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## EXPERIMENTAL EMBRYOLOGY.

*Experimental-Zoologie.* Part i. Embryogenese. Eine Zusammenfassung der durch Versuche ermittelten Gesetzmässigkeiten tierischer Ei-Entwicklung (Befruchtung, Furchung, Organbildung). By Dr. Hans Przibram. Pp. 125; 16 plates. (Leipzig und Wien: Franz Deuticke, 1907.) Price 7 marks.

SOME three years ago Dr. Przibram, who is well known as a brilliant representative of the school of experimental zoologists, published "An Introduction to Experimental Morphology," which met with wide acceptance. The present volume is an expansion of part of the "Introduction," and forms an independent treatise on experimental embryology. It is to be followed by four other parts, dealing with regeneration, evolution, vitality, and function, and the whole will form a text-book of experimental zoology. If the subsequent parts are like the one before us in lucidity and thoroughness, Dr. Przibram will earn the gratitude of all interested in this dynamic aspect of the science; and who, nowadays, can afford to stand aloof? The present volume discusses, in the light of experimental results, the processes of fertilisation, cleavage, gastrulation, and differentiation, and sums up in an analysis of the influence of chemical stimuli, moisture, density of the medium, pressure, gravity, electricity and magnetism, light and heat. There is a copious and carefully executed bibliography, and the figures in the plates, which are partly compiled and partly original, are very clear and interesting.

The author discusses large and difficult problems, in regard to which there is room for considerable difference of opinion, but his treatment of these is thoroughly objective and undogmatic. We cannot do better than give some samples of his general conclusions. Fertilisation, whether artificial or spermatocytic, brings about a withdrawal of water from the egg; this accelerates the vital processes which are going on of themselves, and the egg passes from a relatively resting state to progressive development. The unfertilised egg has an organisation of different kinds of substances which guarantees the forthcoming manifoldness. The direction of the first cleavage is in a plane at right angles to the axis of the first karyokinetic spindle, and the position of the latter is determined by the geometrical architecture of the egg and the fertilisation-meridian (on which the spermatozoon enters).

In regard to the familiar sequence of centrosome division, astrosphere formation, nuclear division, cytoplasmic division, and perhaps also the progressive differentiation of the blastomeres, we must not suppose that any particular link in the chain is the necessary cause of the next link; we must rather suppose that a common cause evokes them in succession, and that their cooperation secures the typical development. Provisionally we may say that the common cause of the mitotic phenomena lies in a localised change in

the fluidity of the enchylemma and the associated rearrangement of a monocentric into a dicentric surface-tension-system. The second and subsequent cleavages depend on a rhythmic recurrence of the metabolic relations involved in the first cleavage (the entrance of oxygen conditioning the continuance of the metabolism, the intensity of which changes with the changes in the proportion of absorbent surface to assimilatory volume), and on the presence of antagonistic substances, which partly prevent the complete separation of the blastomeres (calcium), and partly secure a certain cohesion (sodium).

The arrangement of the blastomeres depends on Plateau's law of the smallest surface, modified by differences in the consistence of different parts of the ovum, which are also responsible for the different sizes of the blastomeres (Balfour's law). Blastulation and gastrulation depend on chemotactic influences, which are set at work by metabolic processes, and admit not only of passive-mechanical displacements, but of active migrations as well. In different zones of the egg there are chemically different substances which normally condition the differentiation of the various organs. Thus the blastomeres acquire a prospective value. If there is no rearrangement of material, an artificial fractioning of the egg is followed by a self-differentiation of the fragments, so that semi-embryos, quarto-embryos, and so on, result; but if a re-arrangement is effected, restoring the *status quo* of the intact ovum, then dwarf complete embryos result. The prospective potency of such blastomeres is greater than their prospective value. The influence of external factors is subsidiary when compared with the internal formative factors, and animal embryogenesis may be described as an almost quite perfect self-differentiation in Roux's sense.

We have stated these general conclusions because of their great interest, but it must be noted that the bulk of the book is a terse statement of concrete facts from which the expert student may draw his own conclusions, and at this stage that is well.

J. A. T.

## GEOLOGICAL REVIVALISM.

*Geologische Prinzipienfragen.* By E. Reyer. Pp. x+202. (Leipzig: W. Engelmann, 1907.) Price 4.40 marks.

