THURSDAY, MAY 16, 1907.

DEVELOPMENT OF THE HUMAN EMBRYO.

Handatlas der Entwicklungsgeschichte des Menschen. By Prof. Julius Kollmann. Part i. Pp. viii+340 figures, many of them printed in several colours, with a brief explanatory text. (Jena: Gustav Fischer, 1907.) Price 13 marks.

THOSE who wish to see at a glance a truthful and graphic representation of our present knowledge concerning the conception and development of the human body will find it in this hand-atlas by Prof. Kollmann. Here is a museum rather than a book, a museum in which specimens illustrating nearly all stages of development have been judiciously collected from the best sources—many of them from the shelves of the author's own museum—and represented by all the skill of modern pictorial art, a brief description being given of each specimen to supply the place of a catalogue. Altogether, this work will contain 800 figures illustrating stages in the development of the human body.

Five-and-twenty years ago our knowledge of the human embryo, if not a complete blank, was almost a complete series of blanks. When the late Prof. His published his great monograph on the early human embryo in 1882, he was able to find accounts of only ten specimens belonging to the first month of development, these accounts being, for the greater part, imperfect descriptions of the external appearances of poorly preserved embryos. The rapid progress which has made the production of this hand-atlas possible was the result of the application of a new method by which the minute and exceedingly delicate embryo could be cut, fixed, sectionised, and accurately reconstructed on a magnified scale. The reconstructional method gave embryologists an easy means of mutual exchange; by a reconstructed model it became possible to show accurately in five minutes what had been acquired by five months of labour. The method of reconstruction by wax plates is usually ascribed to Prof. Born, but the late Prof. G. B. Howes claimed the invention for Mr. E. T. Newton, who applied it to the reconstruction of the brain of insects before 1878. This laborious method has never appealed to the English anatomist; hence we find that not one of the forty-four specimens which Prof. Kollmann uses to illustrate the stages of development in the first and second months was prepared in England; the reconstructed models of which illustrations are given were made in the laboratories of Germany, Switzerland, and America. Yet the method by which progress has been attained was first used in England; nor were human embryologists lacking in England in the early days, for when Prof. His began his great work he counted that of the late Prof. Allen Thomson amongst the best. How far we have lost preeminence in this subject may be seen from the fact that in the 340 illustrations used in the first part of this atlas, only one is the work of a British anatomist, and that is a diagram published a good many years ago by Sir William Turner, of Edinburgh.

It has always been the habit to utilise our knowledge of the developmental history of the domestic animals to fill in the blanks in the history of human development. That is now unnecessary except for the first week; Leopold's ovum represents the earliest stage of human development, and it is probably in the seventh or eighth day of growth. The fertilisation and segmentation of the human ovum have not yet been seen, but it is highly improbable that they will present any peculiar features. To supply this blank, Prof. Kollmann reproduces the excellent illustrations of the fertilisation of the mouse's ovum given by Sobotta, and those of the segmentation of the ovum of the dog and bat depicted by Bonnet and van Beneden. The author also realises the great value of comparative embryology as a key to the more obscure processes of human development, and draws freely on the work of van Wijhe, Flemming, van der Stricht, Hertwig, Froriep, Stöhr, and Schauinsland. Abnormalities of development are also illustrated.

There was a general expectation that a complete knowledge of the phases of embryonic development would give a key to the origin and past history of man. That expectation has not been fulfilled. If to some extent developmental phases do recapitulate certain generalised stages of evolution, yet so blurred are they, so much are they modified by the conditions of fœtal growth, that they give us no certain knowledge. In the excellent series of models which the author uses to illustrate the transformations at the end of the first month and beginning of the second one can see the gill arches and cleft appear and then disappear, the tail bud out and then become suppressed. But even in these early stages it is to be seen that the brain is planned on a large scale; Prof. Kollmann reproduces side by side a human embryo in the second month of development with that of an ape (*Macacus cynomolgus*) in a corresponding phase; superficially they look wonderfully alike, especially as regards their limbs, but the human head, if the same in type, already shows a distinct difference in form and proportion. It is too soon to say how far embryology may yet throw light on the relationship of man to other Primates. We know practically nothing of the embryology of the anthropoids which are most closely related to man. Thanks to the labours of Selenka, which are freely used by Prof. Kollmann, we know a good deal of the early history of one anthropoid, the gibbon, and in it the process by which the ovum becomes embedded in the uterus is identical to that in man and differs from that of the common ape. That was to be expected from what is known of their anatomy. It is possible, too, that the investigations which are being made in America by Mall, Bardeen, and Lewis on the later stages of the development of the human embryo—the formation of the bones and muscles of the limb and trunk—may give definite bearings as to man's relationship to other Primates. All the present evidence for the solution of such problems has been brought together and made available for those who are interested in this subject by Prof. Kollmann. The price of the hand-atlas is so low that one marvels how the venture can be made to pay.

THE PROBLEM OF CRYSTALLISATION.

An Introduction to Chemical Crystallography. By P. Groth. Authorised translation by Dr. Hugh Marshall, F.R.S. Pp. xii+123. (London: Gurney and Jackson, 1906.) Price 4*s.* net.

IN providing for English-speaking readers a translation of Prof. Groth's "Einleitung in die chemische Krystallographie," Dr. Marshall has performed a task of great utility, the value of which is no doubt enhanced to many in this country by the references to abstracts and papers in the Journal of the Chemical Society added by him. In preparing the translation he has kept closely to the original, but not so slavishly as to mar the literary style.

The question as to the precise nature of the constitution of unorganised matter, including as it does the problem of the phenomenon of crystallisation and the relation between the chemical composition and the crystal structure, has since the time of Lucretius, and even earlier, been the subject of no little speculative thought, much of which has necessarily been abortive because the knowledge derived from experiment was not sufficiently far advanced to act as a check on the correctness of the various theories propounded. The past century has, however, seen a vast increase in the store of facts relating to the characters of mineral substances, and chemists have, particularly in recent years, recognised the importance of determining with precision the crystallographical properties of the salts prepared by them in the laboratory. For many years past Prof. Groth has been engaged in the preparation of a complete digest of the physical properties of all crystallised substances. The first of the four volumes in which that work will appear was reviewed in NATURE of April 4 (vol. lxxv., p. 529). To that colossal work this small volume forms an introduction.

In a remarkably brief compass, and with all his customary lucidity of exposition, Prof. Groth has summarised the state of our knowledge at the time of writing. After a short discussion of the possible varieties of crystal structure, he proceeds to consider the main subject in its various aspects. Polymorphism deals with the various modifications displayed by the same substance, such as, to take the best-known instance, sulphur, and the nature of the transition between them. The next chapter is concerned with morphotropy, or the comparison of the crystal structures of chemically allied substances, such as, for instance, the aromatic compounds. Isomorphism is a particular case of morphotropy, in which the change in composition leaves the structure almost unaltered. The last chapter treats of molecular compounds, which, however, cannot be differentiated from isomorphous mixtures.

So vigorous is the growth of this subject that, even though various alterations have been embodied in the translation which were necessitated by the publication of investigations during the short interval that elapsed between the dates of appearance of the original and the translation, further revision is demanded by still more recent material. Of primary importance is the simple yet fundamental theory of close-packing put forward by Mr. Barlow and Prof. Pope in a paper read before the Chemical Society in November last.

We may commend this introduction to all who are interested in this important subject, and especially to chemists in this country, to whom we hope it may reveal the advantages of a study of crystallography, a branch of science of which they are said to be neglectful.

PHYSICS FROM MANY POINTS OF VIEW.

(1) *First Year's Course in Practical Physics.* By James Sinclair. Pp. viii+124; illustrated. (London: George Bell and Sons, 1906.) Price 1*s.* 6*d.*

(2) *Theoretical and Practical Mechanics and Physics.* By A. H. Mackenzie. Pp. xvi+112; illustrated. (London: Macmillan and Co., Ltd.; New York: The Macmillan Co., 1906.) Price 1*s.*

(3) *Junior Experimental Science.* By W. M. Hooton. Pp. viii+260; illustrated. (Cambridge: University Tutorial Press, Ltd., 1906.) Price 2*s.* 6*d.*

(4) *Text-book of Mechanics.* By Louis A. Martin, jun. Vol. i. Pp. xii+142; with diagrams. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 5*s.* 6*d.* net.

(5) *The Tutorial Physics.* Vol. v. Properties of Matter. By C. J. L. Wagstaff. Pp. iv+251; illustrated. (Cambridge: University Tutorial Press, Ltd., 1906.) Price 3*s.* 6*d.*

(6) *Practical Physics.* By W. R. Bower and J. Satterly. Pp. xi+399; illustrated. (Cambridge: University Tutorial Press, Ltd., 1906.) Price 4*s.* 6*d.*

(7) *The School Magnetism and Electricity; a Treatise for Use in Secondary Schools and Technical Colleges: based on Potential and Potential-gradient.* By Dr. R. H. Jude. Pp. vi+403; illustrated. (Cambridge: University Tutorial Press, Ltd., 1906.) Price 3*s.* 6*d.*

(8) *Mechanics Problems for Engineering Students.* By Frank B. Sanborn. Second edition, revised and enlarged. Pp. viii+194; illustrated. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1906.) Price 6*s.* 6*d.* net.

(9) *A First Course in Physics.* By Dr. R. A. Millikan and Dr. H. G. Gale. Pp. viii+488; with illustrations. (Boston, New York, Chicago, and London: Ginn and Co., n.d.) Price 5*s.* 6*d.*

ANYONE who thinks that the existing supply of text-books in mechanics and physics is quite sufficient is neglecting to make an adequate estimate of the extremely varied conditions under which teachers and pupils work. There was never a time when so much teaching was being done as now. Elementary school, high school, public school, technical school and college, each is developing on different lines, with the result that each feels the need of a text-book written specially to suit its work. Besides these, there is the cramming school, the main object of which is to get a man "through" an examination; this also has its special aims and needs, and seeks to satisfy them. Those of us who are ceasing to be young fared very differently in our day

from the modern student. A few leading text-books we had from which to select; after reading these we were encouraged at once to study the more simple of original papers and treatises. In this way we were led early to view science in the making, and ever since we have valued the independent spirit which this mode of training infused into us. Granting the increased facilities for absorption (it is amazing what some of our junior students "know"), it yet remains to be seen whether the present mode of boiling down science into a sort of intellectual pemmican will turn out better scientific men. Meanwhile, the flow of text-books continues, each written to meet some want. The above are some that we have received.

(1) In this first course in practical physics an attempt is made to provide for pupils in day schools, evening schools, and pupil teachers' classes a course which is not too difficult for young students, but which contains all that is really essential. The description of the experiments is not surrounded by any theory, the author's opinion being that this should be given by the teacher—at any rate in the first year. The course is a very simple one, consisting of exercises in the measurement of length, area, volume, mass, relative density, pressure of air, and of a few experiments in heat. The instructions given seem to be very clear in the main, and the order of experiment is quite logical.

(2) The text-book by Mr. Mackenzie is intended for artisans in evening schools. These belong to a class of student which has not been sufficiently catered for up to the present. A volume like this is an effort to provide something suitable for preparing them to benefit more fully from the instruction given them in the principles underlying their trades.

The course laid down is wholly experimental.

"Although instructions on the carrying out of experiments are given in detail, the students are not told as a rule what they are expected to see or what conclusions they should draw."

No previous experience of laboratory work is expected. The range covered is the same as in No. 1. We recommend this volume as a very suitable introduction to the rudiments of the subject.

(3) "This book has been written in order to supply a want," viz. a work containing approximately all that is required by the syllabuses in experimental science set for the Oxford and Cambridge junior local and Central Welsh Board junior examinations. It is primarily meant to help the teacher by providing the material required for revision. The subject-matter includes hydrostatics, mechanics, heat, and chemistry. Each experiment is prefaced by a short theoretical account which will add value to the book, and each chapter ends with a set of questions. There is not much room for originality in such a volume—the conditions laid down in producing it tend to preclude originality. The descriptions, so far as they go, appear to be clear, and provided a student actually does the described experiments are probably sufficient. We regret to see the phrase "whole pressure" alluded to in a modern text-book; still more do we regret to see it defined as the total force tending to deform a body.

(4) Mr. Martin's "Text-book of Mechanics" deals only with statics; the kinematics and kinetics are to follow in a second volume. For such an elementary book sufficient care is not always exercised in connection with fundamental illustrations. The necessity of a strong push to displace appreciably a large ball of iron hung up by a string indicates its great *weight*, and not its great mass. The difficulty of displacing it *quickly* depends on its mass. It is not usually true to say that "two bodies of equal mass moving with equal and opposite velocities will on impact (collision) come to rest." Even two equal lead balls will not behave in this way. Force is defined in the introduction as rate of change of momentum; no attempt is made to connect this definition with the use of the word force in the body of the book. Putting aside, however, this incompleteness of logical treatment, the volume may be considered a useful summary of elementary rules regulating the equilibrium of bodies. The last third of the book consists of chapters on graphical statics with applications to stresses in members of framed structures. These chapters will be found to be useful in teaching technical students, for whom they are primarily intended. There is no calculus employed, although it will be used extensively in the companion volume, which is nearly ready for the press.

(5) "Properties of Matter," by Mr. Wagstaff, is a somewhat more ambitious work, since it is intended to include all that is usually required for a pass degree; it therefore deserves a stricter examination. We must point out that Borda's metre has long been obsolete; the same remark applies to Borda's kilogram. The work of the Bureau International seems to be little known to writers of text-books. The author deserves credit for attempting to introduce vitality into his subject by outlining various attempts to "explain" matter. However, is not Osborne Reynolds's interesting granular theory now discredited? Also, is there not some doubt about the possibility of explaining all mass as being electromagnetic? We think that the selection of problems has been very well made, and the treatment is very clear. A proof is given of most of the theorems stated, and this is usually sufficient for those who intend to proceed only to a pass degree. Suggestions, of course, might be offered in many ways. The experiment on a stretching wire is most easily made with a wire of copper. With a thin wire the whole course of the extension up to the breaking point can be obtained with small loads, and the amount of permanent extension is much more considerable than with steel. We think that some idea of the nature and character of rolling friction should be included. Were this done, an explanation could also be given of the incompleteness of the working out of the problem of the disc rolling down an inclined plane. The solution given (the usual one, by the way) involves perpetual motion of the disc when once started on a horizontal plane, for its acceleration would be zero. The fact is that if the friction be represented by a single force it cannot be represented

at the same time as acting at the point of contact between the disc and the surface.

(6) In the "Practical Physics" of Messrs. Bower and Satterly we have a course intended for matriculated students. No previous knowledge of experimental physics is assumed, however, and hence the handbook is a complete elementary manual of the subject. Great pains have evidently been taken to secure efficiency, and the result is a text-book which merits great praise. Both the writers have had considerable experience in practical work, and, moreover, have the ability to impart the results of this experience to others. The volume is profusely illustrated with sketches, which will prove of great use to teachers who are obliged to make their own apparatus. Most of the experiments are intended to be performed in a properly equipped laboratory; certain of them are designed to be performed at home. The latter have been arranged so as to keep the cost of performance low, but at the same time merely trifling experiments have been avoided. These experiments form part of the complete course, and are meant to be done in a laboratory, if not at home.

(7) In spite of the considerable merit of the preceding manuals, we turn from them to Dr. Jude's elementary treatise and peruse it with some sense of exhilaration. It is only a school book, containing "all of the subject that is required for the London University Matriculation," though not written to the syllabus of any examination; but from first to last there is an originality of treatment which makes it interesting reading even to one who is *blasé* in the reading of text-books. Our only doubt is whether it is not too thorough for such examinations as that named; a wise teacher will know, however, how to benefit by it himself, and at the same time to temper it to the more junior boys without sacrificing the thoroughness. According to its subtitle, it is based on "potential and potential-gradient," notions which even university students sometimes find it hard to grasp. The fallacy of the old theory of "free and bound" charges is exposed, and this exposure is made much more effective than is customary. It is shown that when a conductor is under electric induction, the amount of electricity which runs out of the conductor on earthing is not in general equal to that which resided beyond the neutral line before the earth connection was made. In the case of a sphere under the action of a point-charge placed at a distance of four times the radius from the centre, the so-called "bound" charge is less than one-fifth of the induced charge when the sphere is earthed. A matriculation pupil will not understand the mathematical quotations in respect to this point, but these quotations will serve to keep many a teacher on the right path. This example indicates the thoroughness characteristic of the volume. The diagrams are numerous, and, in general, are good, but it is certainly with regret, and also with some surprise, that we see certain familiar lines-of-force diagrams doing duty once more. A moment's reflection should persuade anyone that a diaper pattern between two north poles (p. 206) hardly does justice to the lines as pourtrayed by iron-filings, imperfect though these are. Still less does it do justice to the true lines of force between two such poles. The figure for two opposite poles (Fig. 94) should also be replaced by a much more satisfactory one. We do not wish to conclude the notice of the book by an adverse criticism, however slight. It has given us great pleasure to read through it, and we hope that this pleasure will be felt by very many more.

(8) The collection of mechanics problems made by Mr. Sanborn is a second edition of a book prepared for engineering students. The aim has been to present many practical problems, together with brief definitions and solutions of typical problems, to help the student to follow George Stephenson's advice to his son Robert: Learn for yourself, think for yourself, make yourself master of principles. It is illustrated with process-work cuts in the new manner, presumably with the object of adding interest to a mere collection of problems. Whenever these cuts illustrate a definite point, their inclusion acquires a real value. In some cases the moral is somewhat hazy. The frontispiece of an engine belching black smoke on an up-grade on the Pennsylvania Railroad at Tyrone seems somewhat superfluous, especially as the camera, having seized the wrong perspective, has given the lines a down-grade rather than an up-grade appearance. In other cases, where, for example, it is a dipper dredge which is depicted in full working order, the picture is necessary to the proper understanding of the problem on the opposite page. There is a novelty about the choice of problems which we very much appreciate. The utility of the book would be enhanced if more of these problems were worked out in detail. With regard to provision of answers, a middle ground has been taken in giving them to about half the questions. The answer to a problem is not the principal thing from the standpoint of education, though it of course becomes very important when it forms the basis of a monetary transfer. The one feature of the book which we fail completely to understand is the order in which the questions are arranged—work, force, motion. Is it possible that it is intended that the exercises should be performed backwards?

