for April, Mr. G. J. Williams discusses the geological age of the Parys Mountain, Anglesey, and records a number of fossils recently discovered in shale beds opened up by the boring of a tunnel in the Mona Mine.

PROF. CHARLOTTE A. SCOTT contributes to the *Annals of Mathematics*, viii., 3, an interesting note showing how the regular polygons of five, seven, or nine sides can be constructed by determining four of their vertices as the points of intersection of a circle and a rectangular hyperbola.

IN the *Journal de Physique* for May, M. Ch. Maurain discusses the influence of torsion on magnetisation, and refers to the methods adopted in order to separate the effects of torsion from those of hysteresis. This paper may with advantage be taken in conjunction with one by K. Honda and T. Terada on the change of elastic constants of ferromagnetics, published in the Journal of the College of Science (Tokyo), vol. xxi., art. 4.

AN interesting paper on the genesis of mathematics is contributed by M. Jules Sageret to the *Revue scientifique* (vii., 19). The author gives a detailed account of Rouse Ball's observations on the Rhind papyrus, and refers to Tannery's conclusions regarding the work of the geometrical schools of Thales and Pythagoras. He considers that mathematics originated out of an empiricism which might have attained a high stage of development before any science came into existence, and that the fertile germ came from certain metaphysical ideas of imagination (shall we say intuition?) in the early ages of human thought. The genesis of mathematics differed from that of other sciences owing to the important part played in the latter by experience and observation. We can only wish that papers on the lines of M. Sageret's appeared more frequently in popular journals in Britain. They would do much to remove that unpopularity of mathematical study which arises from a too exclusive consideration of the mere examination ideal.

IN the *Psychological Bulletin* (iv., 4), Mr. David Coyle contributes a note on the inversion of the image in vision, and points out that the eye-movement theory of upright vision does not necessitate the inversion of the retinal images. In other words, an organism fitted with an eye capable of giving an upright image would execute the same eye-movements in turning its eye towards any definite object. In connection with this simple result, it might be interesting to direct attention also to the ease with

which a microscopist can pick out diatoms under a non-erecting microscope, where the eye-movements are opposite in direction to the movements of the hand, showing how readily even the eye-movement sense of direction can be reversed by habit.

AN interesting contribution to the study of the so-called "addition-compounds" is contained in a paper by L. Mascarelli and U. Ascoli in the *Gazzetta* (vol. xxxvii., 1, 125). Many aromatic nitro-compounds combine with mercuric chloride or bromide to form "salts" analogous to those obtained from the corresponding iodoxy derivatives. Most of the substances formed in this way are, however, comparatively unstable, undergoing dissociation into their constituents in presence of the ordinary solvents; none of them has a true melting point. Their formation, however, is clearly demonstrated by the manner in which the melting point of the nitro-compounds varies as the mercuric haloid is added. The salts formed with mercuric chloride are more easily obtained than those derived from mercuric bromide, whilst mercuric iodide fails to give additive compounds at all.

MESSRS. A. GALLENKAMP AND CO. have sent us a copy of their catalogue of bacteriological and hygienic apparatus. It forms a volume of 260 pages, is profusely illustrated, and every piece of apparatus likely to be of use in laboratories of bacteriology and hygiene seems to be included.

MR. EDWARD STANFORD has published a second edition of his Geological Atlas of Great Britain and Ireland, based on Reynolds's Geological Atlas, which was reviewed in NATURE on February 2, 1905 (vol. lxxi., p. 315). The new edition is, like its predecessor, preceded by descriptions of the geological structure of Great Britain and its counties and of the features observable along the principal lines of railway. Mr. H. B. Woodward, F.R.S., the editor of the atlas, has added to the new edition, however, a sketch of the geological features of Ireland, its counties, and main lines of railway, and this subject is illustrated by geological maps of the country. A full list has been appended of the figured fossils, with indications of their zoological position and range in time.

MR. ROBERT SUTTON has published a third edition of Mr. T. Charters White's handbook for beginners on "The Microscope and How to Use it." Mr. Maurice Amsler has contributed to the new edition a chapter on staining bacteria, and the author has added a chapter on the marine aquarium as a field for microscopical research. The price of the new issue is 3*s*. net.

A CLASSIFIED list of publications of the Smithsonian Institution available for distribution as an aid to research or study has just been published by the institution. The list contains the titles of about one thousand papers, memoirs, and reports upon scientific subjects, grouped, so far as possible, according to the system of the International Catalogue of Scientific Literature, and arranged in each group alphabetically according to names of authors. Many of the papers can be obtained upon application by investigators interested in the subjects with which they deal, and others can be purchased at a nominal price from the Smithsonian Institution, Washington, D.C., U.S.A.

ANOTHER new edition—the fifth—of Mr. R. Kearton's "Wild Life at Home" has been published by Messrs. Cassell and Co., Ltd. The increasing popularity of what Mr. Kearton aptly calls "this new and bloodless form of sport" is a hopeful sign, as likely to lead to an increase of knowledge of the natural surroundings of living animals and their characteristics in the wild state. Mr. Cherry Kearton's photographs are both remarkable and artistic, and some of them provide abundant evidence that the peaceful sportsman need not lack the excitement which comes from danger to life and limb. The hints given how to study and photograph wild life should prove invaluable to naturalists beginning work in this direction.

OUR ASTRONOMICAL COLUMN.

A NEW COMET.—A telegram from Kiel announces the discovery of a thirteenth-magnitude comet by Prof. Giacobini, at Nice, on June 1.

The comet's position at 10h. 54·7m. (Nice M.T.) was

R.A. = 10h. 14m. 19·7s., dec. = +24° 4′ 41″,

very near to ζ Leonis.

The daily movement is given as +1° 10′ in R.A. and −36′ in declination.

SEARCH-EPHEMERIS FOR COMET 1900 III. (GIACOBINI).—A continuation of Herr Scharbe's ephemerides for comet 1900 III., during the apparition of 1907, is given in No. 4177 (p. 11, May 18) of the *Astronomische Nachrichten*.

These ephemerides give the positions, for every eighth day, from May 24 to July 27, for ten different values of the comet's daily movement, the normal argument being that perihelion will be passed on June 8.

COMET 1905 IV.—A further instalment of the ephemeris for comet 1905 IV. is given by Prof. Weiss in No. 4177 (p. 12, May 18) of the *Astronomische Nachrichten*.

This comet has been under observation for nearly 2½ years, and is now so faint (mag. = 14·0 approx.) that it will only be observed with the largest instruments. The present ephemeris gives the position of the comet at 12h. (M.T. Berlin) for 1907·0, and extends from June 1 to August 12.

DISCOVERY OF A SECOND ASTEROID NEAR JUPITER.—An investigation of the orbit of the minor planet 1907 XM, which was discovered by Dr. Kopff at Heidelberg on February 10, has been carried out by Dr. E. Strömgren, and has led to the interesting result that this asteroid is similar to (588) [1906 T.G.] in that its abnormally great aphelion distance lies in the immediate neighbourhood of Jupiter's orbit. The elements, derived from observations made on February 10, March 11 and 21, and April 12 and 16, are as follows:—

Epoch 1907 *February* 10·0 (*M.T. Berlin*).

M = 335° 47′ 12″·3		$\phi = 2° 8′ 23″·6$
∞ = 183 51 51·9		$\mu = 292″·584$
Ω = 341 58 21·9	1907·0	log $a = 0·722504$
i = 18 7 16·9		

From the above it is seen that the length of the semi-major axis of this planet's orbit is roughly 5·28 astronomical units, that of Jupiter being 5·20.

This discovery of a second asteroid near Jupiter raises the question as to whether we are just discovering a hitherto unknown group of minor planets which for ages has been retained by the major planet in the neighbourhood of his orbit, or are dealing with the harbingers of an extension of the system of minor planets. The importance of answering this question is a further justification for vigorously prosecuting the apparently endless business of asteroid discovery (*Astronomische Nachrichten*, No. 4177, p. 13, May 18).