THIS work recalls, with renewed interest, a remarkable paper by Mr. Reyer on the Schlossberg of Teplitz, to which the attention of the present writer was directed by Prof. Judd nearly thirty years ago. Are not some of Reyer's models still preserved in London, and have not these models, and respectful visits to the Schlossberg itself, influenced many of us in our attempts at teaching ever since? Mr. Reyer, however, when he went further into the theory of the formation of mountains by the protrusion of masses from below and the gliding of the superincumbent layers, found the geological world opposed to him, and he turned, as he now informs us (p. v.), to fields of sociological activity. Yet he should surely be satisfied with the numerous references to his

work, especially on volcanic questions, in Zittel's "History of Geology" or Geikie's monumental "Text-book." Ampferer's recent exposition of "Unterströmung," moreover, as a cause of mountain-crumpling comes very near in many of its details, though not in its foundations, to Reyer's theory of superficial "Strömung" (see *NATURE*, vol. lxxvi., 1907, p. 423). Though Ampferer quotes very few authorities, it seems likely that Reyer's views are still fruitful, even if they bear forbidden fruit. At any rate, we may welcome his return to the arena at a time when no champion can assert that his own views on mountain-building have satisfied all known conditions.

Mr. Reyer himself, in this clearly-written treatise, proposes to leave his statements and arguments unburdened by a bibliography. The numerous illustrative diagrams suggest in most cases drawings made from models, and some of them represent the results of experiments performed in plastic materials. There is a freshness of exposition that brings home to us many facts that are familiar, but which are often liable to be passed over without adequate consideration. The exposition itself is, if we may say so, diagrammatic. The author points out very early how delta-deposits slide upon the rocks beneath them, and how a loose valley-side moves out towards the river, which carries away the material, and thus renders the land-flow less apparent. From p. 52 onward we read of massive extrusions of material from the molten interior of the earth, and we remember the sliding of the deltas when we are asked to picture successive extrusions as lifting the crust above them and allowing of a lateral slip of the ruptured sedimentary layers. The great difference between these postulated extrusions and our common notions of intrusive bodies appears to lie in their long-continued and successive character, whereby a later igneous mass causes a previous one to bulge up and swell out as a coat, through which the later mass may break. It is urged that if this occurs below a deep ocean, the extruded matter may become as crystalline as granite, and subsequent sediments may be laid down on it with a false appearance of having been invaded.

All this should probably be kept in mind, but we doubt if the average field-observer has been so often misled as Mr. Reyer would wish us to believe. He opposes the idea of the differentiation of a common igneous magma (p. 61), since acid and basic magmas must have separated early in the history of a cooling globe, and massive protrusions are likely to mix them up again, so as to produce the phenomena observed. Such protrusions or extrusions are held to be sufficient to explain the existence of infolds of sediments between adjacent igneous masses (pp. 69 and 155); and an admitted revival of the "crater of elevation" theory appears on p. 73. There is much in the book that is in pleasant accord with the views consistently maintained in Britain in regard to the relations of various types of igneous rock; and the principle of successive extrusions (or may we say intrusions?) has been adopted, to mention only two examples, by Prof. Sollas for

the Leinster Chain and by Dr. Harker for the gabbros of the Cuillin Hills.

Mr. Reyer's views cannot fail to make us think more carefully, and we trust that his book will be widely read by those who have to interpret the history of great regions of the crust. We may hereafter be grateful to him for maintaining the theory of gravitational gliding (pp. 142, 147, &c.) as opposed to the crumpling of strata by lateral thrust against the influence of gravitation. In this respect he has relighted a very ancient candle, which burnt brightly in Scrope's hands in 1825 ("Considerations on Volcanos," pp. 201-2). It will now, in all probability, never be entirely put out. GRENVILLE A. J. COLE.

#### HYDRAULICS.

*Hydraulics.* By F. C. Lea. Pp. xii+536. (London: Edward Arnold, 1908.) Price 18s. net.

WHATEVER may be the extent to which the science of hydraulics was neglected during the century which elapsed between the theoretical researches of Bernoulli and the practical applications of Armstrong, it cannot be urged that there is any lack of attention to the subject at the present time, if one be permitted to judge from the number of text-books which have appeared within recent years, and even within the last few months. So striking an output must surely be fraught with great potentialities.

The science of hydraulics has a field which is somewhat vague and ill-defined, and is of greater or less extent according to the views of different writers. Originally, the definition of the term only covered a reference to the laws which governed the motion of fluids in pipes and water-courses. Then it was extended to include the use of water for motive purposes, and the means and appliances by which that end was achieved. Other developments have followed, and now it is rare to find two text-books covering even approximately the same ground, or agreeing in respect of either limits or order of treatment. We are acquainted with one treatise which includes within its purview the principles of lubrication; with another which regards what is commonly differentiated as the science of pneumatics as a constituent section; with a third which ignores the motion of bodies in fluids; and so on.

The range of the treatise under consideration, though not so extreme as in some cases, is nevertheless exceedingly comprehensive, and it may be added that the treatment is very complete. In view of the license to which allusion has just been made, we do not presume to offer any criticism on the propriety of presenting the elementary principles of hydrostatics as an introduction to the subject; we ourselves should hardly have thought of referring to a text-book on hydraulics for them. No doubt it is useful for the student to have his memory refreshed on fundamentals, though he may not unreasonably be supposed to have acquired a competent knowledge of them elsewhere. Still, there they are for consultation, if required, and they form a not inapt introduction.