(9) "A First Course of Physics," by Drs. Millikan and Gale, "has grown out of the actual needs of the elementary work in Physics in the University of Chicago, particularly in the University High School." The aim has been to give "a simple and immediate presentation, in language which the student already understands, of the hows and whys of the physical world in which he lives." It must not be understood from this quotation that we have here merely a compilation for the amateur reader; the volume is a genuine text-book for schools. We think that in the choice of matter and in its treatment the authors have been successful. Not the least valuable feature is the large number of excellent portraits of physicists, old and new, from Aristotle to Galileo, Maxwell, and J. J. Thomson; these will help to stimulate the budding genius. In the section on image formation the method of wave-curvature has been adopted. We agree that in the elementary treatment of images there is advantage in this method; at the same time,

we do not see in what respect the representation of waves by their wave-fronts is associated with less fiction than what the authors refer to as "the time-honoured fiction of rays." Whether the wave is represented by its front or its normal is a question merely of convenience or lucidity. The fiction which affects both equally consists in regarding the wave as a simple spherical one, and when the question is the higher one of the deviation from sphericity, we think the advantage lies all on the side of the method of rays. We conclude by wishing this volume all success; it deserves to be widely read.

THE PRINCE OF ENTOMOLOGY.

Les Débuts d'un Savant Naturaliste. Le Prince de l'Entomologie. Pierre-André Latreille à Brive de 1762 à 1798. By Louis de Nussac. Pp. vii+264. (Paris: G. Steinheil, 1907.) Price 5 francs.

THE subject of this memoir was the natural son of Baron d'Espagnac, and some doubt exists as to the exact date and place of his birth; his biographers, however, are agreed in giving the former as 1762, and Brive, in the department of Corrèze, as the place where he first saw the light of day. He was educated at Brive and at Paris, took orders in 1781, and eight years later became a fully ordained priest. The Revolution altered the ecclesiastical future of Latreille, for in 1793 he was arrested on the charge of neglecting to take the oath of allegiance to the new Government, was thrown into prison, and sentenced to exile in Cayenne in company with other recalcitrant priests.

Latreille was saved from this fate by the influence of friends and by a fortunate accident, the story of which is of considerable interest. On the wall of his cell, which he shared with an invalid prisoner, Latreille, who was already an expert entomologist, found a specimen of a beetle that he recognised as new to science; the surgeon attending the invalid observed Latreille's excitement, and on discovering the cause of it asked if he might give the specimen to a scientific friend, M. Bory. Next day the surgeon brought back word that M. Bory was unable to identify the new beetle, and Latreille, perceiving that he was dealing with a brother entomologist, sent him the message:—"Vous lui direz que je suis l'Abbé Latreille, qui va aller mourir à la Guyane avant d'avoir publié son 'Examen des Genres de Fabricius.'" Steps were immediately taken to free the captive, and he was literally snatched from the ship bearing the exiles to Cayenne; the ship subsequently foundered off the French coast, and all hands were lost. Latreille, in his classic work on insects and crustaceans, describes the insect that was the means of his salvation as *Necrobia ruficollis*, and details the circumstances of its discovery; in his "Genera crustaceorum et insectorum" he apostrophises it as "Insectum mihi carissimum," and a representation of it is carved on the bust of the great entomologist in the museum at Brive with the inscription "Necrobia ruficollis Latreillii salus anno MDCCXCIII.

After these adventures Latreille returned to Brive, and tranquilly resumed his entomological studies. The end of the eighteenth century in France was marked by the immense stimulus given to the scientific study of agriculture; societies for the encouragement and advancement of agriculture sprang up everywhere, and met with official sanction and help. Experiments on the cultivation of all sorts of crops were carried out, new agricultural machines were invented and tested, efforts were made to combat insect pests, and the methods of other countries were studied. In fact, France more than a century ago had arrived at a stage in agricultural progress which the modern Englishman may well envy. To-day an industrious peasantry, firmly rooted to the soil, is the prop and mainstay of France, and who can doubt that their existence is largely due to the work of those early agricultural societies, called into being themselves by the revulsion of feeling against a tyrannical and effete landed aristocracy? The cry of "Back to the Land" is only heard in those countries where the needs of agriculture are regarded by legislators with languid indifference.

In a milieu of eager and scientific inquiry a man like Latreille was bound to make his mark; he was appointed professor of natural history at Brive, and in 1798 was elected a member of the Institut National des Sciences et des Arts of France. During these years he was in active correspondence with Fabricius, to whom he owes his title of *Princeps Entomologiae*, with Olivier, Bosc d'Antic, and other entomologists of the day, and he was personally known to the Paris zoologists, the great Cuvier, Duméril, Daubenton, and Lacépède. Several of his letters are quoted by M. de Nussac, and these alone show, even if we had not his published works to convince us, that Latreille possessed the true Frenchman's power of generalisation and ability to seize on characters of prime importance for systems of classification. In 1796 Latreille published at Brive his first great work, "Précis des Caractères génériques des Insectes," which earned for him the plaudits of the entomological world of the day; it was followed by "Essai sur l'Histoire des Fourmis de la France," and shortly afterwards Latreille migrated to Paris to take up a post in the Natural History Museum. There his biographer leaves him, but promises a second volume on his subsequent career; M. de Nussac will find it difficult to write a more interesting volume than his first. R. S.

OUR BOOK SHELF.

The Steam Turbine as Applied to Marine Purposes. By Prof. J. H. Biles. Pp. vii+126. (London: Charles Griffin and Co., Ltd., 1906.) Price 6*s.* net.

PROF. BILES delivered the Keith lectures before the Royal Scottish Society of Arts in Edinburgh during the spring of 1906, and as only a condensed summary of the lectures was published by the society in its monthly journal, while many requests were made to the lecturer for complete copies of the lectures, he decided to publish them in book form.

Before dealing with the special form of turbine most suitable for marine purposes, the author gives a condensed and useful account of the development of the turbine from the time of Hero to the present day. In the second chapter the main features in the design of marine turbines are discussed, and then a detailed account is given of the method of blading the turbine drum and casing. In a convenient table at the end of this chapter the author gives in detail the sizes of the blades and their spacing for the H.P., L.P., and astern turbines of an ocean liner. The next chapter is well illustrated, and the reproductions of photographs, taken at various stages in the process of building a large set of marine turbines, will do much to make the non-technical reader familiar with the more important details in turbine construction. The thermodynamic principles which govern the design of turbines are then briefly touched upon, and their application illustrated by the calculations, necessary in determining blade dimensions for a channel steamer, being fully worked out. The success of the marine turbine is so entirely dependent on the efficiency of the propeller to which it is connected that it was most desirable that Prof. Biles should in these lectures discuss fully the theory and design of the screw propeller as employed in turbine vessels; the important and complete series of experiments carried out at the United States Navy Tank at Washington are admirably summarised; the results are illustrated by graphs, and their application to the design of a propeller which has to work under any given set of conditions is clearly explained.

The book concludes with a summary of all the trustworthy information at present available as to the comparative economy of turbine and reciprocating marine engines, and it is worth pointing out that, judging from the performances of certain cross-channel steamers, the considerable economy of the turbine-engined steamer which is shown during the preliminary trials is apparently not maintained in active service, though the author has every confidence that this loss in economy, which he considers is due to cavitation, will eventually be overcome.

T. H. B.

A First Year's Course in Geometry and Physics. By Ernest Young. Parts i. and ii. Pp. viii + 101. (London: George Bell and Sons, 1907.) Price 1*s.* 6*d.*

THIS satisfactory first year's course of work in geometry and physics recognises fully the desirability of making the introductory lessons in mathematics and science as practical as possible. The author is an experienced schoolmaster who understands the need of setting young pupils to do things for themselves if they are really to understand the subjects under consideration. Though there is little that is novel in the methods adopted, the book provides an abundance of well graduated exercises suitable for boys of twelve to thirteen years old.

New Geometry Papers. By Rupert Deakin. Pp. 103. (London: Macmillan and Co., Ltd., 1907.) Price 1*s.*

THE recent changes in teaching geometry have rendered Mr. Deakin's "Rider Papers on Euclid" of little use in most schools, and the present book is intended to serve a similar purpose under the new conditions. The papers are graduated and arranged in order of difficulty, while hints are provided on the method of solving riders. The collection should prove useful as a supplement to the school text-book of geometry.

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 Name of the Cave Horse.

IN the paper on the derivation of the horse in the April number of the *Quarterly Review*, to which reference was recently made in NATURE, Prof. J. C. Ewart expresses the opinion that the wild Mongolian horse, commonly known as Przewalski's horse, is identical with the horse depicted by the prehistoric inhabitants of La Madelaine Cave, in the Dordogne. The same view is even more emphatically expressed by Dr. E. L. Trouessart in the Bulletin of the Paris Museum (1906, p. 453). No mention is made by either writer of any change in nomenclature involved in this identification.

In the Phil. Trans. for 1906 Sir R. Owen described the prehistoric horse of the cavern of Bruniquel (Tarn et Garonne) as *Equus spelaeus*; and although he estimated the height of the animal at 13½ hands, it is practically certain that it was really much less, as he was not aware of the relatively large size of the molars in the Mongolian horse.

Now it can scarcely be doubted that the small prehistoric horse of the Bruniquel cave is identical with the one depicted by the prehistoric hunters of La Madelaine, and as there is equally little doubt that both are merely races of *Equus caballus*, the name of the La Madelaine horse is *Equus caballus spelaeus*.

Hence, if Messrs. Ewart and Trouessart are right, it is also the title of the wild Mongolian horse, the name *Equus przewalskii* dating only from 1881. It is true that there is a possibility that a name given by Hamilton Smith to a horse supposed to be from Tatary may antedate both *spelaeus* and *przewalskii*, while *Equus fossilis*, dating from 1836 or 1846, may possibly be identical with *spelaeus*. Nothing certain can, however, be affirmed with regard to either of these points.

The name *E. c. spelaeus* for the La Madelaine horse certainly cannot be ignored, but it seems inadvisable that it should be made to supersede *E. c. przewalskii*, especially when the wide separation in time and space between the types of the two is taken into consideration. A way out of the difficulty may be found in a refusal to admit Messrs. Ewart and Trouessart's absolute identification of the fossil with the living form, and to regard them as distinct, although closely related, races, when they will stand respectively as *Equus caballus spelaeus* and *Equus caballus przewalskii*.

I may add that I cannot agree with Prof. Ewart in regarding the skull of Przewalski's horse as conforming to the type in which the face is bent down on the cranial axis. On the contrary, it is more or less of the straight type, in common with the prehistoric horses of Europe. The bent type seems to me characteristic of domesticated breeds, especially thoroughbreds and Arabs, and as it also occurs in the fossil Indian *Equus sivalensis*, my suggestion that Arabs and thoroughbreds are descended from that species, while the ordinary "cold-blooded" European horses trace their origin to the "Przewalski," is strongly confirmed. In a short time I hope to put skulls of the two types on exhibition in the Natural History Museum, so that visitors can judge for themselves on the point at issue.

R. LYDEKKER.

The Enigma of Life.

IN the review of my book "The Evolution of Life" in NATURE of May 2 (p. 1), "J. A. T." admits his inability to "point out precisely where my experiments are fallacious," and says he does "not know what to answer unless it be that the sterilisation was inadequate, or that the preparations were contaminated before the photographs were taken." But the adequacy of the sterilisation, in accordance with all existing knowledge, is fully shown in the book; and, as for the last suggestion, it seems

really absurd when "J. A. T." was told that the organisms removed from the tube were received on a sterilised slip, covered with a sterilised cover-glass, and were there photographed almost as soon as they were found.

That he should not be convinced, however, by my "final decisive experiments" is only what might be expected when he says, in excuse for not himself repeating my simple experiments, "we regard archebiosis as so great a miracle that we do not expect to see it repeated," thus implying a disbelief even in its occurrence in the past. I certainly could not hope to convince anyone, by my experiments, who disbelieves in the natural origin of living matter on this earth when its crust became sufficiently cool to permit of such an occurrence.

Then, "harking back to heterogenesis," "J. A. T." refers to my belief in the origin of Otostoma from the Hydatina egg, and it is what he says on this subject that tempts me, in the main, to write this letter.

He says I was good enough to show him "the mummy of an Otostoma reposing within the egg-case of Hydatina. *There can be no doubt about it.*" These latter words, which I have italicised, are of some significance in reference to previous doubts expressed by many persons; but in the former statement Prof. J. Arthur Thomson (for your reviewer evidently affects no concealment of his identity) has certainly said too little. I showed him, not one specimen of Otostoma only, but about fifty specimens of this rare ciliate, either within egg-cases of Hydatina or lying among them. As he says, he thought it a result of parasitism, notwithstanding all the evidence against this view; and he left me with the expressed intention of investigating the subject himself. He now says that he, and also Dr. John Rennie, "watched many ova of Hydatina. But neither the expected nor the unexpected happened." From which I deem it quite possible, judging from the great rarity of Otostoma, that neither of them may even have seen one of these ciliates among the Hydatina eggs which they were watching. Yet I have taken some hundreds of Otostomata from my experimental pots. One may be permitted to smile at the puerile suggestion that, because Dr. John Rennie saw two infusorians moving within a split Hydatina egg-case, that kind of thing, which may be commonly enough seen, can at all explain my repeated observations with details and photographs concerning the origin of Otostoma from the egg of the rotifer. Yet it is with such a suggestion that "J. A. T." dismisses the subject.

Still, his attitude in regard to this question is much the same as it is concerning archebiosis, seeing that he has previously said concerning it (NATURE, February 25, 1904):—"There are some things that one must see for oneself, and even then one would not believe them." I, however, have seen this transformation, marvellous as it is, on so many occasions that I find no possible room for doubt as to the reality of its occurrence. Parasitism, I maintain, is out of the question, because no minute germs of ciliates are known; because of the extreme rarity of this particular great ciliate; and, above all, because it is the whole substance of the egg which becomes transformed within the unruptured egg-case, and because no movement can be seen until *the whole mass* begins slowly to revolve and speedily issues as a great embryo ciliate—which in its free state attains a bulk two or three times as great. Full evidence in support of this is to be found in my work "The Nature and Origin of Living Matter," chapter xiii., and in the Proceedings of the Royal Society, vol. lxxvi., B, pp. 385–392.

H. CHARLTON BASTIAN.

Radium and Geology.

IN his letter in NATURE of May 9 (p. 31) the Rev. O. Fisher raises a point of wide interest, but one which admits at the present moment of little more than the suggestion of fresh hypotheses and the destructive criticism of old ones.

Sediments rich in radium involve *prima facie* parent rocks capable of supplying the necessary uranium. Failing this explanation, we must, I think, assume that the uranium is derived from an extra-terrestrial source. Neither hypothesis is at the present moment capable of proof. Much will turn upon (among other things) our final estimates of the quantities to be accounted for.

With the concluding portion of Mr. Fisher's letter I regret I am not able to concur. Many predictions, based on the best knowledge available, were made of the temperatures which would probably be encountered in boring the Simplon Tunnel. Geologists and engineers both arrived at results much below those which were afterwards observed. That of Heim was 38°–39°. That of Stockalpen (formerly head engineer of the north boring, St. Gothard) was 38°, &c. The highest predicted temperature—then criticised as quite excessive—was that of the "Ingenieur-Geolog" Stapff, which was 47° C., but the actual temperature reached was 55° C. (see papers by Ed. Sulzer-Zeigler and by Prof. H. Schardt in the *Verhandlungen der schweizerischen naturforschenden Gesellschaft*, July–August, 1904). This will give a considerably higher gradient than that reckoned by Mr. Fisher, more especially as the highest temperatures were by no means coincident with the greatest overlying mass.

Nor do I think the facts will admit of explanation by hot springs coming from below. Prof. H. Schardt, perhaps the highest authority on the subject, in a contribution to the journal cited above, states that the region of highest temperature was characterised by abnormal dryness of the rocks, and to this fact (the *absence* of circulating water) and the horizontality of the strata he ascribes the specially elevated temperature.

Mr. Fox, in the article in NATURE of October 27, 1904 (vol. lxx., p. 628), to which Mr. Fisher refers, states that the ordinary gradient of 1° F. in 70 feet is insufficient to account for the great heat, and suggests a volcanic source.

Trinity College, Dublin, May 13. J. JOLY.

The Relationship of Lemurs and Apes.

IN NATURE of May 2 Dr. Elliot Smith has referred to a memoir presented by me to the Zoological Society on "Recently Discovered Sub-fossil Primates" from Madagascar. On the evidence supplied by the brain-casts of three of these fossils, Dr. Elliot Smith takes exception to my conclusion that certain of these extinct Prosimiæ are in many respects intermediate between the extant Malagasy lemurs and the true monkeys.