THE ECLIPSE OF JANUARY 14, 1907.—The official report of M. Milan Stefánik's expedition to Ura-Tjnbe (Russian Turkestan) to observe the total eclipse of the sun which took place on January 14 is published in the *Comptes rendus* for May 13. His intended observations—like those of MM. Belopolsky, Hansky, and Wittram, who occupied the same station—were prevented by a snowstorm, which commenced on the eve of the eclipse and continued without interruption until the evening of January 15. The crescent sun was glimpsed but once, at twelve minutes before third contact. At the time of totality the darkness was not profound, the earth and sky being of a purplish-blue tint. The passage of the moon's shadow on the lower layer of cloud was plainly visible.

PROGRESS IN REGIONAL GEOLOGY.

AMONG recent publications in the *Verhandlungen der k.k. geologischen Reichsanstalt* for 1906, it is fair to note that Prof. Hörnes and Dr. Franz Heritsch have replied to Vice-director Vacek's onslaught, the tone of which we regretted in a previous article. The stratigraphy of the picturesque basin of Graz thus receives further explanation (p. 305). Herr Gejza v. Bukowski (*ibid.*, pp. 337, 369, and 397) reports his work in the far south of Dalmatia. Among other points, he notes that the Eocene Flysch changes its lithological character according to that of the rocks on which it lies. Dr. E. Römer's discussion of what he styles "fossil dunes" (*ibid.*, 1907, p. 48) has a wide interest for students of the great European lowlands. The author urges that the post-Glacial valleys, which are cut in the deposits left on the withdrawal of the ice, have exercised a controlling action on the formation and origin of the dunes. Evidences of formerly prevailing east winds, and, later, of our present westerly winds, are clear to him, as to previous observers; but he connects the direction of the dunes with that of the river-valleys, into which the winds blew at right angles to the valley-sides. His studies in Galicia, round the head-waters of the Vistula and the Bug, assure him that the typical barchan, the dune with concave front and outstretched wings, is a phenomenon of deserts, and is constantly in a state of change. The European dune, now often surrounded with peat and itself grown over, is a stable product connected with a climate of steppes, not deserts. Dr. Römer (p. 53) observes how Neolithic settlements were established in the shelter of the dunes, indicating a wetter climate, following on that of the east winds and the steppes. Then a return of the steppe-climate led to the formation of sandbanks over the hearths and dwelling-places; and, finally, our present moister climate has restored the boglands and promoted the growth of trees. Anyone who has seen the winds in Poland laying bare the roots on the outskirts of a clump of pines will realise how easily the present balance may be disturbed, and how a slight meteorological change may allow the dunes again to grow.

In a paper on the Gosau beds of the lower valley of the Enns (*ibid.*, 1907, p. 55), Herr G. Geyer incidentally refers to the occurrence of red pisolitic bauxite in the base of the Cretaceous strata, at the unconformable junction with Triassic dolomite below. Two analyses are given, both with 25 per cent. of ferric oxide and about 50 per cent. of alumina.

The *Tenth Annual Report of the Geological Commission* (for 1905, published in 1906) reaches us from the Cape of Good Hope. Through Prof. Schwarz's appointment to a chair at Grahamstown, the staff of the survey has been reduced to two; but the director, Mr. A. W. Rogers, feels that the grant for travelling is not large enough for the requirements of three officers in the field. A pleasant reference is made to the geological tour of members of the British Association, which Mr. Rogers organised with such conspicuous energy and tact. The director contributes an account of a survey of parts of Uitenhage and Alexandria, with preliminary lists of fossils from the Cretaceous strata. Prof. Schwarz describes the coastal plateau south of the Outeniqua and Long Kloof Mountains, the latter rising to some 5000 feet, and the plateau or large shelf lying at 700 feet, bounded by a bold cliff towards the sea. Prof. Schwarz (p. 82) now regards this shelf as a continental ledge cut by the sea, and subsequently elevated. Mr. du Toit gives, in a paper on the Indwe coal area, a striking plan and section of a dolerite sheet undulating among horizontal beds of sandstone over about 2000 square miles of country. The part played by these intrusive basic rocks in the structure of hill-masses in South Africa is well seen in his other sections. Mr. Rogers revises some of Stow's conclusions in a paper on Hay and Prieska, north of the Orange River. Mineralogists will appreciate his description of crocidolite and its alteration-products (pp. 157–161). An ancient glacial conglomerate is well displayed at the top of the Griqua Town series in this area, while the Permian Dwyka boulder-beds are also represented in places. As an example of the work which a pioneer survey has to undertake, it may be mentioned that the structure of 4000 square miles of country, in parts impassable through drought, had to be realised in some three months.

More familiar ground is dealt with by Prof. Schwarz (p. 261) in the Ceres and Worcester area, which is known to most dwellers in Cape Town on account of the fine rock-scenery of the coast-ranges along the railway. We wish that the Hex River Valley (pp. 277–9) and some of the adjacent splendid examples of folded strata could have been illustrated by photographs, instead of by the rough sketches employed throughout this paper and the others in the report. Certainly, sunlight and opportunity are not lacking for geological photography in South Africa, and Mr. Rogers's well-known "Geology of Cape Colony" shows how the structure of so bare and open a country lends itself to the intervention of the camera. The report, with its envelope of maps, is a record of unflagging energy; and we have since received sheets 4 (1906) and 2 and 45 (1907) of the colour-printed geological map of the Colony of the Cape of Good Hope, on the scale of 3·8 miles to the inch. The topography is, of course, broadly set down, without representation of the surface-relief; but descriptions of the type of country are written across each distinctive area on sheet 45, and probably this practice will be continued. Sheet 4 includes the Great Berg River from Wellington to its alluvial area in St. Helena Bay, and the Breede River and Hex River on the east side of the watershed, where they cross the strike of the coast ranges in ravines of sandstone that remind one oddly of the limestone *cluses* among the Juras. The synclinal infolds of the Devonian strata are well indicated in the south-east of the map.

In the *Records of the Geological Survey of India*, vol. xxxiv., part iii. (1906), it is pleasant to note a paper by Mr. R. D. Oldham on explosion craters in the Lower Chindwin district, Burma (p. 137). These crater-pits are often occupied by lakes, since they have been excavated by explosive action to a lower level than that of the permanent saturation of the country. They show no sign of heat or of normal eruptions of ash, although they occur in a region of volcanic action. In accepting Mr. Oldham's explanation, we are reminded of the hydrothermal theory of the South African diamond-pipes, and of the trifling amount of contact-alteration on their margins.

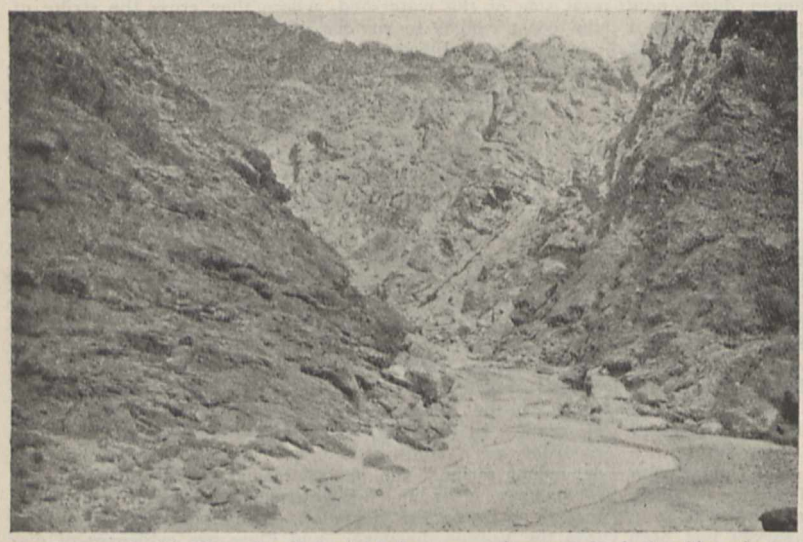
In the same part (p. 172), Mr. Vredenburg discusses the "Tertiary system" in Sind, with references to his previous paper on the Foraminifera as zonal guides in this group of strata. In the field, he finds that the group, previously regarded as a continuous one, "includes five totally independent series," the unconformities between them being fortunately clear in Baluchistan. The basal series is thrown back to the Senonian, the supposed passage-beds into the Eocene disappear, and there are evidences of disturbance at the top of the Eocene and in Middle Miocene and Pliocene times. In Sind, layers of laterite, formed on low-lying continental surfaces (p. 179), represent the stratigraphical breaks. The amended classification leads to a re-examination of the Echinoidea described by Duncan and Sladen in 1882–6, and Mr. Vredenburg is able to separate faunas formerly, and somewhat naturally, confused. The stratigraphical breaks become all the more emphasised by this revision of the genera and species. The paper has thus a considerable additional interest for students of fossil Echinodermata.