The laws governing floating bodies are touched upon, and investigation is carried so far as to cover the eminently practical and up-to-date case of the floating dock. From these considerations, the author proceeds to deal with the subject of fluids in motion, which constitutes the essential feature of the book. He makes Bernoulli's theorem his starting-point, following on to Torricelli's law and the theory of flow through mouthpieces with the coefficients due to various forms of orifice. Then, having dealt with weirs, he directs his attention to fluid flow through pipes and channels, explaining the well-known basic formula,

$$v = c\sqrt{mi},$$

and quoting the values assigned to the coefficient by Chezy, Bazin, Darcy, Ganguillet and Kutter, and others. This brings us to chapter vii., in which we find a description of the methods adopted for gauging the flow of water through an orifice, in streams and in pipes, including a brief reference to Stromeyer's suggestion for the use of a chemical agent. Chapter viii. treats of the impact of water on vanes, and thence it is a natural transition to water-wheels and turbines in chapter ix. Both this chapter and the following, on pumps, are very full and explicit, and are effectively illustrated by a number of typical examples. Chapter xi. is devoted to an exemplification of the application of hydraulic power to industrial purposes by means of various machines. In two short concluding chapters the author deals with the modern investigation of stream-line flow and the resistance to motion of bodies in water.

An admirable feature of the work is the large number of worked numerical examples. The type is clear and the illustrations are good. Altogether the work forms an excellent text-book, and is cordially to be recommended to students of this most interesting and useful science.

#### TECHNICAL CHEMICAL ANALYSIS.

*Traité complet d'Analyse chimique appliquée aux Essais industriels.* By J. Post and B. Neumann. Second French edition, by Dr. L. Gautier. Vol. i., part i. (pp. 217, price 6.50 francs). Vol. ii., part i. (pp. 202, price 6 francs). (Paris: Librairie scientifique, A Hermann, 1907-8.)

THE present review is concerned with the first two instalments of the second French edition of a German treatise on technical chemical analysis, which has already passed through three editions in the original. The complete work will consist of two volumes divided into eight sections, each section dealing with some special branch of analytical practice, and the editors have secured the cooperation of some twenty-seven eminent contributors in order that the various chapters may embody the results of the latest experience. Judging by the style of the first two sections, now before us, it would appear that the editors are aiming rather at a clear and succinct outline of contemporary analytical method, and of the general

nature of the materials to which they are applied, than at an elaborate and detailed treatise. Subject to this proviso, they may be congratulated on having so far achieved a considerable measure of success, and their efforts may be commended to British chemists who feel the need of a manual of this description.

Vol. i., part i., deals with such subjects as water, solid fuels, pyrometry, and gas analysis in a fairly complete and satisfactory manner. The opening chapter on water analysis (pp. 1-38), by Dr. H. Vogel, of Berlin, is somewhat too compressed and desultory to be of real use, and might be advantageously enlarged in future editions. Then follows an excellent *résumé* by Dr. H. Langbein of the methods in vogue for the chemical analysis and calorific valuation of solid fuels (pp. 39-73); the value of this chapter would have been enhanced by a fuller treatment of the ash analysis of coals and its importance in relation to the various uses of the raw fuel. The third chapter, by Prof. B. Neumann, of Darmstadt, on pyrometry (pp. 74-126), deals very completely with the various thermoelectrical and optical methods used in technical practice, and so far as these methods are concerned the treatment of the subject is all that could be desired. The scanty references to the air thermometer and to electrical resistance methods are, however, to be regretted.

The concluding chapter, on gas analysis (pp. 127-217), also by Prof. Neumann, is disappointing in that it deals with little else than the crude and untrustworthy methods of Hempel and Orsat (or various modifications of them), which have long been the despair of workers, who instinctively demand something both accurate and convenient, and which, we had hoped, were being rapidly discarded in technical laboratories. In these days, when the applications of gaseous fuels are increasing daily, the introduction of really accurate methods of gas analysis in technical practice is fast becoming an urgent necessity, and it is quite a mistaken notion that methods of precision are necessarily inconvenient or tedious, and therefore unsuited to the exigencies of a works laboratory. The opinion of Dreschmidt, quoted on p. 136, as to the incompleteness of the absorption of carbonic oxide by an ammoniacal solution of cuprous chloride may be disputed, since it can easily be demonstrated that a properly prepared and *fresh* solution will absorb the gas almost as rapidly, and, for all practical purposes, as completely, as a caustic alkali absorbs carbon dioxide. It may also be remarked that there is no reference to gas calorimetry in this chapter.