I have nowhere in my memoir maintained, as Dr. Elliot Smith seems to imply, that, *so far as their brain-conformation is concerned*, these recently discovered sub-fossil lemurs form a distinct link between the existing genera and monkeys. On the contrary, I have emphasised the fact, insisted on by Dr. Elliot Smith himself, that many of them show evidence of marked retrogressive changes in their brain-structure; and I have pointed out that, just because of this *retrogressive specialisation*, it is the condition of the brain which, of all characters, is least likely to afford satisfactory evidence of close affinity between the Malagasy lemurs and the Old and New World monkeys. I will not anticipate the suggestions which I make in my memoir as to the possible causes which have brought about this curiously degenerate condition of the brain of these Malagasy lemurs, nor is it possible here to give in detail the facts and arguments on which I base my conclusion that, *in spite of this brain degeneracy*, these recently discovered fossils do, in fact, afford strong evidence that they, in common with their extant allies, are descended from ape-like ancestors. A detailed study of these fossils and a comparison with their nearest living relatives, on the one hand, and with various genera of Old and New World monkeys on the other, has convinced me that most of the so-called *lemuroid* characters of the extant Malagasy lemurs have been secondarily acquired, and that, taken as a group, the characters which differentiate the Malagasy lemurs, recent and extinct, from the monkeys are so few and (with the possible exception of brain-structure) so unimportant as not to justify their retention in a separate suborder.

A satisfactory discussion of the subject seems, however, hardly possible until the publication of the two memoirs by Dr. Elliot Smith and myself describing in detail the fossils themselves.

H. F. STANDING.

South Kensington, May 9.

IMPERIAL COLLEGE OF SCIENCE AND TECHNOLOGY.

THE draft of the Charter for the incorporation and government of the Imperial College of Science and Technology to be established at South Kensington has now been laid on the table of the House of Commons. It provides for the appointment of a governing body which, when complete, will consist of forty members, each member holding office for a period of four years. The governing body will be constituted in accordance with the recommendations of the Departmental Committee which reported in January, 1906. When complete, it will consist of forty members, of whom six will be appointed by the Crown, four by the President of the Board of Education, five each by the University of London, the London County Council, and the City and Guilds of London Institute, two by the Royal Commissioners for the 1851 Exhibition, one by the Royal Society, four by the professorial staff of the college, and eight by various technical societies, viz. one each by the Institutions of Civil Engineers, Mechanical Engineers, and Electrical Engineers, the Iron and Steel Institute, the Institution of Naval Architects, the Society of Chemical Industry, the Institution of Mining Engineers, and the Institution of Mining and Metallurgy. The President of the Board of Education will summon the first meeting of the governing body, which will be deemed to be constituted on the occasion of that meeting. The governing body will meet at least four times a year, and will publish a report of its proceedings annually. It will be permitted to delegate powers to an executive committee and to other committees, provision being made for the possible inclusion on any of these committees, except the executive committee, of non-members of the governing body. The governing body will in this way be able to secure the advice of independent experts, including persons with practical experience of industrial requirements. Advisory boards may also be appointed with the same object in view.

The purposes of the Imperial College will be to give the highest specialised instruction and to provide the fullest equipment for the most advanced training and research in various branches of science, especially in its application to industry, and to do all or any of such things as the governing body consider conducive or incidental thereto, having regard to the provision for those purposes which already exists elsewhere. For these purposes the governing body will carry on the work of the Royal College of Science and the Royal School of Mines (at present under the direct control of the Board of Education), and may establish colleges or other institutions or departments of instruction. Any institution or department so established, and, subject to the fulfilment of certain conditions, the Central Technical College of the City and Guilds of London Institute, will become integral parts of the Imperial College. The special conditions attaching to the affiliation of the Central Technical College have for their object to secure for the college a certain measure of independence. The college, which will in future be known as the City and Guilds College, will be managed—subject to such powers of general supervision, direction, and control as are reserved for the governing body of the Imperial College—by a committee of management appointed for the purpose by the City and Guilds of London Institute, to which committee the governing body of the Imperial College will add five additional members; and the Institute will continue to exercise its privilege of awarding the diplomas of Associate and Fellow. As already announced by Mr. McKenna, the Royal School of Mines will retain its name, and the governing body of the Imperial College will award the diploma of "Associate of the Royal School of Mines" to any student who completes the prescribed courses to the satisfaction of the governing body. Subject to agreement with the authorities of any college or other institution, the governing body may by resolution recognise that college or institution or any department thereof as being in association with the Imperial College, but no such resolution will be valid or operative until allowed by His Majesty in Council. Power will be reserved to His Majesty in Council to amend or add to the provisions of the Charter, and in particular to declare and define more precisely the purposes and scope of the Imperial College in relation to matters appertaining to the biological sciences, and to make such provision in reference thereto as may appear expedient.

As regards the connection between the Imperial College and the University of London—a matter which has been fully discussed during the past year—it is proposed that, pending the settlement of the question of the incorporation of the Imperial College with the University, the college shall be established, in the first instance, as a "school" of the University. It is expected that an inquiry by Royal Commission, which has been suggested by Mr. McKenna, will be necessary before this question of incorporation can be decided. In the meantime, the governing body of the college will be directed to enter into communication with the University with regard to the coordination of the work of the college with the work of the University and its other schools, and for the purpose of carrying out or facilitating such coordination the governing body may enter into such arrangements either by way of transferring or exchanging departments of instruction or otherwise, and upon such terms as may be agreed upon between the governing body and the University.

The resources which are at present available for the purposes of the Imperial College are considerable. In the first place, there are the buildings and equipment of the Royal College of Science, including the new chemical and physical laboratories, which have cost nearly 300,000*l*. The Royal Commissioners of the 1851 Exhibition have resolved to appropriate certain portions of their estate at South Kensington for the purposes of the college. The late Mr. Alfred Beit bequeathed 50,000*l*. and 5,000 preferred shares of 2*l*. 10*s*. each in De Beers Consolidated Mines (total value about 135,000*l*.) to be applied for the purposes of the "College for Technology (including Mining and Metallurgy) in connection with the University of London." Lord Rosebery, in a letter to *The Times*, published on June 29, 1903, announced that Messrs. Wernher, Beit and Co. had offered to place a sum of money in the hands of trustees to be applied as a contribution towards the cost of building and equipping an institution at South Kensington for advanced technology, and that further offers of the same kind had been made by other public-spirited London citizens. The Bessemer memorial fund, which will probably amount to not less than 20,000*l*., will be devoted in whole or part to the Royal School of Mines. As regards income, the Treasury has consented to place in the Estimates a grant of 20,000*l*. per annum in respect of the cost of the staff and of laboratory expenses of the Royal College of Science and the Royal School of Mines. The London County Council, which in the past has not contributed generously in aid of higher technological work, may be expected to avail itself gladly of the opportunity of developing such work in London which the establishment of the Imperial College will afford, especially in view of the fact that the Council is now under a legal obligation to consider the educational needs of its area, and may supply or aid the supply of higher education. The Council on

July 21, 1903, considered Lord Rosebery's letter, to which reference has already been made, and placed on record its opinion that, when certain conditions had been complied with, the Council would be well advised to contribute out of the money annually placed at its disposal under the Local Taxation (Customs and Excise) Act of 1890 a sum not exceeding 20,000*l.* per annum towards such part of the work described in Lord Rosebery's letter as fell within the statutory definition of technical education. Although the conditions are now entirely changed, there is no reason to suppose that the annual contribution of the Council to the college will be less than that suggested four years ago. The Board of Education will pay the fees for its selected scholars, and the fees payable by other students will amount to a considerable sum. It is expected that the resources of the Central Technical College will also be available. The total expenditure on this college for buildings, fittings, &c., has exceeded 130,000*l.*, and the current expenses of the college (about 15,000*l.* per annum) are met by the fees of students and a subvention from the City and Guilds of London Institute. The total value of the land, buildings, equipment, and capital available for the Imperial College (including the Central Technical College) will certainly exceed one million pounds.

The assets in the way of teaching staff and students also deserve mention. The teaching staff of the colleges includes such well-known men of science as Profs. Tilden, Callendar, Perry, Watts, Gowland, Cox, Ayrton, Armstrong, Dalby, and Henrici. At the Royal College of Science and the Royal School of Mines the total number of students is about 300; a high standard for entry is not at present demanded, and the proportion of students preparing for university degrees is comparatively small; but a large number of able students are entered at the college under the Board of Education system of national scholarships for science students. At the Central Technical College the number of regular students is about 375; the test for admission is approximately equivalent to London Matriculation, and a fairly large number of students are reading for London degrees as internal students of the University.

THE BUTTERFLIES OF INDIA.[1]

THE second volume of Colonel Bingham's important work on the butterflies of India includes the Papilionidæ and Pieridæ, and five out of the seven subfamilies into which the author divides the Lycænidæ "provisionally . . . on the structural characters of the imago or perfect insect." These subfamilies are Gerydinæ, Lycæninæ, Curetinæ, Liphyrinæ, Poritinæ, Theiclinæ, and Arhopalinæ, of which the last two stand over until the next volume. The tables and descriptions are very carefully drawn up, and the illustrations, both coloured and uncoloured, the latter often representing venation, legs, and other important structural characters, are worthy of high praise. Some of the text-figures of large species are reduced. The transformations, broods, habits, flight, scent, stridulation, &c., of various butterflies are also fully discussed, especially the curious relationships between Lycænidæ and their larvæ and ants and aphides. We notice, however, that references to the transformations of common European species have generally been omitted; we are not certain whether this is done to save space (for it might have been thought hardly necessary to repeat information to be found in every European book on butterflies) or because Indian records of the transformations of these particular species happen to be wanting.

Notwithstanding the care with which the book is written, we notice an occasional oversight; for instance, the range of the genus Colias is incompletely given, as it is found in Lapland, South Africa, and other localities which would seem to be excluded by the wording of the paragraph. Perhaps the newest and most interesting observation in the book is that recorded by Colonel H. J. W. Barrow, R.A.M.C., who observed a Lycænide (*Allotinus horsfieldi*) "milking" an aphis in the same manner as if the butterfly had been an ant (p. 287, Fig. 73). The description of the tentacles of the larvæ of *Curetis bulis* (p. 445) is also quite original and very curious, as is also the long account of the carnivorous larva of the very anomalous *Liphyra*

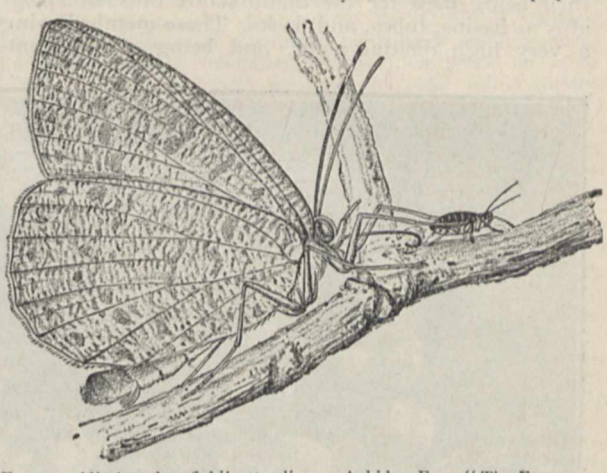


FIG. 1.—*Allotinus horsfieldi*, attending an Aphide. From "The Fauna British India. Butterflies, vol. ii."

brassolis (pp. 448–56), but the latter particulars have mostly been published before.

It will be seen that there is much in Colonel Bingham's volume which appeals to the general naturalist, and not merely to the lepidopterist.

W. F. K.

THE ROYAL SOCIETY CONVERSAZIONE.

THERE were numerous interesting exhibits at the Royal Society conversazione on May 8. The guests were received by the president, Lord Rayleigh, and included representatives of many departments of intellectual activity.

During the evening, demonstrations were given in the meeting-room of the Society by Mr. Louis Brennan, C.B., Dr. C. G. Seligmann, and Dr. Hele Shaw, F.R.S. Mr. Brennan explained the principle and action of his mono-railway by means of a working model. On his system each vehicle is provided with automatic stability mechanism which endows it with the power of maintaining its equilibrium upon a single rail laid upon the ground, either while standing still or travelling at any rate of speed, notwithstanding that the centre of gravity of the vehicle is above the rail, and that wind pressure, centrifugal force, or the movement of passengers or displacement of load may tend to upset it. This mechanism consists of two gyroscopes, revolving in opposite directions, and their precession, by being accelerated, produces a restoring couple at right angles to the rail. The same principle

[1] "The Fauna of British India, including Ceylon and Burma." Published under the Authority of the Secretary of State for India in Council. Edited by Lieut.-Colonel C. T. Bingham. Butterflies, vol. ii. By Lieut.-Colonel C. T. Bingham. Pp. viii+480; plates xi–xx. (London: Taylor and Francis, 1907.)

is applicable to motor-cars, flying-machines, and other structures.

Dr. C. G. Seligmann gave a kinematograph exhibition of native dances taken during the course of the Daniels ethnographical expedition to British New Guinea. The demonstration by Dr. Hele Shaw was on the subject of aërial gliding. During the last few years a large number of experiments have been made in connection with aëroplanes and machines for soaring and gliding. Dr. Shaw gave a brief account of the work of Lilienthal, the Wright Brothers, and others, and summarised the present state of our knowledge on the subject.

Two exhibits of particular interest were apparatus of pure iridium and rhodium and of fused silica by Messrs. Johnson, Matthey and Co., Ltd. This firm has succeeded in producing iridium and rhodium of such extreme purity as to render these hitherto practically unworkable metals so malleable as to enable their being used for the manufacture of such apparatus as basins, tubes, and flasks. These metals, having a very high melting point, and being almost unattacked by acids, should prove of great value in chemical research. The scientific work of which the process of manufacturing apparatus of fused silica is the outcome was carried out by two English men of science about ten years ago; unfortunately, as so often happens in these cases, its commercial importance was first recognised in Germany, and its production on an industrial scale commenced, little or nothing of a similar nature being attempted at home. Messrs. Johnson, Matthey and Co. have now taken up the original process, and by suitable modifications to meet industrial requirements are enabled to place this material upon the market at a price which can no longer be considered prohibitive. The apparatus is manufactured from the purest silica obtainable. At a high temperature this substance melts, and yields a viscid liquid which can by suitable means be fashioned into apparatus having all the appearance of ordinary glass, as is shown in the accompanying illustration. The apparatus possesses many properties which are likely to render it of great service both to science and to industry; *e.g.*, it can be made white hot and plunged into water, or otherwise rapidly cooled, without any danger of cracking; it is quite unattacked by water or acids, while ordinary glass under similar conditions is appreciably dissolved.

Transparent Silica Apparatus.

In the subjoined summary of the official catalogue of the exhibits, those on related subjects have, so far as possible, been grouped together.

Mr. H. R. A. Mallock, F.R.S.: Instrument for recording by photography rapid changes of pressure in the air, such, for example, as are caused by the wave produced by an explosion.—*The Director of the Meteorological Office:* Model of the neighbourhood of the winter quarters of the National Antarctic ship *Discovery*, 1902–4.—*Dr. W. J. S. Lockyer:* Cloud studies. The pictures exhibited represent some of the first results secured in attempting to photograph cloud forms during the past year. After some trials it was found that by the use of yellow screens (×10 for summer and ×5 for winter) and an ortho-process plate, sufficient contrast was obtained without undue length of exposure. No difficulty was experienced in photographing either heavy "cumulus" cloud or very elevated "cirrus."—*Solar Physics Observatory, South Kensington:* (1) Stellar spectrograms. (*a*) Bellatrix. (*b*) Rigel, (*c*) Sirius, (*d*) ε Ursæ Majoris, (*e*) Capella. (2) Spectroheliograms. Two series showing the development of the large spot of March (5–17), 1907. (3) Recent photographs of British stone circles, &c., in Cornwall.—*Commander Chetwynd, R.N.:* Improved liquid compass. In the compass exhibited the diameter of the card is considerably smaller than that of the bowl, the proportion being three-quarters, so that the edge of the card is substantially outside the influence of that ring of damping fluid which, on altering the ship's course (or whilst turning the compass bowl), adheres to and is drawn round by the inner surface of the bowl. The edge of the card being so far from the inner surface of the bowl on which the lubber's line is usually marked, a special lubber's mark or pointer is introduced projecting horizontally from the bowl on a level with the card. The extremity of this pointer, filed to a fine point and being in close proximity to the edge of the card, obviates all possibility of error of parallax in reading the course, without in any way causing a disturbance of the card.—*Mr. H. Cunynghame, C.B.:* A detached gravity escapement. The object of this escapement is to cause the impulse on the pendulum to be given by means of a light arm which falls by the action of gravity, and is hence independent of the force of the train, and to provide that the release of the train that winds up the arm is not derived from a blow by the pendulum, but of the arm itself.

Prof. W. E. Dalby: Working models, illustrating the balancing of a two-cylinder gas engine and a locomotive.—*Prof. A. G. Ashcroft:* Lecture table testing machine.—*Colonel R. E. Crompton, R.E.:* Crompton's measuring machine, combining accuracy with rapidity in working. With this measuring machine, which has been designed for observing length differences due to the heat treatment of specimens of steel, measurements of objects from 1 inch to 6 inches long, not differing among themselves more than a quarter of an inch, can be made and entered on the test sheet at the rate of one per minute. The accuracy obtainable is greater than 1 in 200,000.—*Mr. S. G. Brown:*

Relay working of long submarine telegraph cables. The apparatus consists of (1) an automatic transmitter, the movements of which are governed by means of a perforated tape, and originate the signals sent into an imitation cable; (2) a relay, receiving the signals at the other end of the line, and actuating an automatic perforator by which a duplicate of the originating type is reproduced at the relay station for re-transmission on another cable.—*Sir James Dewar, F.R.S.:* The Crookes radiometer—motion arrested in very high vacua, &c. (1) Experiments showing the cessation of radiometer action in very high vacua, made by charcoal cooled in liquid hydrogen or liquid air, even when the instrument is subjected to the concentrated radiation of an electric lamp. (2) Radiometer filled with helium at atmospheric pressure, which is inactive to a charcoal liquid-air vacuum, but becomes active in a charcoal liquid-hydrogen vacuum.—*Mr. W. Duddell, F.R.S.:* Persistent electric oscillations. The oscillations are produced by the method of the "musical arc." In this method a direct-current arc is shunted with a circuit consisting of a condenser and a self-induction in series. The frequency of the oscillations can be varied by altering either the capacity or the self-induction in the shunt circuit. The oscillograph records exhibited show the variations in the potential difference and current when the oscillations are produced. To obtain powerful oscillations at very high frequencies, the arc may be placed in hydrogen gas as employed by Paulsen. In the apparatus shown the arc burns in coal gas, and *no magnetic field* is used to blow out the arc. Experiments in magnetic induction, tuning, and discharge *in vacuo* are easily demonstrated with persistent high-frequency oscillations. The persistent oscillations are of special use for energising the transmitter in wireless telegraphy, as they permit better syntony or tuning to be obtained.—*Mr. W. A. Douglas Rudge:* The action of radium and other salts on gelatin culture medium. Radium, barium, strontium, and lead salts, when placed in contact with gelatin culture medium, give rise to a kind of cellular growth, which is due to the formation of an insoluble precipitate with the sulphuric acid usually present. Radium salt added to the medium from which the sulphuric acid has been removed causes no growth, but the addition of a soluble sulphate produces a growth at once. Analyses of the growths obtained with radium salts show that they are composed of barium sulphate.