Going further east, Herr Georg Boehm adds considerably to his previous exploration of Jurassic strata from Celebes to New Guinea ("Neues aus dem Indo-Australischen Archipel," *Neues Jahrbuch für Min.*, &c., Beilageband xxii., 1906, p. 385). In Buru, contemporaneous volcanic ashes are found containing ammonites and belemnites (p. 399). The occurrence of European species in the Far East is regarded as surprising, but is paralleled, as the author points out, by facts in animal distribution at the present day. *Argonauta argo* and *Octopus vulgaris* are cited as examples.

The *Geological Survey of New Zealand* forwards to us Bulletin No. 2, a quarto on the "Geology of the Alexandra Sheet, Central Otago Division," by Prof. James Park, of the University of Otago. The region is a mountainous one in the South Island, and is of importance in the production of gold. The possibility of the alluvial gold having

been derived from folia of quartz in the old mica-schists, a view quoted (p. 33) with hesitation from Mr. A. McKay, reminds us of the problems of the Klondike. The uptilted lacustrine gravels, on which the Pleistocene moraines rest unconformably, are regarded provisionally as Pliocene, but raise an interesting stratigraphical question. The photographic illustrations, one of which we reproduce, are admirable, and may be commended to the notice of the authorities who hold the public purse at Cape Town. The petrographic section, where the rocks are described from the point of view of the laboratory, includes analyses of several of the schists, and photographs of rock-slices on the unnecessarily liberal scale adopted in the first bulletin of this survey.

The *Summary Report of the Geological Survey Department of Canada* for 1906, which bears two dates on its title-page, 1906 and 1907, informs us that the survey has decided to send its maps and reports "free to any *bona fide* applicant in Canada." This surpasses even the generosity of the United States Survey, which still, we believe, places a price upon its maps. The colour-printed sheets of part of Nova Scotia, surveyed by Mr. Hugh Fletcher, and sent us with the report, are as large as those for which we charge eightéenpence in England. Of course the topography shows far less detail, but the scale is, like ours, one inch to one mile, and the sheets have the price of 10 cents printed on them. We gather, however, on the other hand, that the sums paid in Canada to the junior members of the staff are not at all adequate, considering the competition with mining companies, which draw away the best geologists. The same difficulty has been met in India (Circular of the Department of Commerce and Industry, September 7, 1906) by a courageous increase in the salaries of the official geologists. The Canadian Survey spreads its operations over an enormous field, the areas examined being largely determined by the economic requirements of the year. The routes of projected railways naturally receive attention. This is Mr. A. P. Low's first annual report.



The Manuherikia River, New Zealand, forming a gorge along fault rifts in the schist series.

We fancy that Mr. G. R. Mansfield's paper on the Roxbury conglomerate near Boston (*Bull. Mus. Comp. Zoology at Harvard*, vol. xlix., 1906, pp. 91–272) would not have been a third as long had it not been presented as a thesis for a degree. Pages 105–151 contain a disquisition on conglomerates in general, according to the custom of American geologists when introducing a special subject in a literary form. The conclusions on p. 259 make us wonder whether the Roxbury conglomerate was worth describing at all; but this is probably because our sense of irritation, in this busy world, inclines to make us unfair to an obviously accurate observer.

G. A. J. C.

THE FEDERAL CONFERENCE ON EDUCATION.

IT is often made evident that the Government in this country leaves very important matters to be initiated and even carried on by private enterprise. Those who do not already know, will hardly be surprised to learn that the Federal Conference on Education, which was opened by Lord Crewe on May 24 in Caxton Hall, was organised by an independent society, the League of the Empire, and the League may well be proud, for it is understood that the next conference, which will be held in 1911, will be convened by the Government.

The business of the conference was divided as follows:—There were first of all the meetings of the representatives of colonial and Indian education departments and their committees. These took place behind closed doors, and were attended by the officials of the English, Welsh, Scotch, and Irish Boards. This official conference discussed a number of important matters, and we give some of the results of their deliberations. For instance, they decided that at present, owing to the way in which certificates are awarded and various local conditions, it is impossible to arrive at any complete recognition of the teachers' certificates issued by different educational bodies in different parts of the Empire. The desirability was recognised of teachers and inspectors acquiring experience in other parts of His Majesty's dominions than their own, and the conference thought that financial and administrative arrangements should be made to enable this to take place.

While it was not deemed desirable to attempt uniformity as to curricula and text-books, it was urged that the different education departments should define year by year with precision the terms used in their publications. Other important conclusions expressed were that a conference of representatives chosen by the Governments should be held every four years, and that the Imperial Government should summon the first. Furthermore, the present conference was unanimously agreed as to the importance of a central bureau of educational information.

The next series of meetings to be considered are those of the full conference, consisting of the representatives already mentioned and delegates from universities and associations. On Monday, May 27, Lord Reay presided, and higher technological education was considered, and various speakers, including Prof. Hopkinson (of Cambridge), Dr. Headlam (Principal of King's College, London), Dr. Bodington (Vice-Chancellor of the University of Leeds), and Dr. G. R. Parkin (University of New Brunswick), urged that technical training should go on side by side with the study of classics, poetry, and philosophy. Afterwards the following resolution, proposed by Dr. Clay, was unanimously agreed to:—

"That it is desirable that the Colonial Office and the Board of Education should cooperate in issuing officially, particulars as to the courses of study, fees, expenses of living, &c., at colonial universities, technical colleges and agricultural colleges, together with statements of the advantages attaching to their degrees and diplomas, and that information should be circulated in the colonies as to similar advantages and facilities which exist in this country."

On the following day, Mr. Inch (Superintendent of Education, New Brunswick) took the chair, and Mr. C. W. Bailey (Liverpool University) supported the idea that freedom should be given to each individual school, while Dr. H. J. Spencer (Headmasters' Association) pointed out with regard to the suggestion that each school should shape its own curriculum according to the needs of its pupils that there were several types of a good general education, any one of which might be chosen.

On Wednesday, May 29, under the presidency of the Vice-Chancellor of Cambridge University, two topics were discussed; first, the advisability of various educational bodies recognising each other's certificates of admission was generally agreed upon, and afterwards the question of cooperation between the old boys' associations throughout the Empire was discussed. Dr. Gow (Headmaster of Westminster) spoke of the difficulties of organising permanent associations of old boys of English public schools who go to the colonies, while Mr. L. A. Adamson (Victoria Secondary Schools' Association) made the following suggestions:—(1) that it is desirable to form a union of the great boys' schools of the Empire; (2) that this will best be done through their "old boys'" associations; (3) that the League of the Empire be asked to act as the organising centre.

At the open meeting on May 27, Sir Philip Magnus presided, and Sir Horace Plunkett gave an address on agricultural education in which he traced the work that had been going on in Ireland, and said that the problem of rural life was to be solved mainly by education, general and technical. During the discussion, Lord Monteagle pointed out that the farmer should be taught to appreciate technical instruction by practical demonstrations, and that the interest of the children should be awakened by nature-study.

Lord Elgin took the chair at a similar meeting on May 28, when the connection between elementary and secondary schools was discussed. The chairman pointed out that it was now the boast of Scotland that the path was open from the parish school to the university, and he thought that Scotland had done a great deal to bring about what is required. Several representatives from the colonies described in some detail the state of affairs in their own countries.

Meetings were arranged by the three standing sections of the League and other sections which were constituted for the occasion. The following is a list of sections with their chairmen:—History, Prof. Bury; nature-study, Sir John Cockburn, K.C.M.G.; museums, Lieut.-Colonel Plunkett; universities, Sir Arthur Rücker; technical, Sir Philip Magnus, M.P.; teaching of English, Prof. Saintsbury; training of teachers, Canon G. C. Bell.

Such a large number of papers were read in the various sections that it is impossible to summarise or even enumerate them here. In the technical education section many important aspects of the subject were dealt with in a series of special papers, which included the questions of training and research, both in this country and in the colonies.

The museums' section was chiefly occupied in passing the following useful resolutions:—

(1) "That the formation of school collections illustrative of science or art is a valuable aid to education" (proposed by Dr. R. F. Scharff).