Vol. ii., part i., dealing with the physical, mechanical, and chemical testing of limestones, mortars, cements, ceramic products, glass, and the like, has been entrusted to Drs. H. Seger and E. Cramer, of Berlin. Their treatment of the subject is admirably clear and succinct, and will certainly be appreciated by all general readers. Whilst there is nothing very new, good judgment has been exercised in selecting the best methods and appliances, and the whole is a singularly well-balanced production, and eminently readable. The one fault to be found with their work is the paucity of the references to analytical literature.

The two sections are clearly printed and admirably illustrated, but, as is unfortunately the case with the majority of chemical treatises published on the Continent, references to British work and authorities are conspicuous by their absence.

W. A. B.

#### BRITISH ARCHÆOLOGISTS IN ITALY.

*Papers of the British School at Rome.* Vol. iv. Pp. x+296; illustrated. (London: Macmillan and Co., Ltd., 1907.) Price 31s. 6d. net.

THE "Papers of the British School at Rome," while similar in format, are not similar in form to the "Annals of the British School at Rome," nor can they be precisely similar in content, since the pleasure of chronicling the results of actual excavations is denied to the director of the British School at Rome. Let us always gratefully recognise the greater liberality of the Hellenic authorities and the greater tolerance of the Greek archæologists, who, while naturally and rightly desirous of keeping Greek antiquities in Greece, at the same time recognise the fact that the antiquities of classic Greece and Rome are the heritage of the whole civilised world, not of one country alone, and admit that the privilege of searching for them should be freely extended to all who have the money and the will to carry out the work. Some day, perhaps, the Italians will do likewise. Until then, British archæologists in Italy are confined to the contemplative life, and can do little more than write papers of the type presented in the volume under review.

The director, Mr. Thomas Ashby, most approaches the standard of the practical work of the Athens school in his very interesting paper on the "Classical Topography of the Roman Campagna," which is illustrated by good photographs, perhaps somewhat unnecessarily reproduced abroad, either in France or Italy, as the lettering beneath them shows. Probably we hardly realise how intensely hideous was the Roman style of country-house architecture, until we see such a place as Sette Bassi, which Mr. Ashby illustrates. It must have looked exactly like a warehouse, or, more probably, a piano factory. All the beauty and grace of "classical" architecture is Greek; the Romans were by nature as inclined to unredeemed utilitarian ugliness in their architecture as are the Germans or ourselves. Of the other papers, Mr. A. J. B. Wace's "Studies in Roman Historical Reliefs" is an interesting piece of critical work. Mr. Yeames, late of the British Museum, assistant director of the school, has some interesting remarks on Roman art of the post-Antonie period (first half of the third century A.D.) as exemplified in a small ivory statuette of a *gobbo* or hunchback in the British Museum.

The last paper, and in some ways the most important, is on "The Early Iron Age in South Italy," by Mr. T. E. Peet, who reaches interesting conclusions. In his preface the director says that the papers

"of Mr. Yeames and Mr. Peet, the latter especially,

though still belonging to the archæological sphere, deal with departments of it which have not previously found a place in the Papers of the School."

Since to the minds of many the department of archæology represented by Mr. Peet's paper seems the most important of all, it is to be hoped that no future Papers of the School at Rome will fail to contain some contribution on the prehistoric antiquities of Italy, about which we want to know far more than we do at present.

H. H.

#### OUR BOOK SHELF.

*Armature Construction.* By H. M. Hobart and A. G. Ellis. Pp. ix+348. (London: Whittaker and Co., 1907.) Price 15s. net.

THE widespread use of dynamo electric machinery for all sorts of purposes is sufficient justification, if such be required, of treatises dealing with the design and construction of such machinery. Many books have been written on this subject, but we believe this is the first time that a complete volume has been devoted to the consideration of the construction of what is, perhaps, the most important part of any dynamo, viz. the armature.

To those who know anything of this class of machinery, it will be obvious that there is ample scope for a writer with first-hand knowledge to compile an interesting and valuable book; to mention only one point, the practical construction of a good commutator is a process full of interest. The book before us will certainly repay careful study in spite of a certain lack of proportion which is very noticeable.

A very brief summary of the contents is as follows: The first seven chapters describe the various workshop processes whereby the mechanical parts of the armature are built up, that is to say, the armature stampings, the spider, and the commutator; the next two chapters are devoted to armature windings for direct-current machines and for alternators, treated diagrammatically; and the last four chapters to the methods of winding and to finishing and testing. When it is stated that 172 pages (including full-page illustrations) out of a total of about 390 are devoted to winding diagrams alone, it will be apparent that the authors have allowed their enthusiasm for such diagrams to get the better of their judgment. There is no doubt that the subject is of great interest, but in the opinion of the present writer the two lengthy chapters devoted to it are quite out of place in such a work; in so far as explanations are necessary for the proper understanding of subsequent chapters, three or four pages would be ample to furnish all that are required.