Messrs. R. and J. Beck, Ltd.: (1) New diffraction wave-length spectroscope. This instrument comprises a Thorpe replica diffraction grating with a collimator and slit. The observing telescope swings on an axis which passes through the grating, parallel with the lines. The motion is by means of a micrometer screw which reads the sine of angle of rotation direct, thus giving on its divided milled head the wave-length in A.U. (2) The "isostigmar" photographic lens on optical testing bench.—*Mr. A. Kershaw:* A new visual method of measuring the speeds of photographic shutters.—*Mr. Ulrich Behn:* (1) The flame tube. A simple apparatus capable of indicating very small changes of air-pressure. It consists of a short metal tube with wide outlets, at which, after the tube is connected with the gas main, the gas is lighted. It shows, if one end is raised a few millimetres, the decrease of atmospheric pressure with height by the changes in size of the flames. The tube is capable of various applications. (2) Demonstration of the theory of microscopic images. (3) An indirect method of measuring the temperature of liquid-air baths. (4) A short glycerine barometer. This consists of an air thermometer of the old Italian type, the bulb of which is kept at zero by means of ice in a Dewar vessel.—*Dr. J. T. Bottomley, F.R.S., and Mr. F. A. King:* Experiments with vacuum gold-leaf electroscopes on the mechanical temperature effects in rarefied gases. The apparatus consists of a "radium clock" and various types of vacuum electroscopes. The vacuum electroscopes are set up to show the effects of radiations from sources of heat and light upon gold leaves hanging within highly exhausted enclosures. The gold leaves of the vacuum electroscope diverge when illumination of any kind falls upon them, and stand permanently apart when placed in bright daylight. By suitably manipulating such sources as a spirit flame, candle, or Nernst lamp near the electroscope, forces, which vary in direction and magnitude from point to point within the enclosure, are generated, and cause the leaves to be twisted into curious shapes. The gold leaves will remain in this contorted condition for a considerable time after the exciting cause has been removed.—*Dr. J. R. Milne:* A special camera for the purpose of automatically recording the readings of the scale of any instrument.—*Messrs. Pilkington and Gibbs, Ltd.:* A heliochronometer which gives Greenwich mean time by a simple direct solar observation. It comprises devices for adjustment in latitude, longitude, level, and azimuth, and is self-correcting for the equation of time.

The Cambridge Scientific Instrument Co.: (1) Prof. Féry's self-contained radiation pyrometer. The pyrometer utilises the heating effect of the "total radiation" from a hot body, focussed as an image of that body by means of a concave mirror. It differs from the already known Féry radiation pyrometer in being entirely self-contained, the image falling upon a minute bi-metallic flat spiral (Breguet spiral). This becomes partially uncoiled as its temperature rises, and a light pointer attached moves over a dial divided to give direct (centigrade) temperature readings. (2) Universal portable electrometer, designed by Mr. C. T. R. Wilson, F.R.S. A gold-leaf instrument with very small capacity and fused quartz insulation, suitable for work on atmospheric electricity, radio-activity, &c., and self-contained, with means for standardising the readings, which are very steady even in a fairly high wind.—*Mr. Joseph Goold:* Vibration experiments with steel plates and six bars tuned accurately to 400, 500, 504, 600, 700, and 800 vibrations per second.—*Dr. Otto Schlick, and Messrs. Swan, Hunter, and Wigham Richardson, Ltd.:* Working models illustrating the action of the Schlick gyroscope in steadying ships at sea (see NATURE, April 11, p. 561).—*Dr. Robert Knox and Mr. G. Pearce:* Skiagraphy of the human subject; examples illustrating the advantages of reduction in exposure. The instruments employed to produce skiagraphs, with exposures varying from one to seven seconds, consist of a powerful induction coil yielding a greatly intensified secondary current, worked in conjunction with an electrolytic interrupter directly from high-tension electric light mains. The core of the coil consists of transformer plates. The primary is of a much larger wire than usual, and has more turns. The secondary is smaller than usual. The X-ray tube is provided with a heavy anode to withstand the current. In series with the X-ray tube, a rectifier is placed to render the current unidirectional.

The Thermal Syndicate, Ltd., Wallsend-on-Tyne: Pure fused silica ware. The articles consist of pure silica, and are manufactured by an electric furnace process at a temperature of about 2000° C. The material is highly refractory, and possesses a very low coefficient of expansion (about 1/17th of that of glass), and in consequence it is able to resist sudden and extreme changes of temperature without cracking. It is unaffected by practically all acids, is an excellent electric insulator, and retains its insulating properties even at high temperatures. The specimens show that it is possible to produce a brilliant lustre on the surface of the material.—*Dr. F. D. Chattaway, F.R.S.:* Copper mirrors deposited upon glass from aqueous solution. In the mirrors exhibited, the copper had been deposited upon the glass by reducing cupric oxide by an aqueous solution of phenylhydrazine in presence of potassium hydroxide, which accelerates the action to a remarkable extent. The mirrors are equal in brilliancy and uniformity of surface to silver mirrors, and on account of the colour of the copper are much more beautiful.—*Hon. C. A. Parsons, F.R.S.:* Photographs of microscopic diamonds obtained from pure iron heated in a carbon crucible in an electric furnace and rapidly cooled. Scale, 150 diameters.—*Prof. J. Perry, F.R.S.:* British Association Album, meeting in South Africa, 1905. Two copies of an album prepared by Mr. Eustace Calland from photographs selected from those taken by members of the British Association.

Marine Biological Association of the United Kingdom: Marine algæ and their reproduction. A small representative collection of sea-weeds from the Plymouth district exhibited to illustrate their different habits of growth and reproduction.—*Prof. E. Ray Lankester, F.R.S.:* (1) Metamorphosis of the eel. Series of specimens showing the

transformation from the marine larva or Leptocephalus of the common eel into the fresh-water "elver" and young eel. Also a series showing the metamorphosis of the conger eel. (2) Specimens of Cephalodiscus. Specimens of *Cephalodiscus nigrescens* and *Cephalodiscus hodgsoni* obtained by the *Discovery* in the Antarctic Ocean, and *Cephalodiscus gilchristi* obtained by Dr. Gilchrist in the Cape Seas. Also the original Cephalodiscus (*Cephalodiscus dodecalophus*) obtained by the *Challenger* in the Straits of Magellan in 1876, for comparison with the above newly discovered species. (3) Coloured cast of the tile-fish. The tile-fish was first discovered in 1879 in about 100 fathoms in the North Atlantic, and was expected to become a regular marketable fish. In 1882 a vast destruction of the tile-fish took place, owing, it is supposed, to a chilling of the part of the sea which it inhabited, and millions of the dead fish were found floating on the surface of the ocean. It was feared that the fish had become extinct, but since 1892 specimens have been caught in fair numbers. This cast was prepared and coloured by the authorities of the National Museum at Washington. (4) Specimen of the okapi. The specimen is an immature male, obtained by Major Powell Cotton in the Ituri Forest, Congo State. The bony horns have not yet penetrated the skin as they do in adult animals. Special interest attaches to this individual, in that Major Powell Cotton was able to examine the recently killed body and determine the sex. The specimen has been presented by Major Powell Cotton to the Natural History Museum, which already possesses the complete skeleton of the same individual.

Dr. F. A. Dixey: Seasonal dimorphism in butterflies. It has recently been established, partly by observation, but mainly by the experiments of Mr. G. A. K. Marshall, that in many tropical and subtropical species of butterflies which produce two or more broods in the course of the year, the broods differ in appearance according to the season at which they emerge. In several of these cases the difference is so extreme that the seasonal phases of the same insect have received different specific names, and have even been considered to be widely separated from each other in the systematic series. In some instances it has been found possible to transform one seasonal phase into the other by artificial means. Similar phenomena have long been recognised in certain European Lepidoptera (butterflies and moths), but it is only lately that experimental proof has been obtained in the case of tropical forms such as those exhibited.—*Prof. E. B. Poulton, F.R.S.:* The female forms of the African *Papilio dardanus*, the most remarkable example of mimicry hitherto discovered. Mr. Roland Trimen, F.R.S., first showed (in 1870) that these diverse forms were the females of a single species with a non-mimetic male. His evidence was not confirmed by the final test of breeding until 1902, when Mr. G. F. Leigh, of Durban, bred a single family containing males and two of the female forms. After other partial successes Mr. Leigh succeeded, in the autumn of 1906, in breeding the single family exhibited. It was bred from a female of the second form, and contains fourteen males, and examples of all the female forms known in South-East Africa: eight of the first, three of the second, and three of the third.—*Colonel Bingham:* Pupa of *Binsitta barrowi*, Bingham, with photograph of moth and pupa, and a coloured drawing of the head of a tree-snake (*Lycodon aulicus*, Linn.). *Binsitta barrowi*, Bingh., is a rare moth belonging to the family Tineidæ, lately discovered by Colonel Waller-Barrow at Maymyo, a hill station near Mandalay, Upper Burma. Colonel Barrow found the moth just issuing from the chrysalis, and noticed at once the curious resemblance of the latter to the head of a snake. When the chrysalis is looked at from in front, the likeness to the head of *Lycodon aulicus*, Linn., a bird-eating snake, is at once perceived.—*Mr. Fred Enock:* Ovivorous parasitic Hymenoptera (Mymaridæ).—*Prof. Charles Stewart, F.R.S.:* Selected specimens from the Museum of the Royal College of Surgeons, England.—*Mr. H. St. J. Donisthorpe:* The inhabitants of British ants' nests.—*Mr. W. Woodland:* Microscopic preparations illustrating the development of the plate-and-anchor spicules from the soft tissues of *Synapta inhaerens* and *S. digitata*.—*Mr. H. B. Fantham:* Microscopic preparations of *Spirochaeta* (*Trypanosoma*) *balbianii* from the crystalline style and intestine of the oyster.—*Prof. A. Dendy:* (1) The "pineal eye" in the New Zealand lamprey (Geotria) and in the tuatara (Sphenodon). (2) Reissner's fibre in the brain and spinal cord of Geotria.—*Mr. R. I. Pocock:* Example of the skins of English domestic cats. English domestic cats, whatever their colour may be, and whether they belong to "Manx," "Persian," or "ordinary" breeds, are shown by their pattern of stripes to be referable to two distinct kinds, known as the "striped" and "blotched" tabbies. The striped tabby appears to be the scarcely modified descendant of the European and North African wild cats. The origin of the blotched tabby is unknown.

Mr. R. H. Biffen: Hybrids of wheat and barley.—*Prof. W. B. Bottomley:* Fixation of nitrogen by leguminous and other plants.—*The Director, Royal Botanic Gardens, Kew:* (1) *Welwitschia mirabilis*, Hook. f. (Gnetaceæ), south-west tropical Africa. (2) *Acanthosicyos horrida*, Welw. (Cucurbitaceæ), western tropical Africa. (3) Labrador lichens. A striking feature of the Labrador lichens is their similarity to those of northern Europe. *Platysma nivale, Cetraria islandica, Bryopogon jubatum*, and species of Stereocaulon so abundant in Norway and Sweden, flourish equally well in Labrador, whilst, just as in Lapland, *Cladonia rangiferina*, the "reindeer moss," covers vast areas. (4) Figures of remarkable new or rare plants (exhibited by Mr. W. Botting Hemsley, F.R.S.). (5) Figures of African terrestrial Utricularieæ (exhibited by Dr. Otto Stapf).

Prof. John Milne, F.R.S.: Records of recent large earthquakes. (1) Jamaica earthquake; (2) San Francisco earthquake; (3) the so-called Valparaiso seismogram (see NATURE, February 21, p. 403).—*Rev. R. Ashington Bullen:* Cable broken by the Jamaica earthquake of January 14, 1907. The cable had remained intact for twenty years. It rested on a muddy bottom in a depth of 700 fathoms, about seventeen miles south of Kingston. The probability is that here it crossed the line of a geological fault.—*The Director of the Imperial Institute:* (1) Igneous and metamorphic rocks of northern Nigeria. Typical specimens collected during the course of the mineral survey of northern Nigeria now in progress in connection with the Imperial Institute. (2) Tinstone from Bauchi, northern Nigeria, and tin smelted from it. (3) New or exceptional minerals from Ceylon. (4) New vegetable products of hitherto unknown composition.—*Mr. C. Carus-Wilson:* (1) Crystallised granite. A remarkably fine mass of Cornish granite in which the mineral constituents had crystallised out around the walls of a large cavity. (2) Musical flint nodule from the chalk near Faversham. The specimen is 21 inches long, and emits a loud metallic ring when struck at the thin end.

Mr. F. J. Lewis: The succession of plant remains in British peat mosses. All the Scottish and north of England peat mosses show a definite succession of plant remains. Detailed investigations have been carried on in twenty-four districts, from Westmorland to the Shetland Islands, and the geographical distribution of the successive strata ascertained. The evidence so far shows that two distinct arctic beds and two distinct forest beds occur in the peat, and these features are so regular and spread over so wide an area that the alternation must be due to climatic changes during early post-Glacial times.—*Mr. H. F. Standing:* Recently discovered sub-fossil Primates from Madagascar. The chief interest of these relates to the light which they throw on the origin of the extant Malagasy lemurs. They show these latter to be descended from ape-like ancestors, and that many of their so-called "lemuroid" characters have been secondarily acquired. Some of the recently discovered species are of gigantic size, showing evidence of various retrogressive changes, notably in the frontal region of the brain. One of these gigantic extinct Prosimiæ (Palæopropithecus) was probably aquatic. Its brain indicates certain affinities with the aye-aye, that curious aberrant rodent-like "lemur" from the Malagasy forests.—*The Director, British Museum (Natural History):* Mandible of Tetrabelodon from the Loup Fork formation (Lower Pliocene), Nebraska, U.S.A. This specimen shows that the primitive mastodons, with a long chin and lower tusks, reached North America before their final extinction.

(Exhibited by the Keeper of Geology.)—*Prof. H. G. Seeley, F.R.S.:* Skull of a South African saurischian (*Erythrosuchus africanus*). The remains were collected by Dr. R. Kannemeyer in 1897. They were displaced, and in unusual confusion. The matrix has been entirely removed by Mr. Richard Hall, of the British Museum, but portions are missing, so that the skull has not been reconstructed as yet. The whole skeleton indicates a new division of this order of animals.

Mr. W. Dale: A cordoned bucket or cist of bronze, "Halstatt" type, early Iron age of Europe, late Bronze age of Britain, *circa* 700 B.C., found at Weybridge, Surrey, April, 1907, at a depth of 10 feet, in sinking a shaft for the pier of a bridge close to the river at the new motor track. The bucket is of north Italian manufacture, and is similar to specimens found at Halstatt and in other parts of Europe as far as Hanover, but never before in Britain. It has quite recently been proved that some brooches, in museums and private hands, found in England, must have come from north Italy in the early Iron age of Europe. On the strength of this, it has been asserted that there was commerce between Europe and Britain as early as 700 B.C., and the theory is confirmed in a remarkable way by the discovery of this bucket. The British Museum Catalogue figures a Halstatt bucket (Fig. 30, "Guide to Early Iron Age") exactly similar. The workmanship of the handles is the same as that of the ancient torques.—*Mr. Rowland G. Hazard:* Arrow heads and spear points from North America, Egypt, and Japan.—*Sir Benjamin Stone, M.P.:* History pictures of Egypt. These views are a selection from the series of photographs taken by Sir Benjamin Stone during the recent winter season. The series of about 800 views shows the aspect of Egypt and the Soudan at the present time.

NOTES.

WE regret to learn that Dr. Alexander Buchan, F.R.S., the distinguished meteorologist, died on Monday, May 13, at seventy-eight years of age.

AT the Chemical Society on Thursday, June 13, Prof. J. B. Farmer, F.R.S., will deliver a discourse entitled "Some Borderline Problems in Botany."

M. LE CHATELIER has been elected a member of the Paris Academy of Scences in succession to the late Prof. Moissan.

THERE will be a reception at the Linnean Society on June 7 in celebration of the 200th anniversary of the birth of Linnæus. The principal exhibits will be of objects associated with or belonging to Linnæus, such as letters, manuscripts, and objects of natural history.

PROF. E. RAY LANKESTER has left for the Continent with the view of studying the specimens of the okapi in the museum of the Congo Free State at Tervueren, near Brussels, and in other collections.

DR. J. HALM, assistant at the Royal Observatory, Edinburgh, has been appointed first assistant at the Cape Observatory, in succession to Mr. S. S. Hough, F.R.S., who was recently promoted to succeed Sir David Gill as H.M. Astronomer at the Cape.

THE fifteenth "James Forrest" lecture of the Institution of Civil Engineers will be delivered by Dr. Francis Elgar, F.R.S., on the evening of Tuesday, June 18, his subject being "Unsolved Problems in the Design and Propulsion of Ships." The fourth engineering conference will be held on June 19–21, commencing each day at 10 a.m., and the annual conversazione on the evening of June 20 at the Royal Albert Hall.