(2) "That when school collections are made to illustrate natural history or other branches of knowledge, arrangements for the exchange of such collections between various parts of the Empire will assist the objects for which the League is instituted" (proposed by Dr. Chalmers Mitchell).

(3) "That teachers and others should discourage the making of such collections as might tend to the extermination of rare plants or animals, and should assist in preserving such objects by fostering a knowledge and love of nature" (proposed by Sir Harry Johnston, G.C.M.G.).

(4) "That this conference recognises the value of arrangements for the circulation of museum objects, as organised at the Victoria and Albert Museum, South Kensington, and at the Dublin Museum of Science and Art, at Sheffield Museum, and elsewhere, and warmly advocates an extension and development of the system" (proposed by Prof. Kidd).

(5) "That this conference recommends the organisation of a permanent collection of objects specially interesting and useful to those engaged in educational work, in connection with one of the great museums in London. That such a collection should include typical school museums and the outlines of a local educational museum" (proposed by Mr. John Maclaughlan).

In the nature-study section the following resolutions were carried:—

(1) "As nature-study gives that wide knowledge of the world and its products which is required throughout life, it should be inculcated at all stages of sound general education, and this section recommends its earnest encouragement in the home, in the school, and in the outside world. Furthermore, this section trusts that the education authorities of the Empire will endeavour to extend and encourage knowledge self-gained from original observations, as a vitalising factor in the progress to full intellectual efficiency" (proposed by Mr. T. R. Ablett).

(2) "That the supply of teachers acquainted with true methods of nature-study being the greatest present requirement, special efforts be made to provide facilities for the proper preparation for the work, of students and teachers in training" (proposed by Miss Rees George).

The museum section arranged exhibits consisting of a large series of travelling cases from Dublin Museum, and one of the cases illustrating the structure of birds now being arranged in the Lawson Memorial Wing of Eton College Museum.

In connection with the nature-study section were a number of exhibits illustrating the main phases of nature-study in this country, including the work of the Royal Drawing Society. The hon. secretary of the section on May 27 gave a lantern lecture entitled "Illustrations of Nature-study."

A large series of photographs was sent by the Government of New Zealand illustrating its educational work, and a very large number of publishers and makers of apparatus exhibited in the trade section.

Mr. S. H. Butcher, M.P., acted as chairman of the official conference, and Mrs. Ord Marshall as honorary secretary.

THE BIOLOGY OF THE COLORADO BEETLE AND ITS ALLIES.[1]

DR. TOWER, who is already well known as the author of a careful monograph on the development of colour in insects, has set forth in this bulky volume the results of his prolonged researches into the life-histories and interrelations of a group of plant-feeding beetles, one species of which is celebrated as a dreaded potato pest. The work certainly bears ample witness to the patience and ingenuity of this observer, who is one of that ever-increasing school of zoologists holding the view that further light can be thrown on the mysterious problem of evolution mainly by observation of and experiments on the living animal.

The first chapter treats of the geographical distribution of the genus Leptinotarsa; southern Mexico is regarded as the centre of origin of the group, whence it has spread southwards to the Isthmus of Panama and northwards to the United States. Much interesting information and speculation on the dispersal of the Colorado beetle *L. decemlineata* is supplied. Spanish caravans and wandering herds of bison are regarded as the agencies whereby the hooked and spined seed-pods of *Solanum rostratum*, the characteristic food-plant of Leptinotarsa, were transported from Mexico to Texas, Arizona, and the eastern slope of the Rocky Mountains; the insects followed in the track of their food-plant, and became established in these areas. The westward advance of civilisation in the middle of the nineteenth century brought with it the cultivated potato, which proved a most acceptable food to the beetles; all obstacles to the eastward extension of this destructive insect were now removed; in 1872 it had reached the Atlantic sea-board, and in less than fifty years it was generally distributed over the United States and southern Canada.

In chapter ii. the variation of colour patterns and structural characters is examined both qualitatively and quantitatively. The nature of the material not lending itself to minutely accurate measurements, the author has evolved a highly complicated series of formulæ which express succinctly forms of coloration on different parts of the body; these formulæ are "seriated into classes," and the percentage of individuals possessing given colour-formulæ

[1] "An Investigation of Evolution in Chrysomelid Beetles of the Genus Leptinotarsa." By William Lawrence Tower. Pp. x+320; illustrated. (Washington, D.C.: Carnegie Institution of Washington, 1906.)

is recorded. The author proves to his own satisfaction "that the highly complicated methods of biometry are no more reliable in their results as far as this material is concerned than other methods far less cumbersome and slavish." The nature of coloration and its ontogeny in the adult beetles and in the larvæ is discussed in chapter iii., and Dr. Tower adheres to his former view that colour originates from definite centres, and all patterns are merely extensions of these centres; all species start in life with an identical arrangement of colour-producing centres, which become modified, suppressed, or accentuated in different stages and in different species. Strong evidence against atavistic influences on the colour-development is adduced in the case of three species. Large numbers of specimens in all stages of growth were subjected to the most various conditions of temperature and humidity, and the conclusion is reached that like results are produced by diverse stimuli, *e.g.* any factor, such as heat, above or below the normal has the effect up to a certain point of producing increased pigmentation, beyond that point, of retarding it. The author believes that stimuli applied before the germ-cells begin to develop produce somatic variations only, which are not heritable; on the other hand, if the beetles were subjected to abnormal conditions when their germ-cells were sensitive to such stimuli, heritable variations resulted, and he attributes the inheritance of characters produced in the experiments of Weismann, Standfuss, and others to the fact that the stimuli acted on sensitive germ-cells, not on the soma. The subject is open to considerable argument, and doubtful critics may be referred to pp. 212–5 of Dr. Tower's monograph for a complete exposition of his views. Of high interest are the observations on the protective value of the gaudy coloration of these beetles. All the species have on the elytra and round the edge of the thorax, rows of glands whence exudes an oily and distasteful fluid; young fowls turned loose in a potato field, where *L. decemlineata* was common, eagerly attacked the insects at first, but soon learnt to avoid them, and subsequently could not be induced to eat them even when offered in company with edible insects. Specimens with the yellow stripes of the elytra covered with blackened shellac were given to experienced fowls, and then were readily seized, but as soon as their distasteful properties were realised they were dropped.

Limitations of space forbid a discussion of the experiments on selective and pedigree breeding, but they are of much interest and of great importance; the experiments extended over several years, but were brought to an abrupt conclusion through the carelessness of some workmen; Dr. Tower has with indomitable perseverance recommenced them, and his final conclusions will be awaited with eagerness. In the last chapter Dr. Tower confesses the faith that is in him; he will have none of the "Weismannian id-biophore-determinant hypothesis." He puts his finger on the weak spot in the theory of de Vries, and asks how mutants fare under natural conditions; his experience with Leptinotarsa shows him that they are rigorously exterminated. Variations he regards as epigenetic, not predetermined, evolution is continuous and direct, and new species have arisen in magrating races by direct response to the conditions of existence, natural selection acting as the conservator of the race by limiting the variations to a narrow range of possibilities. R. S.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Mr. T. B. Wood, university reader in agricultural chemistry, has been appointed Drapers' professor of agriculture in the University. Mr. Wood has been secretary of the Board of Agriculture since the foundation of the board, and the marked success of the agricultural department at Cambridge is in no small sense due to his energy and initiative. The professorship was vacated owing to Prof. Middleton being appointed assistant secretary to the Board of Agriculture and Fisheries. Mr. Wood is the author of many scientific and practical papers on agriculture, and he is co-editor of the *Journal of Agricultural Studies*.

Keith Lucas has been appointed an additional demonstrator in physiology; and F. A. Potts has been appointed assistant to the superintendent of the museum of zoology.

Demonstrations in practical physics will be given during the long vacation, commencing on Monday, July 8. The chemical laboratory of the University will be open for the use of students during the months of July and August. Notice is also given that during the month of July, Mr. Fearnsides will deliver a course of elementary lectures on "The Study of Rocks."

An examination for one "Surveyors' Institution Scholarship" will be held on July 24–27. The scholarship will be tenable for three years, and of the value of 80*l.* per annum. Candidates will be examined in (*a*) elementary chemistry and physics; (*b*) more advanced chemistry, physics, botany, and geology.