The chapters that deal with construction pure and simple are well written and illustrated, and contain a large quantity of valuable information. Chapter ii., on armature laminations, is perhaps the best in the book, and contains specifications for the composition of suitable steel; the various methods of testing the quality of the steel are described, and constants are given which may be taken as satisfactory. The process of stamping the core plates is given in detail, and is illustrated with a number of photographs of slotting presses and other tools. The other chapters are also full of interest, and, but for the error of judgment mentioned above, the whole book might be unreservedly recommended to those who from one cause or another are concerned with the practical details of armature construction.

*The Dancing Mouse; a Study in Animal Behaviour.* By Robert M. Yerkes. Pp. xxi+290. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1907.) Price 5s. net.

THE most characteristic feature of the best psychology of the present day is the tendency to look for much of the explanation of mental life in its antecedents and surroundings. The older individualistic position is being rapidly left behind. The continuity of mind is now as clearly recognised as the continuity of life. Lower forms of mental activity, in the race no less than in the individual, are found to throw much light upon the nature of developed human consciousness. Such forms are, however, matters of inference, not of direct observation; it is therefore not surprising that the science of comparative psychology is so far from keeping pace with its elder brother, comparative anatomy. The work thus far done has been of a somewhat sporadic nature, in one prominent case, at least, vitiated by faulty psychological theory. More decided progress may be looked for in the application of the experimental method.

Dr. Yerkes's book on the Japanese dancing mouse, the first of a series to be devoted to the study of animal behaviour, is an excellent example of this plan of procedure. A very full description is given of the two principal forms of test employed, viz., the light-discrimination test and the labyrinth test. The former was employed to investigate not only the visual discrimination of the animal, but also its powers of learning by experience and of retaining the lessons thus learnt. As "motive" to the use of the discriminative faculty, Dr. Yerkes employed punishment, in the form of mild electric shocks for mistakes made, considering this not only more humane than the motive of hunger usually employed in such experiments, but also better adapted to the peculiarities of behaviour of the animal, viz., its superabundant activity. Here the criticism at once suggests itself that such a mode of procedure would probably encourage a mechanical production of habit in the animal, and fail to stimulate any germs of higher mental faculty that might be present. The results obtained certainly fail to show the presence of any reasoning power above sense discrimination. Even the inference to power of discrimination may not be completely justified. Sense-differentiation and the mechanical working of hedonic selection would seem able to account for all the facts. Yet the mice might have been capable of higher mental processes, e.g. in terms of kinæsthetic imagery, which the experiments failed to call into operation owing to the insufficiency of the stimulus or motive employed.

Apart from its value as a contribution to science, the book is an extremely readable one, and is, moreover, admirably bound and printed. W. B.

*Studies in the Medicine of Ancient India.* Part I., Osteology, or the Bones of the Human Body. By Dr. A. F. Rudolf Hoernle, C.I.E. Pp. xii+252. (Oxford: Clarendon Press, 1907.) Price 10s. 6d.

SOME time ago, when Dr. Hoernle was preparing an edition of two old Indian medical tracts, preserved in the Bower manuscript of the fifth century A.D., he was surprised to find how little we knew of medicine as taught and practised in Ancient India. The volume under review is the first fruit of a resolve to make good that deficiency in the history of medicine so far as it can now be made good by a study of existing manuscripts and documents. Of the three systems of medicine which have come down to us the most ancient is that ascribed to Ātreya, a physician who is assigned by Dr. Hoernle to the sixth century B.C.; the system ascribed to Suśruta, the

surgeon, is nearly as ancient; the third system, that of Vāgbhata, the Galen of the mediæval East, as Dr. Hoernle describes him, dates from the seventh century A.D., and is a compound of the two older systems.

Evidently amongst the ancient Indians, as among medical men of to-day, a knowledge of the bones was regarded as fundamental in the study of medicine. In the system of Ātreya the number of bones in the human body is given as 360 (the nails, teeth, and tooth sockets are counted as separate bones); in that of Suśruta 300, while in Vāgbhata's system they number 360. In modern text-books of anatomy the number of bones is variously estimated from 200 to 214, the number varying according to the inclusion or exclusion of certain small bones and some which are only occasionally present. The ancient Indian anatomist shows an intimate knowledge of animal tissues in classifying the cartilages with bones; he regarded cartilage as an immature form of bone. In the course of transcription the text naturally became corrupt; for instance, in Ātreya's system the two *humeri*, four wrist bones and two eyes (their outer coat was believed to be cartilaginous, hence they were classified as bones) came to be omitted, but the total number of 360 was made good by increasing the number of face and neck bones. In all three systems the thumb is stated to have three joints or phalanges; Dr. Hoernle points out that a similar mistake is made in the summary of bones given in the Talmud. The Talmudic summary, probably derived from the Greek school at Alexandria, follows very closely the systems of Ancient India. How far the systems of medicine amongst the early Greeks and the Ancient Indians were related cannot yet be estimated; thanks to the labours of Dr. Hoernle we know much more of the systems practised amongst the Indians than amongst the Greeks.