WE are informed that Prof. H. F. Osborn has returned to New York from Egypt, where he accompanied and superintended an expedition to search for remains of the fossil vertebrates of the Fayum for the museum he represents. He took with him a staff of trained collectors, who have been left in Egypt for some time longer to continue the work of collecting. As the result of such expert collecting, a number of remains of the smaller mammals have, we believe, been obtained, which should prove of great interest.

AN interesting undertaking is that of a party now at Seattle on the way to study seismic and volcanic conditions in the Aleutian Islands. One of the fifty-nine volcanoes in these islands was reported active last March. The expedition is headed by Prof. T. A. Jaggar, of the Massachusetts Institute of Technology, and includes Prof. H. V. Gommere, of the University of California, and Dr. Van Dyke, of San Francisco.

ON May 11 the Lowell Astronomical Expedition to the Andes sailed from New York. Its main object will be the observation of Mars in July. The site for the observations will be selected next month, probably either in the high Andes of Peru or in the desert regions of northern Chili. The work is in charge of Prof. David Todd, director of the Amherst College Observatory, Mass., who will be accompanied by Mrs. Todd. Mr. E. C. Slipher, also of Amherst, will be responsible for the photographic side of the expedition, and Mr. Albert G. Ilse, of the firm of Alvan Clark and Sons, of Cambridge, Mass., will be chief mechanician and instrument maker. The appointments of the *personnel* of the expedition have been made by Prof. Percival Lowell, who is himself working at present at Flagstaff, Arizona.

THE Cardiff public telescope and observatory are proving a decided success. During the last few weeks, in response to an appeal from Mr. Albert Taylor, a large number of teachers in the locality have applied for permission to use the instrument. The attendance of the general public also has been such as quite to warrant the corporation in the expense to which it went in connection with the observatory.

ON Thursday next, May 23, Sir James Dewar will commence a course of three lectures at the Royal Institution on "Chemical Progress—Work of Berthelot, Mendeléeff, and Moissan." The Friday evening discourse on May 24 will be delivered by Prof. J. A. Fleming, on "Recent Contributions to Electric Wave Telegraphy," and on May 31 by Mr. A. H. Savage Landor, on "Recent Journey Across Africa."

THE Gypsy Lore Society, which was first formed in 1888, and has lain dormant since 1892, is to be revived under the presidency of Mr. David MacRitchie. On July 1 next it is proposed to issue the first number of a new series of the society's quarterly journal, the publication of which ceased with the termination of the activities of the association in 1892. The society aims at enrolling every amateur of gypsy philology, folk-lore, and ethnology, and every student of Sanskrit and Indian languages. The society will be conducted on a purely honorary basis—neither writers nor officers being paid. Interested persons should communicate with the hon. sec., Mr. R. A. Scott Macfie, 6 Hope Place, Liverpool.

THE annual report of the Ray Society, read at the annual general meeting on May 9, stated (*inter alia*) that part iii. of the "British Annelids," by Prof. W. C. McIntosh, F.R.S., is now in the press, and will be issued for the present year, and that there is a sufficient number of monographs waiting their turn for two volumes per

annum to be issued for several successive years if the funds of the society will permit. The officers and council for the ensuing year were elected, Lord Avebury being re-elected president; Dr. F. DuCane Godman, F.R.S., treasurer; and Mr. John Hopkinson, secretary. The new members of the council elected were Sir Charles Eliot, K.C.M.G., and Mr. C. D. Soar.

MR. G. R. DUNELL, whose death on Sunday last, at fifty-nine years of age, we regret to have to record, was the author of many articles and reports on engineering subjects in the columns of NATURE. For the past twenty-five years or so, Mr. Dunell's life was devoted almost entirely to literary work connected with engineering and industry; and his wide knowledge and lucid style gave his articles a distinctive character unusual in technical description. Formerly he was a frequent contributor of articles to the *Times*, but in recent years most of his work was done for *Engineering*. His last contribution to our columns appeared on April 11, and dealt with the gyroscopic apparatus for steadying ships described at the recent meeting of the Institution of Naval Architects. Mr. Dunell was a familiar figure in the engineering world, and his death will be sincerely deplored by all who knew him.

THE Catania Observatory states that at 7.40 p.m. on May 10 Stromboli burst into violent eruption, throwing masses of stone, ashes, and lava towards the eastern portion of the island, which is inhabited, and causing fires in several vineyards. The eruption was preceded by loud rumblings. Mount Etna is also in a state of activity. Large columns of thick vapour have issued from the cone of the volcano and spread over the surrounding country. On the evening of May 10 slight earthquake shocks were reported at Belpasso, Nicolosi, and Viagrande.

A SPECIAL meeting of the proprietors of the London Institution, Finsbury Circus, was held on May 8 to consider a proposed scheme of re-building, having for its objects "such an increase of revenue as would enable the committee to carry out the objects of the charter on a wider basis than at present, and at the same time to give improved accommodation to the proprietors." The scheme provides for the removal of the present lecture theatre and smoking room, thus rendering vacant 10,612 superficial feet of land, to be let on a building lease for eighty or ninety years. The alterations would include a new theatre, a storage room for 200,000 volumes, refreshment and other rooms, and the dividing of the present reference library into a reading room, small lecture room, and a committee room. The cost is estimated to be about 15,600*l*. Strong criticism of the scheme led to the adjournment of the meeting for four weeks.

THE ninetieth annual meeting of the Société Helvétique des Sciences Naturelles will be held at Fribourg on July 28–31. The first day will be devoted to preliminary matters and to a social gathering of visitors. The inaugural address will be delivered on July 29 by Prof. Musy, and afterwards Prof. Mühlberg will lecture on the subject of the supposed condition of Switzerland and neighbouring regions during the five Ice ages, interglacial periods, and the return of the last glaciation. Dr. John Briquet and Prof. Zchokke will speak on the post-Glacial immigration respectively of flora and fauna into Switzerland. The subject of the utility of an international atlas of erosion will be discussed by Prof. E. Chaix, and a lecture will be delivered by Prof. Jean Brunhes on glacial action. The following day will be devoted to sectional meetings, and a joint meeting of the geological, botanical, and zoological sections. The centenary of Agassiz will be celebrated on the concluding day, when discourses will be delivered by Profs. de Girard and Th. Studer. The Swiss Geological, Botanical, Zoological, and Chemical Societies, and the Physical Society of Zurich, will hold their annual meetings at Fribourg on the same days.

THE twelfth annual congress of the South-Eastern Union of Scientific Societies will be held at Woolwich on June 12–15 under the presidency of Prof. Silvanus P. Thompson, F.R.S. The following papers will be read:—Goethe as a naturalist, Dr. Treutler; geology of Woolwich and district, W. Whitaker, F.R.S.; an experiment in cooperative field-work in botany, Prof. Oliver; the antiquity of *E. caballus* in Europe, with special reference to remains found in Kent, W. H. Griffin; xerophytes, Mrs. W. Plomer Young; concretionary types, forces, and evolution, G. Abbott; the storage and use of rain-water for domestic purposes, G. F. Chambers; how to make our local societies more efficient, H. Norman Gray; and local archæology, W. T. Vincent. Excursions, weather permitting, are planned to Well Hall, Eltham Palace, and Avery Park; Charlton Camp and Pits and Greenwich Park; the Royal Arsenal, R.A. Institution and Rotunda; Lessness Abbey, and Crayford Pits. There will be a reception by the Mayor (Alderman Squires, J.P.) and a congress museum. These meetings, &c., are open to members and associates of the South-Eastern Union. Mr. B. C. Polkinghorne, Woolwich Polytechnic, is the local secretary, and the hon. general secretary is the Rev. R. Ashington Bullen, Englemoor, Woking, from either of whom programmes and tickets can be obtained.

MADREPORIAN corals from the coast of French Somaliland form the subject of a paper by Mr. T. W. Vaughan published as No. 1526 of the Proceedings of the U.S. Nat. Museum (pp. 249–266). As the collection was obtained just outside the mouth of the Red Sea, it is of special interest for comparison with the coral-fauna of that sea on the one hand, and of the East African coast on the other.

"CONVERGENCE" in animals is illustrated in an article contributed by Dr. O. Rabes, of Magdeburg, to the April number of *Himmel und Erde*. An interesting figure of a rorqual-embryo with teeth is reproduced from a paper by Dr. W. Kükenthal. Among the other illustrations, exception may be taken to one which revives the myth of the flying frog, and to a second in which the Ganges dolphin is represented with a relatively huge eye.

A REVISION of the genus Spilanthes, prepared by Mr. A. H. Moore, is printed as vol. xlii., No. 20, of the Proceedings of the American Academy of Arts and Sciences. The genus belonging to the order Compositæ is chiefly distributed over the American continent, but also occurs in the tropical regions of the old world. The author identifies about forty species, of which twelve are new to science.

ACCORDING to a paper by Mr. J. Henderson, of which the first portion appears in vol. iv., No. 2, of the University of Colorado Studies, the land and fresh-water molluscs of Colorado have been greatly neglected by naturalists. Although the land-snails are for the most part small, water-snails and pond-mussels abound in almost every stream and piece of water, even at high elevations.

A PAPER by Dr. S. A. Forbes on the local distribution of certain Illinois fishes, forming article eight of vol. vii. of the Bulletin of the Illinois State Laboratory of Natural History at Urbana, is noteworthy on account of the seven exquisitely coloured plates of so-called "darters" (Etheostominæ) with which it is illustrated. In article nine of the same serial Dr. Forbes discusses from a similar point of view (that is to say, the relations of interaction between organisms and their animate and inanimate surroundings) the results of an ornithological traverse of Illinois in autumn. The predominance of European (we fail to see why they should be specially referred to as English) sparrows in certain districts and situations is very noteworthy.

THE series of "ichnites" in the geological department of the British Museum (Natural History) has just been enriched by the addition of two large slabs of Triassic sandstone from Storeton, Cheshire, displaying labyrinthodont and reptilian foot-prints. Some remarkably well-preserved casts of the foot-prints of "Chirotherium," together with other much smaller ones referred to the reptile Rhynchosaurus, and likewise others of an unknown reptile, are displayed. Both slabs are the gift of the owners of the Storeton quarries. Important additions have likewise been made to the series of exhibits illustrating the development of eels and the nature of the food of well-known food-fishes. In one jar are displayed a number of specimens from the Gulf of Messina, presented by Prof. Grassi, showing various stages in the development of the larvæ of the conger-eel and their final evolution into young congers, while alongside are shown a mass of elvers recently taken in the Severn, and a few young eels from the Thames. The fishes of which the food is illustrated are the plaice, the turbot, and the sole, the exhibits being specially instructive on account of the remarkable difference existing between the nutriment of the turbot on the one hand and that of the plaice and sole on the other. The turbot, for instance, seems to subsist entirely on other fishes, including immature clupeoids and flat-fish and sand-lance. Excepting that young sand-lance are eaten by the first and very small dabs by the second, plaice and soles, on the contrary, subsist on an invertebrate diet, including lug-worms, echinoderms, crustaceans, and tellinas and other small bivalves.

CONSIDERABLE interest attaches to a paper, by Mr F. W. True, just issued as No. 1694 of the quarto series of Publications of the Smithsonian Institution, on an imperfect cetacean skull obtained in 1847 from the Eocene Marl of the Ashley River, near Charlestown, South Carolina. In the same year appeared a brief account of it, with plates, by Mr. M. Tuomey, who referred it to Zeuglodon, and two years later it was named *Z. pygmaeus* by Prof. J. Müller, of Berlin. Soon afterwards the specimen came under the notice of Prof. L. Agassiz, who caused a lithographed plate to be prepared, with the lettering *Phocodon holmesi*, Agass. For some reason this plate was never issued, and in 1895 Prof. E. D. Cope referred the specimen to a new genus, under the name of *Agorophius pygmaeus*. Despite the fact that the specimen, when figured in the plate made for Agassiz, had a single Squalodon-like tooth remaining in the maxilla, a suggestion was made that the species might be an ancestral form of rorqual. Were this confirmed, it would have been a matter of much importance, and Mr. True has therefore been well advised in publishing the original plate. In his opinion, Agorophius is a squalodont, although differing in cranial characters from Squalodon itself. The European so-called *Squalodon ehrlichii* of Van Beneden has, however, a broad rostrum recalling the Carolina genus, and it may be that this imperfectly known form is a connecting link between Squalodon proper and Agorophius.

SEVERAL matters referred to in the report for 1905 of Mr. M. Kelway-Bamber, a Government chemist at the Royal Botanic Gardens, Ceylon, published as vol. iii., No. 24, of the Circulars and Agricultural Journal, are of scientific as well as practical interest. The problem of establishing a connection between the mineral ingredients of the tea plant and the quality and strength of the tea is under investigation, with a prospect of obtaining definite results. From a study of the methods of preparing Oolong tea in Formosa, it is concluded that the quality and characteristics are due to an aroma produced by faint oxidation in drying and a slight scorching during roasting of the leaf, as well as to the mild decomposition caused by a fungus, and it is suggested that the fungus acting on the legumin in the leaf produces flavouring bodies similar to the action of moulds in cheese. The report also contains hints on the distillation of camphor and citronella oil.

AN article in the *West Indian Bulletin*, vol. vii., No. 4, deals with the manufacture of citrate of lime, as an article for export to take the place of concentrated lime juice. The project was brought to the notice of planters in the West Indies by Dr. F. Watts, who has published information on the production of citrate of lime in Sicily, and given public demonstrations on the process of manufacture. The commercial outcome is seen in the shipments first made from Dominica in 1906, and also from Montserrat. In the same number Mr. W. R. Buttenshaw compiles some facts on the distribution of plants from the various botanic stations in the West Indies to indicate the valuable service rendered in this connection. Incidentally he refers to the popular practice of observing Arbor Day, and mentions that palms, principally the cabbage palm, *Oreodoxa oleracea*, and the royal palm, *Oreodoxa regia*, are commonly chosen for planting, often, too, the mahogany or the white wood, *Bucida Buceras*.

THE principal article in the last issue (No. 4) of the Kew Bulletin, contributed by Mr. J. S. Gamble, treats of the gutta-percha trees in the Malay Peninsula. After reviewing the species belonging to eight genera of the Sapotaceæ found in Malaya, the author concludes that the only important tree is *Palaquium Gulta*, known as "Taban Merah," with its variety oblongifolium, "Taban Sutra"; three other species, *Palaquium Oxleyanum*, *Palaquium obovatum*, and *Payena Leerii*, afford a second-rate gutta, and cultivation is being restricted to these four species. The lists of new plants from the herbarium comprise a decade of orchids, mostly from Asia, determined by Mr. A. N. Rolfe, and exotic fungi from India and elsewhere, identified by Mr. G. Massee. Supplementing the information given in the first two numbers of the Bulletin for this year, Mr. T. A. Sprague confirms the distinction between Dubouzetia and Tricuspidaria, and offers a revision of the former genus.

THE second part of the nineteenth volume of the Proceedings of the Royal Society of Victoria contains some interesting papers on the biology and geology of Australia. It begins with the eighth of Mr. Frederick Chapman's valuable "Additions to the Palæontology of Victoria"; in this number he describes some interesting new Silurian ophiurids. He also describes a new Cypridina

from Hobson's Bay. Mr. J. A. Leach directs attention to the value of surface tension in the formation of canyons, a factor hitherto neglected. There is also a contribution to the flora of Australia, describing new or little-known plants, by Prof. A. J. Ewart, who holds the double appointment of the new chair of botany at Melbourne University and botanist to the Government of Victoria.

IN the Records of the Geological Survey of India (vol. xxxiv., part iv.) Mr. R. R. Simpson describes the Jaipur and Nazira coalfields, Upper Assam. The measures are of Middle Tertiary age, and the coals closely resemble in appearance those from the Makum area, but they are somewhat inferior in quality. They burn readily, with considerable flame and great heat. The amount of workable coal exceeds 20 million tons in the Jaipur field and 35 million tons in the Nazira field. The Dikhu River area is the most suitable for the establishment of a colliery. The accompanying view on the Dikhu River, with the Bor Jan landslip in the background, shows the nature of the ground, which is covered by virgin forest with a dense thorny undergrowth presenting the maximum of difficulty to penetration. The difficulties of transport could probably be overcome by means of an aërial wire-rope tramway. Mr. Simpson also has a note on the Makum coalfield between the Tirap and Namdang streams. Other papers in the same issue are on the Kabat anticline near Seiktein, Upper Burma; on the asymmetry of the Yenangyat-Singu anticline, Upper Burma; and on the northern part of the Gwegyo anticline, Upper Burma, by Mr. E. H. Pascoe; and on *Breynia multituberculata*, an undescribed species from the Nari of Baluchistan and Sind, by Mr. E. Vredenburg.

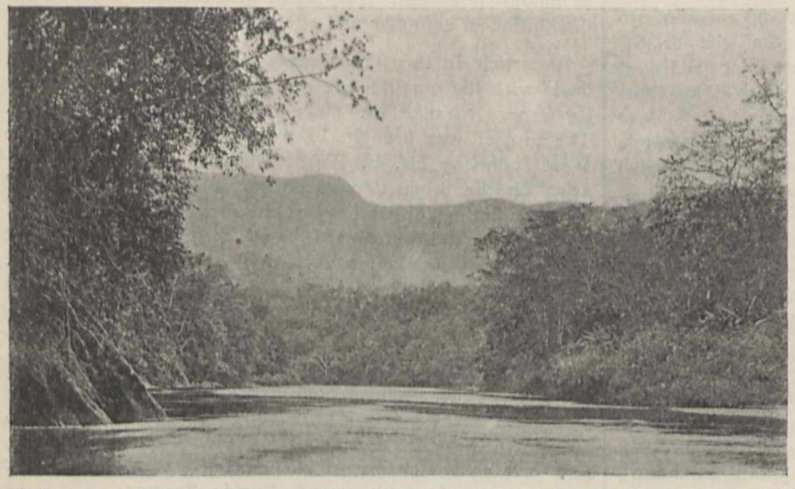


Photo. [*R. R. Simpson.*

View on Dikhu River; the Bor Jan landslip in the background.