OXFORD.—In the Convocation to be held on June 26, it will be proposed to confer the honorary degree of D.Sc. upon the following men of science, nominated by the Chancellor on the occasion of the Encænia following his installation:—Sir Norman Lockyer, K.C.B., F.R.S.; Sir Richard D. Powell, president of the Royal College of Physicians; Sir William Ramsay, K.C.B., F.R.S.; Sir William H. Perkin, F.R.S.; Prof. W. Watson Cheyne, C.B., F.R.S.; and Dr. Ludwig Mond, F.R.S.

THE report read at the annual meeting of the City and Guilds of London Institute on May 28 referred to the negotiations which have taken place with the Board of Education with the view of the Central Technical College of the institute being included in the scheme for the establishment of the Imperial College of Science and Technology at South Kensington. The draft provisions dealing with the purpose and scope of the new institution, and the manner in which the Central Technical College will be associated with the scheme, have been approved by the executive committee.

As was explained in an article in NATURE of May 16 (p. 56), the new Imperial College of Science and Technology is shortly to be incorporated in accordance with a charter which is to be considered immediately by a committee of the Privy Council. The suggested charter provides for the continuance of the Royal School of Mines and of the diploma of Associate of the Royal School of Mines, and the Central Technical College is to retain its individuality and to continue to exercise its privilege of awarding its diplomas of associate and fellow. A question was asked in the House of Commons on May 30 whether, under the proposed charter, it is intended also to retain the title and associateship of the Royal College of Science. The President of the Board of Education replied that the new governing body when established will consider the question and decide whether it is expedient to continue the name Royal College of Science and its diploma, and to secure to present associates of the college their existing privileges.

THE Imperial Department of Agriculture for the West Indies has established agricultural schools at St. Vincent, Dominica, and St. Lucia, and the result has been to provide a good practical training in agricultural science to a selected number of boys. Instruction is given in the theory and practice of agriculture and in agricultural botany and chemistry, in addition to the subjects of an ordinary education. Each boy receives daily training in raising the crops under cultivation and in the care of live-stock. At each school a portion of the land is divided into experimental plots for testing varieties of different plants, the introduction of new plants of economic importance, and methods of controlling insect pests and fungoid diseases by insecticides and fungicides. Besides these facilities, the *Agricultural News* of Barbados reports that rabbit breeding is taken up, and pure-bred Belgian hares have been introduced in order to improve the local stock. Poultry raising also receives attention, and now, by the use of incubators, a good supply of well-bred chickens is available for disposal throughout the different islands. The pupils become acquainted with all the details of work in the field before the theoretical knowledge of science necessary for keeping abreast with agricultural progress is learned. It has been found that the blending of practical

experience with theoretical knowledge is the most desirable method of producing young men qualified to take up responsible positions.

THE first annual conference of the Association of Teachers in Technical Institutions was held at the University of Leeds on May 22 and 23. The president, Mr. V. A. Mundella, of the Northern Polytechnic Institute, London, occupied the chair, and about one hundred delegates were present. Mr. Graham, secretary for higher education in Leeds, said that one of the great difficulties from an educational point of view, especially where it is wished to give students an all-round view of their particular calling, is that of the technical teacher teaching a bread-and-butter subject. If teachers could be convinced that it is absolutely necessary that the pupils should understand the scientific principles underlying that subject and get an all-round view of their particular trade, and not one particular little picture of it, a very great service would be done to technical education. In his presidential address, Mr. Mundella directed attention to the great leakage represented by the passing outside the pale of educational effort of children beyond the age of twelve, and he urged that up to the age of seventeen secondary education, widely diversified to meet local conditions, the standing of pupils, and the wishes of parents, should be made compulsory. There would thus be a perfectly natural development of the child. Scholarships, he said, do not meet the requirements, and grammar schools and public schools have no effect on the problem of secondary education, which is the provision of suitable schools for the 600,000 children who leave the present elementary schools. The examination system for scholarships is fundamentally wrong, besides being very expensive. It works out for the whole country at about 20*l.* per scholar on the average, a sum almost twice as great as would maintain the child in a provided secondary school belonging to the local authority. Mr. H. A. Clark, head of the engineering department of the Northern Polytechnic Institute, read a paper entitled "Notes of an Educational Visit to the United States." He referred to the brotherly feeling between English and American men of science, and described his journey through the States and the various institutions visited. Mr. Barker North, chairman of the West Yorkshire branch of the association, read a paper on the preliminary training of technical students. He condemned the preliminary training of students entering technical colleges as very inefficient, this being in the main due to the desire of educational committees to secure large classes, paying inadequate attention to the training of the students, and unmindful of the fact that it was better to produce six highly-trained men than six dozen inefficiently trained. A paper by Mr. J. Fitzgerald, of the South-Western Polytechnic Institute, and Mr. E. L. Bates, of the London County Council School of Building, Brixton, on syllabus and examinations as applied to building subjects, was read by Mr. Bates. At the outset Mr. Bates referred to the impossibility of one individual becoming proficient in more than one craft. He also dealt with the best course of technical instruction for the craftsman and the general foreman. Several discussions of an instructive kind followed the reading of papers.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society. February 14.—"On the Specific Inductive Capacity of a Sample of Highly Purified Selenion." By O. U. **Vonwiller** and W. H. **Mason.** Communicated by Prof. Threlfall, F.R.S.

The paper contains an account of the application of methods of measurement described by Pollock and Vonwiller (*Phil. Mag.*, June, 1902) to the determination of the specific inductive capacity of selenion. Two methods were employed, one an absolute electrometer method employing forces of a frequency of about fifty per second, and the other a resonance method employing electric oscillations of a frequency of 24 millions per second, which is believed to be more accurate than any high-frequency method hitherto employed. The selenion was cast into the form of a plate, 15 cm. diameter and 1 cm. thick, this plate being cast in such a manner as to ensure its being in the vitreous condition, after which it was ground with carborundum powder until the surfaces were flat and parallel. After each set of measurements the plate was broken up into small pieces, and the density of these pieces compared with that of the plate as a whole.

The following results were obtained:—

Density at 13°·8 C., 4·29.

Specific inductive capacity—by electrometer method, 6·13 at 16° C.; by oscillation method, 6·14 at 23°·6 C.

Specific resistance in the dark, approximate—between $2{\cdot}2\times10^{16}$ ohms at 20° C. and $6{\cdot}5\times10^{15}$ ohms at 25° C.

Resistance measurements were made in the dark, and it was noticed that the specific resistance fell considerably in the light as in the case of the conducting variety of selenion.

It was found that a thin reddish film forms on the surface of the selenion, though it is only exposed to air, and the comparatively high conductivity of this film gave considerable trouble before it was discovered.

February 28.—"The Enzymes associated with the Cyanogenetic Glucoside Phaseolunatin in Flax, Cassava, and the Lima Bean." By Prof. W. R. **Dunstan,** F.R.S., Drs. T. A. **Henry** and S. J. M. **Auld.**

The authors show there is reason to believe that these three plants, flax, cassava, and the lima bean, contain a mixture of the two glucosidolytic enzymes, emulsin and maltase.

The same authors had previously proved that the production of prussic acid from the lima bean, cassava roots, and the seeds or embryo plants of flax is due to the decomposition of the cyanogenetic glucoside, phaseolunatin (α-dextrose ether of acetone cyanohydrin), contained in each of these plants, by an enzyme which resolves this substance into acetone, dextrose, and prussic acid (Proc. Roy. Soc., 1902, lxxii., 285; 1906, lxxviii., 145; and *Ann. Chim. Phys.*, 1907 [viii.], 10, 118).

Since the mixture of enzymes obtained in the usual manner from any one of these three plants decomposes phaseolunatin and amygdalin, the characteristic glucoside of bitter almonds, whilst the enzyme which occurs with amygdalin in the almond decomposes amygdalin, but not phaseolunatin, it seemed clear that flax, cassava, and the lima bean must contain either a mixture of emulsin, with some other enzyme capable of hydrolysing phaseolunatin, or a new enzyme having the property of decomposing both glucosides.