Altogether Dr. Hoernle, although not a medical man himself, has laid medical men under a deep obligation to him by rendering so easily accessible the knowledge and practice of physicians who tended the sick in northern India some centuries before Christ was born.

*The Sea-shore, Shown to the Children.* By Janet Harvey Kelman. Described by Rev. Theodore Wood. Pp. xi+146; with 48 coloured plates. (London and Edinburgh: T. C. and E. C. Jack, n.d.) Price 2s. 6d. net.

THIS book belongs to the "Shown to the Children" series, and consists of forty-eight coloured plates with a short description written in the simplest possible language of each of the subjects depicted.

From such an immense choice of material it was no doubt difficult to decide what should be described and what left out, but, on the whole, we think that the choice has been a very good one. The chief objection to the book is the use of English names for most of the objects described. Some of these names are unfamiliar to us, while others are surely local. In some cases the generic name has been used, e.g. *Chiton*, *Purpura*, *Pinna*, *Terebella*, &c., and we think it would have been an advantage if this system had been more freely adopted, the English names only being used where there could be no doubt whatever as to their being well-known ones. *Alcyonium* is called "the sea-finger"; in some localities, at least, it is known as "dead men's fingers." *Pleurobrachia* is called "the sea-acorn," but in another well-known book of the sea-shore its English name is given as "the sea-gooseberry." The name "sea-acorn" is usually applied to a barnacle.

This attempt to give English names to objects not

well known has led to an unfortunate use of the terms caterpillar and chrysalis, which are here applied to the zœa and megalopa stages of the crab.

We can understand the desire on the part of the author to bring home to the children the fact that the zœa and caterpillar represent the larval stage in the life-histories of crab and butterfly, and that the chrysalis of the butterfly and the megalopa of the crab are also corresponding stages, but to call a zœa a caterpillar and a megalopa a chrysalis is carrying comparison too far.

FRANK BALFOUR BROWNE.

*Déviations des Compas.* By Pierre Engel. Pp. vi+64; with 3 plates. (Paris: Gauthier-Villars, 1907.) Price 2.75 francs.

THE brief introduction well describes the subject-matter of the book. It is divided into four parts. The first consists of a theoretical study of the magnetic field of a ship. It is quite simple, and involves no knowledge of mathematics beyond the rudiments of trigonometry. The second part is equally elementary in its treatment, and deals with the action of the field in question on a magnetic needle, together with an outline of the principle of compensation. The third part deals with the compensation of the Thomson or Kelvin compass, while the fourth part consists of various information and remarks, both general and particular, relating to the Thomson compass. Of the plates, the third and fourth are charts of the world showing curves of equal horizontal intensity and equal magnetic inclination respectively. Ensign Engel has produced a book which should be of great use to naval officers, to whom a knowledge of the principles of the modern mariner's compass is indispensable, but to whom a highly mathematical treatment would be prohibitive.

*Bulletin of Miscellaneous Information. Royal Botanic Gardens, Kew.* Pp. 421+152. (London: Darling and Son, 1907.) Price 5s.

THIS volume of the *Kew Bulletin* is the second of the regenerated series. For the most part the contents are connected with systematic or economic botany. Herbarium workers have contributed lists of new flowering plants from Africa and elsewhere, reductions of the Wallichian herbarium, identifications of algæ and fungi, and special articles. The rubber boom is reflected in several articles, notably in the accounts of Guayule rubber, obtained from *Parthenium argentatum*, and of Mgoa rubber, the product of the East African tree *Mascarenhasia elastica*. Various additions have been made to the wild fauna and flora of the gardens, the most important being the list of lepidoptera compiled by Mr. A. L. Simmons. Notes on the cricket-bat willow and on gardens and parks in South Wales represent the work of members of the gardens' staff, and articles have been contributed from India and Africa by former members of the staff.

*The Will to Doubt: an Essay in Philosophy for the General Thinker.* By Alfred H. Lloyd. Pp. xi+285. (London: Swan Sonnenschein and Co., Ltd., 1907.) Price 4s. 6d.