DR. EREDIA, assistant in the Meteorological Office at Rome, has undertaken a laborious and useful work in discussing the frequency of wind direction in various parts of Italy from the observations contained in the Annals of that office. Part i. refers to the winds of Piedmont, and deals with monthly and seasonal values for various stations. Speaking very generally, winds from the south-west quadrant predominate in winter, while in summer they are south-westerly in Upper, and north-easterly and south-easterly in Lower Piedmont; in spring and autumn no very marked predominance is exhibited.

IN the Bulletin of the Moscow Imperial Society of Naturalists, Nos. 1 and 2, 1906, Dr. E. Leyst completes his valuable series of statistical investigations of optical phenomena. The results deduced from observations at seventy stations, and including in the aggregate 1308 years, show that the phenomena have a yearly and secular range, and that solar coronæ are observed about five times less frequently than lunar coronæ; the maximum of the yearly range occurs in spring, and the minimum about July. The coronæ are seen more frequently inland than near the sea coast.

AT the request of the seventh International Geographical Congress, the Danish Meteorological Institute has for some years past published in its year-book of nautical meteorology valuable details, accompanied by monthly maps (April–August), of the state of the ice, compiled from logs of ships and other sources. The summary for 1906 shows that, as the winter 1905–6 was comparatively mild over Spitsbergen, Barents Sea, and the Kara Sea, and severe over Greenland and parts of Arctic America, the conditions of the ice were consequently favourable in the former region and unfavourable in the latter; in Barents Sea the conditions were especially favourable, while in the Greenland Sea the ice-belt was broader, and off Labrador drift-ice was more frequent, than usual. All things considered, it is expected that the conditions in 1907 will be rather favourable along the coasts of Greenland, and less so around Labrador and Newfoundland. The most important events of the year in the Arctic regions were the accomplishment of the North-West Passage by Captain Amundsen and the attainment of latitude 87° 6′ N. by Commander Peary.

THE revised edition of the Institution of Electrical Engineers Wiring Rules, which has been recently issued, contains a good many alterations and a great deal of rearrangement. The rules apply only for voltages up to 250 volts, the Board of Trade rules being appended and used for the higher pressures. The standard for copper conductors is now that of the Electrical Standards Committee instead of Mathiessen's standard, as in the past. Insulation tests are also modified in that the "bending" test has been omitted, though an increase in the length of time for which the pressure test is applied takes its place. This is a distinct advance, as the danger of mechanical rupture was always present when bending cables of any size, and was in very many cases an unnecessary strain on the cable. Bare conductors also are allowed under special conditions. Switches of more than 5 amperes at 125 volts when placed in cases are to have their cases lined with asbestos. Dynamos and motors are now placed under separate headings, but transformers are no longer kept separate, being under a combined heading with resistances and choking coils. At the end of the rules the Electrical Standards Committee's standard for the resistance and weights of copper conductors is defined as follows:—"A wire one metre long and weighing one gramme having a resistance of 0·1539 E.S.C. standard ohms at 60° F." In addition to the Board of Trade rules for voltages from 250 volts to 650 volts, the Home Office

Regulations for Mining Work are also attached. The revised rules are certainly an improvement on the previous edition, and the rearrangement and enlargement under the different headings tend to simplify them greatly.

THE May issue of the *Westminster Review* contains an appreciative unsigned article on the life and work of the late Prof. Marcellin Berthelot. This biographical notice, in addition to its references to Berthelot's achievements in science, provides much interesting information concerning his private life and his services to France in administrative matters.

OUR ASTRONOMICAL COLUMN.

A NEBULOUS BACKGROUND IN TAURUS.—In No. 3, vol. xxv. (p. 218, April), of the *Astrophysical Journal*, Prof. Barnard discusses the apparently nebulous background shown on some excellent photographs of a region in the constellation Taurus, of which two reproductions are given.

The vacant lanes among the Milky Way stars in Ophiuchus suggest from their appearance that not only are they due to the absence of stars, but that they are really darker than the rest of the sky, that is, they are probably channels in a substratum of nebulous matter. The recent photographs obtained by Prof. Barnard show that lanes of this nature are undoubtedly in a substratum of some kind, and not merely a subjective effect of contrast in a region otherwise densely packed with stars.

The region dealt with is comprised between the limits $\alpha=4$h. 0m. to 4h. 34m. and $\delta=+24°$ to $28\frac{1}{2}°$, well to the east of the Pleiades, and shows numerous narrow, vacant lanes, one of which is singularly well defined, and extends for some 26m. in R.A. Another feature is a large space, nearly devoid of stars, but containing a large nebula which seems to suggest the possible existence of a larger nebula of which the outlying portions are dead or non-luminous, and therefore absorb the light of the stars behind them.

THE WHITE SPOT ON JUPITER'S THIRD SATELLITE.—Referring to the white spot near the north limb of Jupiter's third satellite, observed by Senor José Comas Solá in November, 1906 (see NATURE, No. 1942, p. 281, January 17), Prof. Barnard directs attention to the fact that he observed the same, or a similar, spot some fourteen years ago, and that, as in Senor Solá's observations, it was only seen when the satellite was *following* Jupiter. This leads to the assumption that this feature cannot be a true polar cap in the sense of its being at the pole, or it would be seen with equal facility in all parts of the satellite's orbit. Further, if this white spot is an extra-polar marking, and is only visible in certain points of the satellite's orbit with respect to the earth, it indicates that Jupiter's third moon, like the earth's satellite, always keeps the same face towards its primary.

During the observations of 1893–4, Prof. Barnard saw a similar spot at the south limb of the fourth satellite when that body was near superior conjunction (*Astronomische Nachrichten*, No. 4173, p. 327, April 27).

THE METEORITE FROM RICH MOUNTAIN, NORTH CAROLINA.—The results of a minute examination of a portion of the meteorite which was seen to fall at Rich Mountain, Jackson County, North Carolina, "about June 20, 1903, at 2 o'clock in the day," are given by Messrs. Merrill and Tassin in an abstract (No. 1524) from the Proceedings of the U.S. National Museum (vol. xxxii., pp. 241–244, April 18).

The portion examined seemed to be the nose of a larger mass, and weighed 668 grams. Metallic iron particles project from the crust, and seem to have resisted the frictional heat of the atmosphere better than did the silicate portions. Chemical analysis showed about 7 per cent. of iron, nearly 47 per cent. of olivine, about 4 per cent. of troilite, and about 40·7 per cent. of insoluble silicates. Copper was apparently absent, and, among the compounds, chromite was not found, whilst a relatively large amount of graphitic carbon was present.

COMET 1907*b* (MELLISH).—In No. 4174 (p. 347, May 3) of the *Astronomische Nachrichten*, Prof. Berberich directs attention to the great similarity between the elements of the orbit of comet 1907*b* and those of the bright comet of 1742 as published in vol. clxxii. (p. 105) of the same journal.

Prof. Barnard has discovered an image of this comet on a plate taken on April 13, the day before the object was found by Mr. Mellish, and a number of other American observations are also recorded for April 14, 15, and 17 in the same journal.

THE ORBITS OF FOUR DOUBLE STARS.—Recently determined orbits of the systems of ξ Scorpii, Σ 2173, Σ 3121, and μ^2 Herculis are given by Dr. Doberck in Nos. 4169–70 (p. 257, April 17) of the *Astronomische Nachrichten*. The orbits were determined by successive corrections by the least-square method, and the computed places are compared with all the available observational results; ephemerides extending to 1926 are also given. The periods given by the final elements for each of the above stars are 45·12, 46·20, 35·38, and 44·20 years respectively.

THE DISCOVERY OF VARIABLE STARS.—The value of the new method of discovering, photographically, variable stars, by superposing a negative and a positive copy of a similar negative taken at a different epoch, is illustrated in Circular No. 127 of the Harvard College Observatory. A plan has been started whereby the whole of the sky, as photographed on the Harvard Map of the Sky, will be systematically examined for variables, and the present circular deals with two regions already examined by Miss Leavitt; eight new variables were found in the one region and six in the other. A comparison of the results with those previously obtained shows that apparently all the bright variables exhibiting conspicuous changes in these two regions have now been discovered.

THE RADIANT POINT OF THE BIELIDS.—From observations made at Stockholm in November, 1904, Dr. Karl Bohlin finds the radiant point of the Bielid shower, epoch November 21·33 (M.E.T.), to have been $\alpha=+26°\ 2'$, $\delta=+44°\ 10'$ (1900). The record of the observations and discussion of the results appear with a chart, in No. 2, vol. viii., of the *Astronomiska Iakttagelser och Undersökningar å Stockholms Observatorium.*

IRON AND STEEL INSTITUTE.

THE annual meeting of the Iron and Steel Institute was held at the Institution of Civil Engineers, Westminster, on May 9 and 10. The proceedings opened with the Right Hon. Sir James Kitson, Bart., M.P., past-president, in the chair, who explained that the president, Mr. R. A. Hadfield, having attended to present an address on behalf of the institute at the dedication of the building given by Mr. Carnegie to American engineering societies, was unable to return to England in time for the meeting.

The report of the council, which was read by the secretary, Mr. Bennett H. Brough, showed that the past year had been one of exceptional activity and progress. The membership of the institute amounted to 2052, and the joint meeting with the American Institute of Mining Engineers resulted in the presentation of so large a number of papers that it was found impossible to compress the minutes into the usual two volumes, and two extra volumes were issued. The report by the treasurer, Mr. W. H. Bleckly, showed that the financial prosperity of the institute is a matter for congratulation. The receipts amounted to 6610*l.*, and the expediture to 5915*l.*

The first act of the new president, Sir Hugh Bell, Bart., on taking the chair was to present the Bessemer gold medal to Mr. J. A. Brinell, the eminent Swedish metallurgist.

In his presidential address, Sir Hugh Bell gave a sketch of the iron trade in the last hundred years, the subject being chosen from the fact that the life of his father, Sir Lowthian Bell, begun in 1816 and ended nearly ninety years later, almost covered the period reviewed. The address is a work of conspicuous literary merit, and its value is enhanced by the addition of a carefully compiled chronological table of the more important events con-

nected with iron and steel during the century. A vote of thanks to the president for his address was eloquently proposed by Sir W. H. White and seconded by Mr. Schneider (Le Creusot).

The first paper read was by Mr. D. Selby-Bigge (Newcastle-on-Tyne), who described the latest application of electricity to reversing rolling-mills of high power. The first mill of this kind was started on July 27 last at the Hildegarde Works, at Trzynietz, in Austrian Silesia. The mill is of 10,350 horse-power, and is provided with the Ilgner arrangement of fly-wheel converters. The discussion was well sustained, and the rival claims of electricity and steam were ably urged.

The secretary announced that Carnegie research scholarships had been awarded by the council to C. A. Edwards (Horwich), J. A. N. Friend (Germany), D. M. Levy (Bradford), A. M. Portevin (France), A. K. F. Hiorth (Norway), and B. Saklatwalla (India and Germany). For research work carried out during the past year, medals were awarded to E. F. Law (London) and Dr. O. Stutzer (Freiberg in Saxony). The reports of these two candidates, and the reports of P. Breuil (Paris), W. H. Hatfield (Sheffield), and Dr. Guillet (Paris) were found to be of sufficient merit to warrant their publication in full in the journal of the institute.

Two papers were read by Mr. Arthur W. Richards describing processes he has adopted at the works of Messrs. Bolckow, Vaughan and Co. for the manufacture of steel from high-silicon phosphoric pig iron by the basic Bessemer process, and of high-class steel from pig iron containing chromium, nickel, and cobalt.

Prof. W. A. Bone, F.R.S. (Leeds), and Mr. R. V. Wheeler (Warrington) read a lengthy paper on the use of steam in gas-producer plant. The experiments were made with a Mond gas-producer plant with the view of determining the influence of variation in the proportions of air and steam in the blast upon the composition of the gas, its suitability for furnace operations, and upon the general and thermal efficiencies of the producers. The quality of the gas obtained, though always good, steadily deteriorated as the steam saturation temperature was raised beyond 65°. An investigation of the thermal efficiency showed that the use of steam beyond that required to saturate the air blast at 60° was not attended by any increased economy of working, but rather the reverse. If, however, a gas producer be regarded primarily as an apparatus for ammonia recovery, then undoubtedly it should be worked with the highest steam saturation temperature consistent with the production of combustible gas.

The paper read by Mr. F. W. Harbord (London) is a valuable addition to technical literature. For many years it has been recognised that steels made by different processes, although practically of the same composition, varied in their tensile strength, hardness, and other physical properties, and it has been generally admitted that basic Bessemer steel was softer than acid Bessemer, and basic open-hearth softer than acid open-hearth steel. Mr. Harbord's paper gives for the first time systematic experimental results defining these various differences over a wide range of carbon content. He shows that if engineers wish to obtain rails of equal hardness from the basic open-hearth that they have been accustomed to from acid Bessemer steel, they must permit the manufacturer to increase the percentage of carbon to give the required hardness, as otherwise, although the rails may satisfactorily pass all the usual tests required by the specification, there will soon arise, under the conditions of heavy train-loads now customary, serious trouble due to spreading heads and undue wear. American engineers, in their standard specifications, have already recognised the importance of this, and they vary their rail specifications according to the process of manufacture.

A paper on the ageing of mild steel was read by Mr. C. E. Stromeyer (Manchester). The idea that steel might go through an ageing process has been scouted, but from the tests described the conclusions to be drawn are that certain steels do possess ageing qualities, that some steels tend to improve with time, others to deteriorate; and that as yet the process which gives results which are most in harmony with practical experience is to plane the edges of two samples, to nick them with a specially prepared chisel, and then to bend one sample at once and the other after waiting some weeks or after boiling.

Mr. A. J. Capron (Sheffield) read a paper on induced draught, with hot air economisers, for steel works and blast-furnace boilers. Briefly, the system consists of induced draught in combination with hot air economisers, which utilise the waste heat from the boiler in heating the air required for combustion. A fan is placed at the base of the chimney and draws the gases, as they come from the boiler, through a series of tubes which form a heating-box or hot air economiser. The system has already been adopted at several iron and steel works, and is found to result in considerable economy of fuel and absence of smoke. There is also the advantage that no high chimney is required.

A paper on the distribution of sulphur in metal ingot moulds was contributed by Mr. J. Henderson (Stockton-on-Tees). The question of the distribution of sulphur in ingot moulds made of hæmatite pig iron was recently brought to his notice by the fact that several large moulds were alleged to contain an excessive percentage of sulphur out of all proportion to the sulphur contents of the pig iron from which the moulds were made. The fact that much more sulphur is generally found in the tops of ingot moulds and other large castings is, or should be, well known to all ingot-mould makers and users. Yet in spite of this it is evident that some steel makers drill the tops of the moulds in order to ascertain the sulphur contents, and on the results so obtained condemn the moulds as unfit for use in the open-hearth furnace for melting purposes when they are scrapped. Such a method of sampling is manifestly unfair, as the results obtained by the author show that the excessive sulphur does not go deeper than the first inch, and that after the second inch there is no reason to find fault with the composition of the mould.

A paper on sentinel pyrometers and their application to the annealing, hardening, and general heat treatment of tool-steel was contributed by Mr. H. Brearley (Riga, Russia) and Mr. F. C. Moorwood (Sheffield). An indicator which can, in most cases, be placed exactly on the spot the temperature of which is required to be ascertained may occasionally be more serviceable than a fixed pyrometer of a more expensive type which registers the temperature of its immediate vicinity only. By making the indicators from materials which clearly melt at or above a definite temperature, and, after melting, also continue to show when the temperature falls to or below that point, a simple means is discovered which may claim a place amongst instruments of precision. The authors suggest that, for this purpose, no more suitable materials could be adopted than well-chosen salts of the metallic oxides.

In a paper on carbon-tungsten steels contributed by Mr. Thomas Swinden (Sheffield), a research is described having for its object an investigation of the influence of varying percentages of carbon in the presence of a constant percentage of tungsten.

Reports on research work carried out by holders of Carnegie research scholarships were also presented. Mr. P. Breuil (Paris) gave the results of a systematic investigation of copper steels from the point of view of their industrial application. Mr. W. H. Hatfield (Sheffield), in a research on cast iron, found that there is undoubtedly occasionally a great variation in the strength of cast irons of the same composition as cast; that this variation does not appear to follow any distinct rule with regard to the temperature of the casting operations; that a difference in mechanical tests is generally accompanied by a difference in the microstructure; and that the inequalities of the metal can be rectified by judicious heat treatment, *i.e.* the irregularity need not persist after heat treatment, at any rate under certain conditions. Dr. O. Stutzer (Freiberg, Saxony) gave the results of an elaborate investigation of the genesis of the Lapland iron ore deposits, showing that the phosphoric magnetite deposits of north Sweden are all associated with plutonic rocks of the syenite family, and that they have been formed in a magmatic manner, and, indeed, either as magmatic separations *in situ* or as erratic magmatic segregation. Pneumatolysis has also had considerable influence in the formation of these ores.