Fischer's generalisation that the glucosidolytic enzymes so far systematically examined are divisible into two classes, the one capable of decomposing the α-alkyl ethers of the hexoses and the other the stereoisomeric β-alkyl ethers of these sugars, has rendered it possible to classify an unknown glucosidolytic enzyme by ascertaining whether it is active towards the α-alkyl ethers of the hexoses or towards the stereoisomeric ethers, and E. F. Armstrong has extended Fischer's work in this direction by showing that when the α-alkyl ethers of the hexoses are hydrolysed by enzymes of the maltase type the sugars immediately liberated are the α-forms, and that similarly the stereoisomeric β-ethers on hydrolysis by appropriate enzymes furnish the β-forms of the hexoses.

These methods have been applied to the investigation of the mixture of enzymes contained in these three plants and to the determination of the nature of the dextrose residue in phaseolunatin.

It was found that the mixture of enzymes has the property of hydrolysing amygdalin and salicin, which are both known to be β-glucosides, and similarly it decomposes α-methyl glucoside and maltase, which both have the α-structure.

Further, phaseolunatin is decomposed by yeast maltase and by the mixture of enzymes occurring with it in the three plants already named, yielding, in the first instance, the α-form of dextrose, so that it must be regarded as an α-dextrose ether of acetonecyanohydrin. Accepting Fischer's generalisation, it seems clear from these data that flax, cassava, and the lima bean contain at least two glucosido-

lytic enzymes, the one of the emulsin or β-type, the other of the maltase or α-type, and that it is the latter to which the decomposition of phaseolunatin is due, since this glucoside is derived from α-dextrose.

April 18.—"The Fermentation of Glucosides by Bacteria of the Typhoid-coli Group and the Acquisition of New Fermenting Powers by *Bacillus dysenteriae* and other Micro-organisms." Preliminary communication. By F. W. **Twort.** Communicated by Dr. Leonard Hill, F.R.S.

(1) A large number of glucosides may be fermented by many members of the typhoid-coli group of bacteria. The fermentations vary with the micro-organism tested, and the variations are as marked inside each subgroup of bacteria as between adjacent subgroups.

(2) The sugar-fermenting powers of an organism may be artificially changed by growing the said organism for a succession of generations in media containing a sugar which at the commencement of the experiment it was unable to ferment.

By this means a pathogenic organism may be altered until it gives fermentative reactions characteristic of a non-pathogenic member of its group. It is possible, indeed, that pathogenic organisms in the typhoid-coli group may so alter their characters that they become unrecognisable when growing for some time outside the body in soil, water, &c. If this is so, it might partly account for the difficulty experienced in isolating *B. typhosus* from these situations.

It also seems possible that a non-pathogenic organism may lose its fermenting powers and become pathogenic should it find a suitable medium such as the alimentary canal, and regain its old characters when outside the body. This is, however, only a suggestion, which at present is in no way proved.

In view of the results obtained with the typhoid-coli group of organisms, it seems quite possible that other organisms may show similar changes, and that the fermentation tests worked out by Mervyn Gordon for the Streptococci may also be inconstant, if the same means of experimentation are employed.

May 2.—"On the Variation of the Pressure developed during the Explosion of Cordite in Closed Vessels." By Prof. C. H. **Lees,** F.R.S., and J. E. **Petavel.**

(1) As most of the modern explosives used in ballistics follow the law of combustion by parallel surfaces, it appears from the results described that their properties may be defined by four constants, which may be determined without difficulty by direct experiment.

(2) The constants b and c (of formula 1) fix the maximum pressure which will be attained under any given charging density. The constants a_0 and a (of formulæ 4 and 9) measure the rate of combustion and determine the time which elapses between the ignition of the charge and the development of the maximum pressure.

(3) When the explosive is made up in a cylindrical form, the time occupied by an explosion for the same gravimetric density is proportional to the diameter of the cylinder.

(4) The rate of increase of the pressure is most rapid when about two-thirds of the maximum pressure has been attained.

(5) The maximum rate of rise of pressure per second is equal approximately to $1{\cdot}54a$ into the square of the maximum pressure in atmospheres divided by the diameter of the cordite in centimetres.

(6) When the explosion is fired under a high gravimetric density, the "effective" time of combustion may for practical purposes be taken as equal to the time required if the combustion proceeded always at its maximum rate.

For cordite Mark I. this time is given by $T=36\,D/P$ if the diameter D is measured in centimetres and the maximum pressure P in atmospheres, or $T=0{\cdot}6\,D/P$ if the units are inches and tons per square inch.

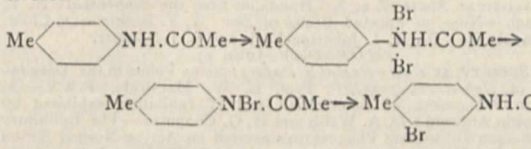
Throughout the above investigation the cooling effect of the walls of the containing vessel during the combustion was taken as small enough to be neglected.

Challenger Society, May 3.—Mr. L. W. Byrne in the chair.—Mr. **Byrne** exhibited and made remarks upon rare deep-water fish of the N.E. Atlantic obtained from various sources.—Dr. **Fowler** exhibited a new horizontal closing tow-net which he had designed for use at different depths down to about 100 fathoms, pointing out that recent work had shown the necessity for a more precise knowledge of the depth at which an organism was captured in the upper zones than was furnished by the ordinary method of open tow-nets of the common surface pattern.—Dr. **Fowler** also exhibited a new "constant resistance" net, designed to avoid damage to delicate organisms collected for morphological or embryological study; it was so arranged that the area of the mouth automatically diminishes in proportion as the resistance (pace) increases.

Royal Meteorological Society, May 15.—Dr. H. R. Mill, president, in the chair.—The standard rain gauge, with notes on other forms: Dr. **Mill.** When the late Mr. Symons founded the British Rainfall Organisation forty-seven years ago, such observations as were being carried on were made with rain gauges of the most varied patterns, set up at any height from the ground that suggested itself to the observer, and read irregularly at almost any hour of the day or night. Since that time there has been a steady approximation to uniformity, and now the greater number of rain gauges in use are of a few definite patterns, set, for the most part, at nearly the same height above the ground. Dr. Mill strongly recommends the Snowdon pattern rain gauge, which is 5 inches in diameter, has a vertical rim to the funnel of 4 inches, and has an inner can and also a bottle. He does not recommend rain gauges with shallow funnels, nor the Howard and Glaisher patterns.—Account of a captive balloon being struck by lightning at Farnborough during a thunderstorm on April 11: Colonel J. E. **Capper.** The lightning flash appeared to travel along the wire until it reached the wagon; then a sudden bright light appeared and ran right up the wire into the clouds in which the balloon was hidden. The wire was fused, being burnt entirely away where it first touched the iron pulleys which guide the wire when running out. One side of the balloon and net was burnt, probably owing to the hydrogen catching fire, but the other side was uninjured.—A remarkable excavation made by lightning in peat earth on August 2 or 3, 1906, in a moorland district of Northumberland: Prof. A. **Herschel.**—Apparatus for measuring fog densities: J. W. **Lovibond.**

Chemical Society, May 16.—Prof. R. Meldola, F.R.S., past-president, in the chair.—The relation between the crystalline form and the chemical constitution of simple inorganic substances: W. **Barlow** and W. J. **Pope.** Close packed, homogeneous assemblages made up of two or more kinds of spheres of nearly the same size must approximate in marshalling to holohedral cubic symmetry or holohedral hexagonal symmetry with the axial ratio $a:c=1:0{\cdot}8165$. All the known crystalline forms exhibited by the elements can be interpreted in the light of the above geometrical principles, which also explain how binary compounds composed of two elements of the same valency crystallise in the cubic system and how silver iodide crystallises in the hexagonal system. The axial ratios of CsI_3 and RbI_3 are also in accordance with the geometrical principles stated above.—Experimental investigation into the process of dyeing: J. **Hübner.** It is shown that the absorption of dyes by cotton and wool is similar in many points to the absorption of these colours by inorganic materials such as graphite and charcoal, and hence it is deduced that dyeing is a purely physical phenomenon.—Esterification constants of substituted-acrylic acids, part ii.: J. J. **Sudborough** and E. R. **Thomas.** The results illustrate the retarding effect which a double bond in the αβ position has on the velocity of esterification.—The addition of bromine to the α- and β-chloro- and bromo-cinnamic acids and their methyl esters: J. J. **Sudborough** and G. **Williams.**—The addition of bromine to unsaturated compounds, part i.: J. J. **Sudborough** and J. **Thomas.**—Separation of cadmium from zinc as sulphide in the presence of trichloroacetic acid: J. J. **Fox.** For the complete separation of cadmium and zinc by this means two precipitations are desirable, but this is unnecessary when the proportions of cadmium and zinc are about equal, or when cadmium is present in excess.—The mechanism of bromination of acylamino-compounds. Preliminary notice: J. B. **Cohen** and W. E. **Cross.** In the ordinary process of brominating acylamino-

compounds in acetic acid solution, the crystalline product, which is first formed, yields, on pouring it into water, the nuclear brominated compound. This intermediate compound has been isolated in the case of aceto-*p*-toluidide. The following provisional explanation of the action is offered :—