THE thesis defended in this, the latest, volume of Prof. Muirhead's ethical library is that doubt is no mere negative of belief, but a positive element absolutely necessary to real life. It is true that the common-sense view of the world is full of contradictions that furnish abundant food for doubt, and that no less must be said of the more special and abstract views which constitute the sciences. But though Prof. Lloyd thus agrees with Mr. F. H. Bradley in holding that our experience at all its levels is "riddled

with contradictions," he does not follow the Oxford philosopher to his famous conclusion that all experience is therefore only of "appearance" and not of "reality." In his view, on the contrary, contradiction actually serves experience by holding it down to the real world which it would otherwise miss. It follows that the "doubter's world" must always present certain positive features which will accord with the principles of Descartes, the typical modern doubter. Among these will be found psychophysical parallelism and "the immortality of whatever is indeed real."

Prof. Lloyd's argument is interesting, and is ably, if not always convincingly, developed, but suffers from his somewhat perverse and strained efforts after brilliance of style. He has, moreover, shown more courage than prudence in choosing a title which inevitably suggests comparison of his work with that of his compatriot, Prof. William James.

#### 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.]

#### An Annotated Copy of Newton's "Principia."

IT may interest your correspondent (p. 510) to know that Le Neve, in his "Pedigrees of Knights" (Harleian Soc., 1873, viii., p. 192), states that Sir Demetrius James, of Itham, was knighted on May 10, 1665. An account of the family may be found in Hasted's "History of Kent," vol. ii., p. 247.

Much information about the preparation of the second edition of the "Principia" may be found in Brewster's "Memoirs of Sir Isaac Newton," vol. ii., p. 273 et seq., but it is needless to burden your columns with quotations from so accessible a book. Two specially bearing on the point at issue will suffice:—"Even in November 1702, when he [Newton] was visited by Bd. Greves, who saw in his hands an interleaved and corrected copy of the Principia, he would not acknowledge that he had any intention to reprint it." "In a letter dated October 11 [1709], Newton intimated to Cotes that he had sent him by Mr. Whiston 'the greatest part of the copy of his Principia, in order to a new edition,' thanked him for his letter of the 18th of August, and requested him not to be at the trouble of examining all the Demonstrations, but 'to print by the copy sent him, correcting only such faults as occur in reading over the sheets,' which would entail upon him 'more labour than it was fit to give him.'"

The results of Mr. Smith's further inquiries will be awaited with interest.

W. R. B. PRIDEAUX.

Reform Club, Pall Mall, S.W., April 2.

#### Proposed Alteration in the Calendar.

WITH reference to the proposed alteration of the calendar so ably discussed by "W. T. L." in NATURE of March 26, it seems to me that the drastic scheme advocated by Mr. Pearce is not only inadmissible because interfering with the continuity of the weeks, but it is not the simplest scheme that could be adopted, even allowing the interference proposed.

The Positivist Calendar agrees with Mr. Pearce's proposal in that it divides the year into fifty-two weeks with a supernumerary day which is not included in any week, and with two such supernumerary days in leap years. The two calendars are also alike in that these supernumerary days are not included in any month. But the Positivist Calendar is the simpler of the two in that it makes all the months of the same length, namely, four weeks; and Blackstone informs us that in law a month means "28 days, unless otherwise expressed."

This makes the number of months in the year thirteen; but it has this advantage over Mr. Pearce's scheme, that not only are the months all of the same length, but that they all begin on the same day of the week, and thus any given day of the month is on the same day of the week in every month.

The seven-day week, which is no doubt descended from the Jewish week, is one of the most widely spread institutions in the world. All Christian and all Mohammedan nations, although they may agree in little else, agree in respecting the week; and it would be impossible to induce many of them to interrupt the continuity of their weeks by excluding one day annually from any week and two days every fourth year, and unless the change were international and all but universal it would only introduce confusion and destroy that identity of the week which now obtains throughout Christendom and Mohammedom.

D. MACKIE.

4 Polmuir Road, Aberdeen, March 28.

### Helium in the Atmosphere.

RECENT investigations have demonstrated the widespread presence of the inert gases in the crystalline rocks, and the Hon. R. J. Strutt has shown that while the bulk of the gases in granite consists of nitrogen, there is a small but appreciable quantity of argon and helium, the former amounting to from three to four times the latter. On the disintegration of the rocks a portion of these must find their way into the atmosphere. The question arises whether our present atmosphere contains the accumulations of past accessions from the earth's crust, in the same way as the sodium chloride in the sea represents, subject to certain qualifications, the sum of the contributions of the rivers in the past.

It is found, however, that while the air examined in our laboratories contains about 1 per cent. of argon, there are only one or two parts in a million of helium. The small proportion of the latter has given rise to the suggestion that it is escaping from the atmosphere as fast as it enters it. This receives no support from the kinetic theory of gases. Dr. G. H. Bryan calculates (Phil. Trans., A, xcvi., p. 19) that at a temperature of 127° C. it would take eighty-four thousand million years to remove a layer 1 centimetre thick of helium from the surface of the earth. In other words, the pressure of the gas which at the beginning of that period was found at the height of a centimetre would at its end, other conditions remaining the same, be found at the surface of the earth.