Mr. E. F. Law (London) dealt with the non-metallic impurities in steel. His paper is the result of an examination of more than one hundred steels. The impurities have been considered as consisting of five in number, namely, iron sulphide, manganese sulphide, iron silicate, manganese silicate, and iron oxide. Iron sulphide very rarely occurs in commercial steels, and is therefore not considered at length. Manganese sulphide is always present in steel, and is usually harmless. The only instance in which it has been found to exert injurious influence on the quality of the steel is when it segregates with phosphide of iron in the form of "ghosts." Silicates of manganese and iron are frequently found in steel, and are highly injurious to the quality of the metal. In large forgings they sometimes occur in considerable masses, but in rolled steel they are distributed throughout the mass. In either case they are responsible for many failures. No indication of their presence is afforded by ordinary commercial means, and they can only be detected under the microscope. Oxide of iron frequently occurs in Bessemer steel. It occurs in a finely divided state, and there is evidence that it is soluble in steel. As a general rule, steels which on pickling evince a tendency to blistering are high in oxygen. The effect of hydrogen on steel containing oxide is discussed, and experiments were made with the view of determining the temperature at which the oxide is reduced. The results of these experiments tend to show that the oxide is reduced at 100° C. Iron oxide differs from other impurities present in its electrical behaviour, and the influence of this difference on the corrosion of iron and steel is discussed. It has been found that the presence of oxide accelerates corrosion, and corrosion of welded iron affords an illustration of this action. Other instances of the effects of the presence of oxide may be found in the pitting of boiler plates and tubes.

The last paper on the programme dealt with the nomenclature of iron and steel. This is the report of an influential committee of the International Association for Testing Materials which was presented by Prof. H. M. Howe (New York) and Prof. A. Sauveur (Harvard) at the Brussels congress of that association. It was then proposed that the report be submitted to the Iron and Steel Institute for consideration, and the secretary will be pleased to receive written comments for publication in the journal.

The meeting concluded with the usual votes of thanks to the Institution of Civil Engineers, proposed by the president and seconded by Sir John Alleyne, and to the president, proposed by Mr. G. Hawksley and seconded by Mr. Saladin (Le Creusot).

On Friday evening the annual banquet was held, with the president in the chair. Four hundred members were present, and the speakers were the Austrian Ambassador, the Swedish Minister, Sir James Kitson, Mr. Yves Guyot, Admiral Sir Cyprian Bridge, Sir C. E. Howard Vincent, Lord Justice Fletcher Moulton, and Mr. Robert Hammond.

CHIMÆROID FISHES.

A MEMOIR on "Chimæroid Fishes and their Development," by Prof. Bashford Dean, has been issued as Publication No. 32 of the Carnegie Institution of Washington. It begins with a short review of the researches in comparative anatomy and palæontology, which led to the view that chimæroid fishes are the most primitive vertebrates or the least modified descendants of the ancestral cranium- or jaw-bearing vertebrate; that, although shark-like, they are nevertheless widely distinct from the shark; and that altogether they represent a lower plane in piscine evolution.

Admitting the importance of the grounds on which these conclusions were based, Prof. Dean refers to the incomplete nature of the evidence. The material at the disposal of investigators was inadequate for the solution of the great morphological problems involved, and especially embryological material was extremely scanty or absent. The author himself failed for several years in his efforts to obtain satisfactory materials, until his attention was directed by President Jordan to the vicinity of the Hopkins Marine Laboratory at Monterey as a promising locality for collecting *Chimaera colliei*. Under the guidance of a Chinese fisherman, Ah Tack Lee, who not only possessed a perfect knowledge of the Chimæra grounds, but proved to be a keen observer of the habits of the fish, the author obtained hundreds of specimens of the adult fish and of ova. Such of the latter as were not required for immediate examination were placed in a case, which was then sunk, attached to a buoy, in water of about five fathoms, to obtain the much needed series of developmental stages.

After having given an account of the habits and mode of propagation of the Californian Chimæra, the author enters into a full description of its egg and capsule in comparison with the ova of other Chimæroids. This is followed by a detailed account of the various stages of development of the embryo and of the post-larval growth of the fish. Next the relationships of fossil Holocephales are considered. In the chapter on organogeny, the discussion of the obscure problem of the development of the dentition and of the homologies of its component parts in living and extinct forms will be studied with particular interest.

Anatomical, embryological, and palæontological evidence, then, appears to the author to be unmistakably in favour of Chimæroids being widely modified rather than primitive forms. The recent forms retain less perfectly the general characters of the ancestral gnathostome than do living sharks. On the other hand, they have retained several characters of their Palæozoic Selachian ancestors which modern sharks have lost. The ancestral Holocephali diverged from the Selachian stem near or even within the group of the Palæozoic Cestracionts, and the many features of kinship retained by the recent Chimæroids and Cestracionts distinctly point at this line of evolution.

The memoir is illustrated by 144 excellent text-figures and eleven plates.

BRITANNIC GEOLOGY.

FEW teachers have utilised the study of our own islands to greater advantage than Dr. Joseph H. Cowham, of the Westminster Training College. For thirty years past he has led his pupils over the varied country south of London, and the present writer is one of those who became pleasantly acquainted at an early date with his interest in scenery and his keenness for the details of a landscape. Dr. Cowham has published in "The School Journey" (Simpkin Marshall, pp. 80, price 1*s.*) an account of his methods, illustrated in the country between Croydon and Godstone; Mr. G. G. Lewis, a former pupil, describes an excursion in the Greenwich and Woolwich area; and Mr. T. Crashaw, another pupil, shows how a class may study erosion and deposition in river-courses on the banks of the Calder, in Lancashire. These expeditions appear to be wisely accepted as part of the regular school curriculum, instead of being relegated, as sometimes happens, to the holidays. Their effect in bringing together teacher and taught is rightly insisted on, and cannot be exaggerated; and the feeling is early engendered that the class-instruction in geography relates to something real and natural, which any eye can see and any willing brain can comprehend.

It is to such teachers, and to their pupils in later years, that the long-established Geologists' Association especially appeals. In part x. of its Proceedings (November, 1906, Stanford, price 1*s.* 6*d.*) Mr. R. S. Herries describes the geology of the Yorkshire coast between Redcar and Robin Hood's Bay, which was the scene of the long excursion of 1906. Especial interest here attaches to the estuarine representatives of the Middle Jurassic series, with *Equisetum columnare* "found upright in the sandstones as it originally grew," and to the zoning of the Lower Jurassic by the abundant ammonites. The valuable "Sketch of the Geology of the Birmingham District," by Prof. Lapworth, with a contribution on petrology by Prof. Watts and one on the glaciers by Mr. W. Jerome Harrison, has now been reprinted from the Proceedings of the Geologists' Association for 1898 (Cornish Bros., Birmingham, pp. viii+104, price 2*s.* net), and will serve as a guide for generations of students in

the Midlands. The region includes exposures of the famous Permian boulder-beds (pp. 60–64), on which we should now like the opinion of some South African geologist.

The Geological Survey of the United Kingdom, which is intent on bringing the knowledge of our own islands up to date, issued two memoirs, with accompanying colour-printed maps, at the close of 1906. In one, Mr. W. A. E. Ussher describes the country between Wellington and Chard (Memoirs of the Geological Survey, "Explanation of Sheet 311," pp. vi+68, price 1*s*. 3*d*.). The map, Sheet 311 of the new series, centres in the interesting watershed of the Black Down Hills, where the streams running south and west have cut through a plateau of Cretaceous rocks into the underlying Trias. The westward extension of the Selbornian beds (largely of Albian age) beyond the Rhætic and Jurassic, and their striking unconformity with these earlier strata, form interesting features in the map. The "clay with flints" appears for the first time in this region as "in part Eocene." The difficulty of selecting colours for superficial deposits which will suit all areas of our complex island is seen in the resemblance between "valley gravel and rainwash" and Triassic strata. In the index, however, this resemblance is greater than in the actual map. In the memoir we touch the work of many previous writers, including De la Beche and Fitton, and have the advantage of the views of Mr. Jukes-Browne on the correlation of the Cretaceous series.

Puckered slate showing "strain-slip," north-end of Watergate Bay, Newquay, Cornwall.

In the second memoir ("Explanation of Sheet 346. The Geology of the Country near Newquay," pp. iv+132, price 3*s*.), Messrs. Clement Reid and Scrivenor describe an area in which the interest ranges from the Pliocene outlier of Saint Agnes to partly abandoned tin and copper mines. The close relation between the lodes and the metamorphic aureole of intrusive granite is at once obvious on the map. The economic section and appendix, the latter by Mr. D. A. Macalister, justly occupy forty-eight pages of the memoir. The granite cuts rocks of Lower Devonian age, which are now coloured on the map in tints of grey. The old familiar brown colour appears in the area of beds, now known to contain Pteraspis, near St. Mawgan, above which undoubtedly marine strata prevail. Interesting veins containing axinite are described by Mr. Flett in association with certain intrusive greenstones. They are attributed to "pneumatolytic" action, such as promoted the formation of tourmaline in other places, and are thus connected with the intrusion of the granite. These garnet-axinite-augite-epidote veins are held to have occurred where lime-silicates or patches of impure carbonate of lime were provided by the greenstones. The post-Carboniferous earth-movements have produced conspicuous cleavage and cross-cleavage in the Devonian shales of Watergate Bay, whereby the original bedding is at times entirely lost. Plate iii. is here reproduced, as a particularly beautiful example of cleavage-planes with secondary puckering, and no trace of true stratification.

The Geological Survey of Ireland has issued a memoir on "The Geology of the Country around Limerick," by Mr. G. W. Lamplugh and the staff of the Survey, as constituted at the time of its transfer to the Department of Agriculture and Technical Instruction (Dublin, 1907, pp. vi+120, price 2*s*.). The drift edition of parts of Sheets 143 and 144, forming a special colour-printed map with Limerick nearly in the centre, is issued simultaneously, price 1*s*. 6*d*. The area is largely covered by Boulder-clay, but includes exposures of the interesting volcanic and intrusive rocks that are here associated with the Carboniferous Limestone. The seven photographic plates by Mr. H. J. Seymour illustrate all the important rocks of the district, and include a good example of beds of limestone carried bodily forward in Boulder-clay from the area surveyed by the author of the plate. Though the main object of the memoir was the description of the superficial deposits, a number of new observations on the underlying rocks have been added by Mr. Kilroe. The same writer has dealt with the economic geology, and particularly with the soils and subsoils.

THE COATS OBSERVATORY, PAISLEY.[1]

THIS observatory, the establishment and maintenance of which are entirely due to the munificence and public spirit of the Coats family, is situated about seven miles to the westward of Glasgow. From a meteorological point of view it occupies a very important position, being in the path frequently taken by the storms coming from the Atlantic Ocean. The observatory is now fully equipped with ordinary and self-recording meteorological instruments; there was, however, at first no intention of carrying on meteorological work, but Mr. Thomas Coats before his death, in October, 1883, having provided a standard barometer and thermometer, the committee of management afterwards supplied other instruments, and with these observations were regularly taken morning and evening. The records are preserved by the Paisley Philosophical Institution; readings have been transmitted monthly to the Scottish Meteorological Society, and the results are also separately published by the institution. The observatory was originally established for astronomical purposes, and was placed under the care of the Philosophical Institution. Mr. Thomas Coats generously offered to relieve the society of all expense in the matter, and to provide a suitable building, and he expressed the hope that the establishment would "prove a stimulus to interest the rising generation of the town and neighbourhood in the study of astronomy—a science little understood among us, but which may, under the leading spirits of our Philosophical Institution, become a subject of instruction that will be eagerly sought after." He endowed the institution with the sum of 2000*l*. in trust, and the observatory was opened to the public on October 1, 1883. We are indebted to the Philosophical Institution for the accompanying illustration of the observatory.

The original design was enlarged by the founder, who supplied a transit instrument, clocks, &c., and after his death his representatives intimated their desire to render the equipment still more complete, and added another

[1] "The Coats Observatory, Paisley; its History and Equipment." By Rev. A. Henderson. Pp. 48. (Paisley: J. and E. Barlake.)

2000*l.* to the endowment fund. The necessary alterations to the buildings were carried out at the expense of Mr. James Coats, who between 1892 and 1898 increased the fund by 6000*l.*, making it 10,000*l.* in all, and also made important additions to the equipment. Milne and Ewing seismographs, magnetometers, and other instruments were also ordered, rendering the observatory one of the most completely furnished in the kingdom. The seismographic observations for the year 1906 show that eighty-two earth movements were recorded.

The following results, taken from the meteorological observations for the twenty-two years 1885–1906, are interesting:—highest reading of barometer 31·002 inches, on January 9, 1896; lowest, 27·584 inches, on December 8, 1886; maximum temperature, 88°·6, on September 1, 1906; lowest, 4°·8, on February 10, 1895 (1°·0 was quoted by the institution on January 17, 1881). The mean annual rainfall is 38·29 inches, the average number of rain-days being 212; the rainfall in 1903 was 69·57 inches, and in 1896 only 24·45 inches. Polar winds prevail, on

The Coats Observatory, Paisley.

an average, on 131 days, and equatorial on 206 days in the year.

The meteorological observations have from the beginning been taken by the curator, Mr. Donald Maclean, formerly assistant to Prof. Grant, at the Glasgow Observatory.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Dr. A. Hill has announced his intention of resigning the mastership of Downing College some time during the long vacation. Dr. Hill succeeded the late Dr. Burkitt some nineteen years ago. He is lecturer in advanced human anatomy, and is the sole representative of medicine and natural science amongst the heads of houses.

The general board of studies will shortly proceed to the appointment of a reader in forestry for a period of five years from October 1, 1907. The annual stipend is 400*l.* Candidates are requested to send in their applications, with such testimonials as they think fit, to the Vice-Chancellor on or before July 15.

The syndicate appointed to obtain plans for the extension of the Cavendish Laboratory has obtained tenders from nine firms. The lowest tender, 7135*l.* (including a provisional sum of 500*l.* for the cost of heating), was that of Mr. W. Sindall, of Cambridge. The syndicate now recommends that the Vice-Chancellor be authorised to accept the tender of Mr. Sindall. The cost of this extension will be largely met by Lord Rayleigh's munificent gift to the University of the Nobel prize.

The syndicate appointed to obtain plans for the extension of the chemical laboratory has laid its scheme before the Senate. It is proposed to fill in the gap which now exists along Pembroke Street between the medical school and the existing chemical laboratory with a three-storied building. This will provide for a large increase to the elementary laboratory, a number of smaller laboratories, and a lecture-room to seat 150 students. The cost is estimated at 13,500*l.*, and in view of the facts that in the last three years the average attendance at the University laboratory has increased from less than 200 students to more than 300 a term, and that Gonville and Caius College proposes to close its laboratory next summer, the building of the extension is urgent. The syndicate learns with regret that Prof. Liveing, who was elected in 1861, proposes to vacate the chair of chemistry some time next year. During the forty-six years he has been professor, the study of chemistry has made great advances in the University. Under his care and control the new chemical laboratory was built in 1887. The success which has attended the school at Cambridge is largely due to his untiring energy and his unselfish devotion to his subject.

The Common Seal of the University has been affixed in the presence of the Vice-Chancellor to:—(1) the certifi-

cate of appointment of Prof. Seward to represent the University at the celebration of the 300th anniversary of the death of Ulisse Aldrovandi to be held at Bologna in June; (2) the address to the Royal Swedish Academy of Sciences, Stockholm, in honour of the commemoration of the bicentenary of the birth of Linnæus to be held at Stockholm in May; (3) the certificate of appointment of Mr. F. Darwin to represent the University at the celebration of the bicentenary of the birth of Linnæus to be held at Stockholm in May; and (4) the certificate of appointment of Dr. Harmer, Mr. W. Bateson, and Mr. A. E. Shipley to represent the University at the seventh International Zoological Congress to be held in Boston in August.

MANCHESTER.—Mr. H. Bateman has been elected to the readership in mathematical physics, endowed by Prof. Arthur Schuster to encourage research in mathematical physics, and to which we recently directed attention (NATURE, January 24, vol. lxxv., p. 309). Mr. Bateman is a fellow of Trinity College, Cambridge, and was senior wrangler (bracketed), 1903; Smith's prizeman, 1905. He has already published a number of important mathematical contributions. His work in this new post will be followed with interest.

Prof. Ernest Rutherford, F.R.S., is to arrive from Montreal on May 24.

A new departure has been made in the publication of a special prospectus of advanced studies in the faculties of arts and science. A brief account is given of the provision for research in the different departments, as also of the courses of lectures, arranged for the session 1907–8, suitable for post-graduate study. It is hoped in future years to extend the scope of this prospectus so as to give a more extensive record of the resources of the University for advanced study and research.

Mr. C. G. Hewitt has been appointed to the recently founded lectureship in economic zoology.

OXFORD.—The following is the text of the speech delivered by Prof. Love in presenting Prof. A. Graham Bell for the degree of D.Sc. *honoris causa* on May 2:—

Adest Alexander Graham Bell, origine quidem Scotus, diu apud Americanos scientiæ promovendæ dux et auctor probatissimus. Qui vir cum primo Physiologiæ Professor esset, dum surdidatis causas et naturam diligentissime expendit, instrumenta quædam arte exquisita effinxit quibus surdi audientium more clara voce loqui docerentur: ita miserorum qui hoc incommodo laborant ægritudines aliqua ex parte relevavit. Idem mox longius progressus latiorem apud homines gloriam adeptus est. Hic ille est qui miraculum illud excogitavit, usu cotidiano iam notissimum, ut ipsa loquentis verba et vivam hominis vocem super montes altissimos et flumina latissima per immensos terrarum tractus et sub ipso Oceano transmittere et, ut aiunt, τῇλε φωνεῖν possemus. Virum igitur iure laudamus cum doctrina tum repertis præclarum, qui non solum mortalium commodis naturæ vim inservire coegit sed miseris et mærentibus malorum solamen obtulit.

In a Convocation held in the Sheldonian Theatre on Saturday, May 11, Lord Curzon was admitted and installed as Chancellor of the University. After his installation he conferred the honorary degree of D.C.L. on the Hon. F. R. Moor, Premier of Natal.