—Mixed semi-ortho-oxalic compounds : G. D. **Lander.** The amide chlorides of methyl and ethyl oxanilates are stable below 100°. On decomposition by heat they pass, by loss of hydrogen chloride, into the imide chlorides, which are further resolved into alkyl chloride, carbon monoxide, and phenylcyanate.—Some derivatives of γ-pyranol allied to certain derivatives of brazilein and hæmatein. Preliminary communication : W. H. **Perkin,** jun., and R. **Robinson.** *o*-Hydroxybenzaldehyde and its derivatives condense with certain acetophenone or hydrindone derivatives to form derivatives of γ-pyranol. Thus β-resorcylaldehyde and acetophenone condense readily in presence of hydrogen chloride to give 7-hydroxy-2-phenyl-1 : 4-benzopyranol hydrochloride. With 1-hydrindone, 7-hydroxy-2 : 3-indeno-1 : 4-benzopyranol hydrochloride is formed. β-Resorcylaldehyde and 5 : 6-dimethoxy-1-hydrindone are condensed by hydrogen chloride in methyl-alcoholic solution to give 7-hydroxy-5 : 6-dimethoxy-2 : 3-indeno-1 : 4-benzopyranol hydrochloride. The substances thus produced may also be obtained by the action of alcoholic hydrochloric acid on the *o*-hydroxybenzylidene-1-hydrindones, and, conversely, the latter are again produced from the pyranols by the action of alcoholic potash.—Arsenic di-oxide : J. T. **Hewitt** and T. F. **Winmill.** The authors have examined Bamberger and Philipp's arsenic di-iodide, and find that it has the formula As_2I_4. Pyridine decomposes it immediately, liberating arsenic.—The formation and reactions of imino-compounds, part iv., the formation of 1 : 4-naphthylenediamine from ethyl γ-imino-α-cyano-γ-phenylbutyrate : J. F. **Thorpe.**—Mercury derivatives of pseudo-acids containing the group .CO.NH. : S. J. M. **Auld.** Unlike cyanuric acid, which forms two isomeric mercuric salts, all the pseudo-acids containing the group .CO.NH. examined have given only one derivative, in all cases an N-salt containing the group .CO.Nhg.—The influence of substitution in the nucleus on the rate of oxidation of the side-chain, iii., oxidation of the nitro- and chloronitro-derivatives of toluene : J. B. **Cohen** and H. J. **Hodsman.** —The reducibility of magnesia by carbon. Preliminary note : R. E. **Slade.** The two methods, which furnished a positive result, confirm the experiments of Lebeau, but whereas this author considers that the reduction only occurs at or above the boiling point of magnesia when the vapours come in contact, the present research seems to show that the reaction can take place at temperatures below the melting point of this oxide.—The reaction between organo-magnesium halides and nitro-compounds. Preliminary note : R. H. **Pickard** and J. **Kenyon.** Aromatic nitro-compounds react very vigorously with an organo-magnesium halide in ethereal solution.—A method for the determination of the equilibrium in aqueous solutions of amines, pseudo-acids and bases and lactones : T. S. **Moore.**—The "true" "ionisation constants" and the "hydration constants" of piperidine, ammonia, and triethylamine : T. S. **Moore.**

Institution of Mining and Metallurgy, May 16.—Prof. William Gowland, president, in the chair.—Siberian mines and mining conditions : A. L. **Simon.** A description of the mines and mining conditions more particularly in the province of Tomsk, the Ural and Orenburg districts, and the Kirghese Steppe. Beginning with a brief historical note, the paper dealt with climate, travelling conditions, the Russian system of weights and measures, mining laws and administration, the methods adopted in applying for claims, prospecting, opening out and working iron, copper and gold mines in Siberia, with details of costs and labour conditions.—Notes on a modern stamp mill : Gilmour E. **Brown.** A series of notes on various details of two stamp mills, compiled from personal experience and observation, containing figures relative to wear, cost of renewal, and the general efficiency of different component parts of the installation.—The use of zinc in assaying copper matte, &c. : Donald M. **Levy.** A description of results obtained by the employment of zinc for separating copper from the solution when assaying mattes, the copper and iron contents of which were both to be determined. The method described involves the use of only one reagent for the two operations. Figures were given of a series of comparative experiments showing the success of the method in practice. —A method of leaching gold ore tailings : R. S. **Botsford.** A brief note showing how, by slow and careful upward leaching, and continuous drawing off from below with the addition of fresh solution above the ore, a material saving was effected in the time occupied by the leaching process.

PARIS.

Academy of Sciences, May 27.—M. Henri Becquerel in the chair.—The suspended collimator of M. Schwarzschild : G. **Lippmann.** The arrangement described by the author in a recent number of the *Comptes rendus* was anticipated by M. Schwartzschild in 1904.—The flora and the relative levels of the coal borings of Meurthe-et-Moselle : R. **Zeiller.** More than 10,000 specimens of fossil imprints of plants have been obtained from these trial borings. These represent 145 species, some of which are new, and of which a detailed account is given.—The positions of the datum stars concerning the planet Eros deduced from the Toulouse negatives : B. **Baillaud.** An examination of the causes of the differences between the results of the reduction already published and those obtained from the same plates by Mr. Hinks.—The absence of polarisation of the prominences : P. **Salet.** Light from the edges of the sun and of the prominences is not polarised, and hence there is a contradiction between the theories of Schmidt and Julius and Fresnel's theory of polarisation.—Applications of a theorem of approximate convergence : Ernst **Fischer.**—The viscosity of fluids : Marcel **Brillouin.** A tentative formula for the viscosity of fluids is given and applied to the case of carbon dioxide, the viscosity of which has been studied experimentally both in the liquid and gaseous states.—A new property of gases issuing from flames : Maurice **de Broglie.** The gases from flames contain centres electrically neuter, possessing the properties of taking a charge under the influence of the radium radiation or Röntgen rays, and of being arrested by an ordinary cotton-wool filter and destroyed by heat. Gases containing these centres, after washing in dilute saline solutions, acquire a higher ionisation.—The sensibility of the electrostatic telephone : Henri **Abraham.**—Measurements of wave-lengths in the iron spectrum for the establishment of a system of spectroscopic standards : H. **Buisson** and Ch. **Fabry.** A completion of results already published by measurements in the ultra-violet.—Some double sulphites of hypovanadic acid : Gustave **Gain.** The alkaline bases possess the property of combining easily with hypovanadic acid in presence of sulphurous acid, giving well-defined double sulphites. Details are given of the compounds obtained with potassium, ammonium, rubidium, cæsium, thallium, sodium, and lithium.—Lead selenide : H. **Pélabon.** A study of the fusibility curves of mixtures of selenium and lead.—The methyl ethers of allyl and propargyl carbinols : M. **Lespieau.** A study of the action of allyl bromide and monochlormethyl ether on magnesium. The resulting mixture of di-allyl and the ether

$$CH_2{=}CH{-}CH_2{-}CH_2.O.CH_3$$

could not be separated by fractional distillation, but the separation was easily effected after converting into the bromine addition products.—A new crystallised principle from kola : M. **Goris.** Hitherto only two definite compounds, caffeine and theobromine, have been isolated from kola ; the author describes a method of treatment by means of which a third substance can be obtained, kolatine, a phenolic substance of the formula $C_8H_{10}O_4$.—The ferment of the fig (*Ficus carica*) : A. **Briot.** The coagulation of fresh milk by extract of fig is retarded or prevented by the existence in the milk of an antiferment. Heat destroys this antiferment, and hence boiled milk is more

easily coagulated than fresh milk by this ferment.—The measurement of the mechanical work furnished by oxen of the Aubrac breed: M. **Ringelmann.**—The frontal gibbosity in fishes of the genus Ptychochromis: Jacques **Pellegrin.**—The duration of the larval life of Eucyphotes: H. **Coutière.**—The results furnished by the complete realisation of the physiological conditions which should be satisfied by the respiratory apparatus to permit man staying and working without danger in irrespirable atmospheres: J. **Tissot.** The conditions necessary are laid down in the following order, from the points of view of mechanics, chemistry, security, and efficiency.—The work developed during phonation: M. **Marage.** The work is measured by VH, where V is the volume of air which escapes from the lungs in a given time, and H its pressure. The author was able to make measurements of these magnitudes in two subjects, one with an artificial larynx, the other with normal vocal cords and with a tracheal cannula. For public speaking, the study of breathing is of the first importance; more energy is expended in speaking in a low pitch than a high one.—Researches on the action of waters containing sulphur compounds in the mercurial treatment: A. **Desmoulières** and A. **Chatin.** It is now well known that syphilitic patients under mercurial treatment who are taking sulphurous waters can tolerate doses of mercury compounds four or five times as great as those permissible without the use of such waters. This tolerance has been usually attributed to the precipitation of the mercury as sulphide, an insoluble form, but according to the authors' researches this is not the case. The effect is produced by increasing the solvent power of the blood serum with respect to the mercury albuminates.—Contribution to the study of the oscillations of the coast line in the Bay of Callao: P. **Berthon.**—The volcanoes of the Logudoro and Campo d'Ozieri, Sardinia: G. **Deprat.**—The dômes of the Coal-measures in French Lorraine: J. **Bergeron.**—The exploration of the free atmosphere above the Arctic regions: M. **Hergesell.**—A new theory of anthelia, paranthelia, and the white halos of Bouguer and Helvetius: Louis **Besson.**

DIARY OF SOCIETIES.

THURSDAY, JUNE 6.

ROYAL SOCIETY, at 4.30.—On the Two Modes of Condensation of Water Vapour on Glass Surfaces, and their Analogy with James Thomson's Curve of Transition from Gas to Liquid: Prof. F. T. Trouton, F.R.S.—The Mechanical Effects of Canal Rays: A. A. Campbell Swinton.—On the Velocity of Rotation of the Electric Discharge in Gases at Low Pressures in a Radial Magnetic Field: Prof. H. A. Wilson, F.R.S., and G. H. Martyn.—The Osmotic Pressure of Compressible Solutions of any Degree of Concentration: A. W. Porter.—The Distribution of Blue and Violet Light in the Corona on August 30, 1905, as derived from Photographs taken at Kalaa-es-Senam, Tunis: Prof. L. Becker.

ROYAL INSTITUTION, at 3.—Chemical Progress—Works of Berthelot, Mendeléeff, and Moissan: Sir James Dewar, F.R.S.

LINNEAN SOCIETY, at 8.—Contributions to our Knowledge of the New Zealand Holothurians: Prof. A. Dendy and E. Hindle.—Observations on Australasian Polyclads: Prof. W. A. Haswell.—Report on the Marine Fishes collected by Mr. J. Stanley Gardiner in the Indian Ocean: C. Tate Regan.—The Lithothamnia of the *Sealark* Expedition: M. Foslie. Notes sur les Ixodidæ recueillis dans les îles de l'Océan Indien, par M. J. Stanley Gardiner: Prof. L. G. Neumann.—*Exhibitions: Orobanche Ritro* and some New Varieties of Plants from the Channel Islands: G. Claridge Druce.

CHEMICAL SOCIETY, at 8.30.—The Relation between Absorption Spectra and Chemical Constitution, Part vii., Pyridine and some of its Derivatives: F. Baker and E. C. C. Baly.—The Interaction of Methylene Chloride and the Sodium Derivative of Ethyl Malonate: F. Tutin.—Molecular Weight of β-Naphthol in Solution in Solid Naphthalene: E. P. Perman and J. H. Davies.—Synthesis of Hexatriene Derivatives, Preliminary Notice: I. Smedley.—The Constitution of the Diazo-Compounds: J. C. Cain.—*p*-Cresol Sulphoxide and Sulphide: S. Smiles and T. P. Hilditch.—*p*-Dioxyphenylsulphoxide: S. Smiles and A. W. Bain.—Coloured Azo-derivatives of 1:3-Diphenylbarbituric Acid. Dynamic Isomerism among the Hydrazones of 1:3-Diphenylalloxan: M. A. Whiteley.—Dibromoaminoazobenzene: J. T. Hewitt and N. Walker.

RÖNTGEN SOCIETY, at 8.15.—Some Recent Investigations in Connection with Crookes' Tubes: A. A. Campbell Swinton.

FRIDAY, JUNE 7.

ROYAL INSTITUTION, at 9.—Studies in High Vacua and Helium at Low Temperatures: Sir James Dewar, F.R.S.

GEOLOGISTS' ASSOCIATION, at 8.—The Chalk of Surrey, Part ii., The Western Area: G. W. Young.

MALACOLOGICAL SOCIETY, at 8.—Description of a New Species of Clathurella, probably from Ceylon: H. B. Preston.—Nudibranchs from New Zealand and the Falkland Islands: Sir Charles Eliot.—Note on the Name "Bourcieria": E. R. Sykes.—Description of Two New Species of Australian Helicoids, and Note on the Presence of a Double Wall in some Species of the Diaphora Group of Ennea: H. C. Falton.

SATURDAY, JUNE 8.

ROYAL INSTITUTION, at 3.—The Contest between Guns and Armour: Sir William H. White, K.C.B., F.R.S.

MONDAY, JUNE 10.

ROYAL GEOGRAPHICAL SOCIETY, at 8.45.—Oceanic Circulation: Dr. Otto Pettersson.

TUESDAY, JUNE 11.

MINERALOGICAL SOCIETY, at 8.—Hamlinite from the Binnenthal: H. L. Bowman.—Note on Faceted Beads of Zinc: T. V. Barker.—On Chlormanganokalite: Dr. H. J. Johnston-Lavis and L. J. Spencer.

THURSDAY, JUNE 13.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Some Points in the Development of *Ophiothrix fragilis*: Prof. E. W. MacBride, F.R.S.—On Certain Phenomena of Inactivation and of Inhibition exhibited by Precipitin Antisera: D. A. Welsh and H. G. Chapman.—The Inhibitory Action upon Subsequent Phagocytosis exerted on Active Normal Serum by Inactive Normal Serum through which Bacilli have been passed: J. C. G. Ledingham.—*Miadesmia membranacea*, Bertrand; a New Palæozoic Lycopod with a Seed-like Structure: Miss M. Benson.—Observations on the Life-history of Leucocytes. Part III.: C. E. Walker.

CHEMICAL SOCIETY (Extra Meeting), at 8.30.—Discourse entitled Some Borderline Problems in Botany: Prof. J. B. Farmer, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—On Partial Differential Equations of the Second Order: Prof. A. R. Forsyth.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Improvements required in Inland Navigation: H. R. de Salis.—Bye-product Coking Plant at Clay Cross: W. B. M. Jackson.—Notes on Bye-product Coke-ovens, with Special Reference to the Koppers Oven: A. V. Kochs.—Bye-product Coke-ovens: P. Schwarz.—Water Supplies by Means of Artesian-bored Tube-wells: H. F. Broadhurst.—Gypsum in Sussex: W. J. Kemp and G. A. Lewis.—The Use of Duplicate Capell Fans: G. M. Capell.

FRIDAY, JUNE 14.

ROYAL INSTITUTION, at 9.

ROYAL ASTRONOMICAL SOCIETY, at 5.

PHYSICAL SOCIETY, at 8.

INSTITUTION OF MINING ENGINEERS, at 10.30 a.m.—The Reform of British Weights and Measures: A. Hopkinson.—The Thick Coal of Warwickshire: J. T. Browne.—Description of the Ozokerite (Mineral Wax) Mine at Boryslaw, Galicia, Austria: D. M. Chambers.—Notes on the Structural Geology of South Africa: Dr. C. Sandberg.—The New Rand Gold-field, Orange River Colony: A. R. Sawyer.—Cast-iron Tubbing: What is the Rational Formula? H. W. G. Halbaum.

CONTENTS.