An election to the Philip Walker studentship in pathology will be made in October next. The studentship is of the value of 200*l*. a year for three years. Candidates may be of either sex, and need not be members of the University of Oxford. They are asked to send in their applications, with three testimonials, to the Registrar of the University by September 14.

THE *British Medical Journal* announces that Prof. August Bier, of Bonn, has accepted a call to the chair of surgery in the University of Berlin, vacant by the death of Prof. Ernst von Bergmann.

THE first annual conference of the Association of Teachers in Technical Institutions will be held in Leeds on May 23, 24, and 25. On Friday, May 24, the following papers will be read:—(1) Notes of an educational visit to the United States of America, H. Ade. Clark; (2) the preliminary training of technical students, Barker North; (3) syllabuses and examinations as applied to building subjects, J. Fitzgerald. Excursions, social meetings, and visits to works will form an attractive part of the meeting.

THE Royal College of Surgeons in Ireland has sanctioned two post-graduate courses to be held annually in Dublin hospitals during the summer. The first course will extend from June 10 to July 2, and the second from September 23 to October 15. The object of these courses is to render available the whole of the clinical material in Dublin for the post-graduate student, so that he may see as much as possible during the brief time at his disposal. Ten general hospitals are included in the list of institutions at which the student may work, as well as hospitals devoted to special subjects. The tickets for the courses admit to the ordinary clinics of all the hospitals, as well as to the special work of the course. Further information can be obtained from, and all applications should be addressed to, Prof. Fraser, Royal College of Surgeons, Dublin.

JUDGED in the light of the results of recent examinations of the Punjab University, the study of science does not seem, says the *Civil and Military Gazette*, to be making much headway in the Punjab. Many years ago the Punjab University arranged a faculty of science with the usual matriculation, intermediate, and bachelors degree tests. A few years ago an additional test was established, viz. that for the degree of master. In 1907, whilst 3546 went up for the matriculation examination in the faculty of arts, only fifty-eight appeared in the similar examination in the faculty of science. Thirty-seven went up for the intermediate examination of the science faculty against 674 who appeared in the same examination in the faculty of arts; whilst the number of candidates in the B.A. examination was 341, only thirteen went up for the same examination in the faculty of science. This comparative neglect of scientific studies is much to be regretted, especially in India, where the object of university education is to effect a combination of the highest results of Western culture and science with the learning of the East.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 7.—"Electric Furnace Reactions under High Gaseous Pressures." By R. S. **Hutton** and J. E. **Petavel.**

Two steel chambers of 20 litres and 2 litres capacity respectively provided with valves, windows, and insulated electrode holders have been constructed and employed at working pressures up to 200 atmospheres. Inside these pressure vessels any desired arrangement for arc or resistance heating is mounted.

Apart from the influence of pressure, which was the primary object of the investigation, special attention was paid to the effect of the nature of the gaseous atmosphere upon the reactions.

Some measurements were made of the electrical constants of carbon and metal arcs in different gases at high pressures, and the rate of oxidation of heated metals was also considered. With a charge of 10 kilos. of lime and carbon the preparation of calcium carbide was studied in atmospheres of carbon monoxide, coal gas, and hydrogen under reduced and high pressures. Contrary to expectation, no unfavourable influence of carbon monoxide upon the yield was noticeable, the back reaction being limited to the surface.

Silica fused under pressure exhibits a marked decrease in vaporisation, but no appreciable increase in fluidity and transparency. The production of carborundum under pressure is much limited, owing to this decreased volatility of silica.

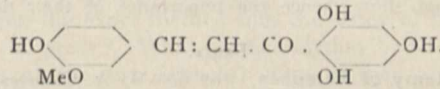
The authors, as a result of a long, detailed, investigation of the reduction of alumina, conclude that this oxide is reducible by carbon at all temperatures above the melting point, but the metal is set free in the form of vapour, and

can only be collected if it be protected from reaction with carbon monoxide.

Having overcome the difficulties of maintaining an electric arc in highly compressed air, it is shown that the production of oxides of nitrogen exhibits an increased efficiency attributable to pressure.

Linnean Society, April 18.—Dr. A. Smith Woodward, F.R.S., vice-president, in the chair.—The œcological functions of stolons and cleistogamous flowers: J. C. **Shenstone.** The author pointed out the advantages to the plants by the colony-forming habit, such as its more certain pollination and greater power of holding its own against competitors, instancing as examples *Bellis perennis*, *Thymus Serpyllum*, and *Mercurialis perennis*. Further examples were dwelt upon in the cases of *Urtica dioica*, *Adona Moschatellina*, and the violets, *Viola odorata* and *V. canina*, where both stolons and cleistogamous flowers cooperate in keeping the colonies compact.—The conservation of existing species by constitutional or physiological variation giving greater power of adaptation without perceptible change of structure: A. O. **Walker.** The author referred to a supposed case of two healthy men going to an unhealthy climate: one, proving immune to the local diseases, might conceivably transmit that quality to his children; the other, falling a victim to the climate, would leave no descendants. As instances he brought forward the case of *Crepis taraxacifolia*, long known in Wales as a rarity, which in 1896 onwards became extremely abundant at Colwyn Bay. He considered that this might be accounted for by a different variety, morphologically identical, yet physiologically distinct, having been introduced, which, by its ability to adapt itself to its surroundings, had rapidly extended its area of growth. Another case was of *Cardamine pratensis*, usually stated to grow in moist meadows, which is accurate as regards North Wales, but in Kent its favourite habitat is coppice woods, the second year after cutting the undergrowth. It is frequent on dry banks, on masses of roots of trees or shrubs, probably as xerophilous a station as could be imagined.—An aberrant Coccid: Hugh **Scott.** The species of Coccid, or scale-insect, described was found at the northern border of the Algerian Sahara by Mr. J. J. Lister.—Some results of inoculation of leguminous plants: Prof. W. B. **Bottomley.** In May, 1906, experiments were begun; tares, *Vicia sativa*, were chosen, and inoculated seeds set in sterilised sand, to which the requisite potash and phosphate salts had been added. A second set of pots were prepared with untreated seed, but besides the potash and phosphate, nitrate of soda proportionate to 2 cwt. per acre was added. In the last week of July the results were tested and found to be:—tares, with nitrate of soda, yielded 1·92 per cent. nitrogen; tares, inoculated, yielded 3·07 per cent. nitrogen, showing that the latter contained more than 50 per cent. more nitrogen than those grown with nitrate of soda, the food value being correspondingly increased. Specimens of field crops were obtained from Scotland to check these results, in September, and the three experimental plots proved:—Section A, no nitrogenous manure, 3·41 per cent. nitrogen; Section B, nitrate of soda, 3·75 per cent. nitrogen; Section C, inoculated, 4·04 per cent. nitrogen. Here the differences are less, due to the fact that farm soil invariably contained a certain number of the nitrogenic bacteria, which accounted for these results. Section B showed a yield of 9 tons 8 cwt. per acre, and Section C (inoculated) showed 12 tons 5 cwt. of fodder.

Chemical Society, May 2.—Sir William Ramsay, K.C.B., F.R.S., president, in the chair.—The chemical action of the radium emanation, part i., action on distilled water: Sir W. **Ramsay.** The action of the emanation alone on water decomposes it into explosive gas, mixed with excess of hydrogen; it has been shown that the emanation, when mixed with explosive gas, causes re-combination, and the rate at which the decomposition of water takes place has been measured. The reason of the excess of hydrogen has not yet been elucidated.—Freezing-point curves of the menthyl mandelates: A. **Findlay** and Miss E. M. **Hickmans.** From a study of the freezing-point curves for mixtures of *l*-menthyl *l*-mandelate and *l*-menthyl *d*-mandelate, it is found that *l*-menthyl *r*-mandelate exists as a definite, partially racemic compound having a stable melting point of 83°·7. It was also pointed out that other freezing-point curves indicate the existence of true racemates in the liquid state.—The constitution of homo-eriodictyol. A crystalline substance from eriodictyon leaves: F. B. **Power** and F. **Tutin.** Homo-eriodictyol, $C_{16}H_{14}O_6$, is isomeric with hesperitin, and similar to the latter in many of its properties, contains one methoxyl group, yields a tetra-acetyl derivative, and is hydrolysed by aqueous potassium hydroxide to phloroglucinol and ferulic acid. From these results it is concluded that homo-eriodictyol must possess the following constitution,



Eriodictyol, $C_{15}H_{12}O_6$ (m.p. 267°), a crystalline substance, which was also isolated by the authors from eriodictyon leaves, contains no methoxyl group. Homo-eriodictyol is probably a methyl ether of eriodictyol.—The relation between valency and heats of combustion. Preliminary note: G. **Le Bas.** The heat of combustion of a substance may be regarded as made up of (*a*) an absorption of heat due to the dissociation or decomposition, and (*b*) an evolution of heat due to the combination of the isolated atoms with oxygen. A study of molecular heats of combustion reveals the following law, which appears to be generally valid. The heat of combustion of an organic compound is equal to the heats of combustion of its possible dissociation products. The factor (*a*) is negligibly small as compared with (*b*). The heats of combustion of organic compounds in most cases are found to be the same as those of saturated and unsaturated hydrocarbons and hydrogen, or of mixtures of these. Similarly the factor (*a*) is negligibly small as compared with (*b*) in the case of the saturated and unsaturated hydrocarbons, and therefore their heats of combustion are sensibly those of their isolated atoms, *plus* an excess for the latter, owing to unsaturation. These relations lead to a second law which applies to all the hydrocarbons. The molecular heats of combustion of the hydrocarbons are proportional to their valency numbers.—The velocity of hydrolysis of aliphatic amides by alkali: J. C. **Crocker** and F. H. **Lowe.** The reactions of the aliphatic amides with sodium hydroxide are shown to follow the bimolecular relation

$$K = \frac{l}{\alpha l}\left[\frac{l}{c} - \frac{l}{c^3}\right],$$

where α is the degree of dissociation of the alkali.—The addition of iodine to acetylenic acids: T. C. **James** and J. J. **Sudborough.**—The chemical changes induced in gases submitted to the action of ultra-violet light: D. L. **Chapman,** S. **Chadwick,** and J. E. **Ramsbottom.** Dry carbon dioxide is decomposed by ultra-violet light. The rate of contraction of a mixture of carbon monoxide and oxygen is practically independent of the degree of desiccation of the gases, due to the fact that, though the presence of moisture causes the rate of formation of carbon dioxide to rise, it results in an equivalent reduction in the yield of ozone.—Studies of the perhalogen salts, part i.: C. K. **Tinkler.**—The interaction of cyanodihydrocarvone, amyl nitrite, and sodium ethoxide: A. **Lapworth** and E. **Wechsler.**—Contributions to the chemistry of oxygen compounds, ii., the compounds of cineol, diphenylsulphoxide, nitroso-derivatives, and the carbamides with acids and salts: R. H. **Pickard** and J. **Kenyon.**

DUBLIN.

Royal Dublin Society, April 23.—Prof. J. A. McClelland in the chair.—Pleochroic halos: Prof. J. **Joly.** The paper is descriptive of more extended observations on the subject. Both in cordierite and biotite the halos attain a like maximum radius, and appear only formed around strongly radio-active enclosures. Their origin appears to be referable to some action of the α rays. In the radial dimension it is found to agree with Rutherford's measurements of the effective range of these rays in matter of similar density.—The quantitative spectra of barium, strontium, calcium, magnesium, potassium, and sodium: Dr. James H. **Pollok** and A. G. G. **Leonard.** The

authors showed photographs of the spark spectra of solutions of these elements, using gold electrodes in the manner described in a previous paper, and the progressive disappearance of the lines on continued dilution was noted, the lines surviving with 1 per cent., 0·1 per cent., 0·01 per cent., and 0·001 per cent. of the element being tabulated. The paper is part of a scheme of work designed to facilitate the use of the spectroscope in its application to ordinary analytical work. The residuary or most persistent lines of an element are not necessarily the most intense as ordinarily tabulated, and when only a small quantity of an element is present it is only those residuary lines that show, hence the importance of their determination.

PARIS.

Academy of Sciences, May 6.—M. A. Chauveau in the chair.—Study of the variations in the solar radiation: H. **Deslandres.** After a discussion of the existing state of knowledge in this subject, the author concludes that the continuous study of the distribution of brightness over the surface of the sun should be organised with great care; if it does not furnish the intensity of the variation of the radiation, it shows the existence of this variation, or at least the existence of important disturbances, in a certain and rapid manner.—An extension of the Friedel and Craft reaction: A. **Haller** and A. **Guyot.** A description of the use of aluminium chloride in the condensation of secondary amines and numerous organic substances. Among the reactions studied are indigotin and dimethylaniline, benzil and dimethylaniline, orthodibenzoylbenzene, ethylphenylglyoxylate, benzophenone, isatin, all with the same base, and other condensations with diethylaniline.—The zoological position, the affinities and development of Peneides of the genus Funchalia: E. L. **Bouvier.**—The direct hydrogenation of the fatty isocyanides: Paul **Sabatier** and A. **Mailhe.** In the presence of reduced nickel at a temperature of 160° C. to 180° C., the primary reduction product of the carbamine R.N : C is the amine $R.NH.CH_3$. Some secondary amines are obtained as bye-products.—Study of the relations between the solar activity and the magnetic and electrical variations recorded at Tortosa, Spain: MM. **Cirera** and **Balcells.** A discussion of the records for the first three months of the present year.—Differential equations of the second and the first degree the general integral of which is with fixed critical points: Bertrand **Gambier.**—Certain congruences of lines: Ch. **Michel.**—An automatic damping arrangement for the rolling of ships: V. **Crémieu.**—Plurivalent atoms: Henri **Pellat.** By admitting the hypothesis that a plurivalent atom consists of a collection of as many monovalent atoms as there are units of valency, numerous facts in electrolysis can be explained.—A speaking condenser: Timoléon **Argyropoulos.**—Wireless telegraphy: L. **Torres.** A discussion and criticism from the point of view of priority of a recent note on the same subject by M. Gabet.—The absolute atomic weight of bromine: Gustavus D. **Hinrichs.** A re-calculation of the analytical determinations of Baxter, from which the value 80·00 is obtained instead of the value 79·953 deduced by Baxter.—The application of the method of limiting densities to the permanent gases at 0° C.; the gas constant for perfect gases: Philippe A. **Guye.** From a critical discussion of the experimental data, the author concludes that the gas constant is not strictly constant, but increases with the critical temperature of the gas, and varies 1/2800 between hydrogen and nitric oxide. This variation is regular, and can be represented by the formula $R = 22{,}410(1 + 10^{-8}T_c^2)$.—Inactive dilactic acid: E. **Jungfleisch** and H. **Godchot.**—Decahydronaphthylketone-α and decahydronaphthylamine-α: Henri **Leroux.**—The origin of serpentine and the crystallophyllian series of Aveyron and Gard: Jules **Bergeron.**—The culture of the forage Leguminosæ: J. **Dumont** and Ch. **Dupont.**—Sucrase in musts of apples and ciders: G. **Warcollier.**—The nuclear evolution of the schizonte of *Aggregata Eberthi*: L. **Léger** and O. **Duboscq.**—The origin of the zonal anodian blastoderms: Jan **Tur.**—Researches on the labic activity of the gastric mucus and on the supposed specific labogenic action of milk: Maurice **Dehon.**—The re-establishment of the pulsations of the heart in fibrillation: H. **Kronecker.**—The law of the hæmolytic effect of the Becquerel rays: C. J. **Salomonsen** and G. **Dreyer.**—The experimental reproduction of granular conjunctivitis in the ape, *Macacus sinicus*: C. **Nicolle** and M. **Cuenod.**—The organisation and systematic position of the genus Sezannella: René **Viguier.**

DIARY OF SOCIETIES.

THURSDAY, MAY 16.

ROYAL INSTITUTION, at 3.—Spectroscopic Phenomena in Stars, (2) Motion: H. F. Newall, F.R.S.

CHEMICAL SOCIETY, at 8.30.—The Relation Between the Crystalline form and the Chemical Constitution of Simple Inorganic Substances: W. Barlow and W. J. Pope.—Experimental Investigation into the Process of Dyeing: J. Hübner.—Some Derivatives of β-Pyranol allied to certain Derivatives of Brazilein and Hæmatein, Preliminary Communication: W. H. Perkin, jun., and R. Robinson.—Mixed Semi-ortho-Oxalic Compounds: G. D. Lander.—The Mechanism of Bromination of Acylamino-compounds, Preliminary Notice: J. B. Cohen.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Present State of Direct Current Design as Influenced by Interpoles: F. Handley Page and Fielder J. Hiss.

FRIDAY, MAY 17.

ROYAL INSTITUTION, at 9.—Seiches in the Lakes of Scotland: Prof. George Chrystal.

THURSDAY, MAY 23.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: 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 Relation of Thallium to the Alkali Metals: a Study of Thallium Sulphate and Selenate: Dr. A. E. H. Tutton, F.R.S.—On the Frictional Resistances to the Flow of Air through a Pipe: J. H. Grindley and A. H. Gibson.—Chemical Reaction between Salts in the Solid State: Dr. E. P. Perman.—Studies on Enzyme Action, IX., The Nature of Enzymes: Prof. H. E. Armstrong, F.R.S., and Dr. E. F. Armstrong.—Studies on Enzyme Action. The Enzymes of Yeast: Amygdalase: R. J. Caldwell and S. L. Courtauld.

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

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—The Present State of Direct Current Design as Influenced by Interpoles: F. Handley Page and Fielder J. Hiss.—Hot Wire Watt Meters and Oscillographs: J. T. Irwin.

FRIDAY, MAY 24.

ROYAL INSTITUTION, at 9.—Recent Contributions to Electric Wave Telegraphy: Prof. J. A. Fleming, F.R.S.

LINNEAN SOCIETY, at 8.—Anniversary Meeting.

PHYSICAL SOCIETY, at 5.

CONTENTS.