Dr. Johnstone Stoney, however, supposes that there may be extraordinary molecular velocities, due to collisions and other causes, which result in the loss of helium. Such an hypothesis, however, is quite unnecessary, for, according to the ordinary views as to the constitution of gases, they will not distribute themselves uniformly in the atmosphere, but to a certain extent take up positions according to their relative densities. Mr. J. H. Jeans ("Dynamical Theory of Gases," 1904, p. 316) calculates that if helium forms a millionth part by volume of the air at sea-level, it must amount to more than 2 per cent. at an altitude, which is dependent on temperature. With our increasing knowledge of atmospheric temperature and the distribution of helium in the earth's crust, we ought soon to be in a position to calculate the present amount of free helium, and employ it to obtain an approximate higher limit for the total disintegration of crystalline rocks since the consolidation of the earth's crust.

J. W. EVANS.

### April Meteors.

MOONLIGHT will prove a serious impediment to observations of the Lyrids in the present year, the more especially as, according to calculations made by the writer, the general maximum of these meteors will take place immediately after full moon. The following are particulars as to when meteor showers at this period may be expected to make their appearance, and the computed intensity of the display in each instance, the results being expressed in Greenwich Mean Time:—

Epoch, April 18. Shower of second order of magnitude;

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the maxima precede the epoch, the principal of which occur on April 16, 6h. 25m.; April 16, 14h.; and April 17, 6h. 50m.

Epoch, April 18, 15h. This shower is of the twenty-second order of magnitude, and has its principal maxima on April 16, 7h. 45m.; April 16, 9h. 40m.; and April 17, 13h. This minor shower has also two secondary maxima, occurring on April 17, 23h., and April 18, 3h., respectively.

Epoch, April 21. This shower is of the twenty-first order of magnitude, its principal maxima, which precede the epoch, occurring on April 19, 16h. 35m.; April 19, 19h. 20m.; and April 20, 17h.

Towards the end of April there is another meteor shower of the ninth order of magnitude, the epoch of which occurs on April 29, 6h., and the principal maxima of which fall on April 27, 16h.; April 27, 19h. 30m.; and April 27, 21h.

As a general rule, the intensity of a meteoric display is inversely as its estimated order of magnitude; hence meteors may be expected to be most abundant on the night of April 16, as the two strongest maxima of a shower of the second order of magnitude occur on this date, besides two maxima of another shower which is partly superimposed on the former. Lyrids will probably be most in evidence on the morning of April 17.

Dublin.

JOHN R. HENRY.

### Coloration of Glass and Quartz by Radium.

ON many occasions attention has been directed to the coloration of glass and quartz by the rays from radium. The coloration of glass is generally connected with the presence of manganese or lead, and I venture to suggest that in quartz too the darkening arises from the association of some foreign substance with the silica.

A small plate of quartz crystal was exposed to radium for three weeks, and became, not only irregularly violet at one place, but also showed two sharply defined parallel lines strongly coloured, with the space between them scarcely affected. On the other hand, a quantity of powdered chemically pure silica acquired no colour after the same exposure. It may also be pointed out that pure boric acid, fused to a transparent plate and protected from moisture, was unaffected by radium even after two months' continuous exposure to the rays.

Borax, however, will show a slight action after three weeks, and both these substances afford, when incorporated with a small quantity of pure sodium silicate, a good basis for the production of experimental glasses to test the action of radium when other constituents, such as lead, iron, &c., are added either singly or together.

It may be found that the coloration by radium will serve as a test for the purity of the silica used in making vessels for certain classes of chemical research, so that, apart from its physical interest, the matter seems worth following up.

CHARLES E. S. PHILLIPS.

Castle House, Shooters Hill, Kent, April 2.

### An Early Notice of Neolithic Implements.

THE subjoined quotation must, I think, be among the earliest specific descriptions of a Neolithic implement found in this country.

Newbury's "A Compendious History of the World" (vol. i., London, 1768, pp. 11-12):—"That the earth has been amazingly altered since its first formation is evident from the spoils of the sea being daily discovered even in the midst of rocks and the tops of mountains: to which let me add that the skeletons, horns, &c., of the animals of one country, have been dug out of the bogs and mines of another, even at an immense distance, and where such animals are not now to be found: even stones have been discovered at a great distance in the earth, which bore evident marks of art about them; and some time since I had two taken out of a peat pit near Newbury in Berks, which were large, ground to an edge in the form of an ax, and so perfect that wood might be cut with them."

JOHN L. MYRES.

The University of Liverpool, March 23.

NOTES ON ANCIENT BRITISH  
MONUMENTS.<sup>1</sup>

VIII.—THE ABERDEEN CIRCLES (*Continued*).

IN my last notes I dealt, amongst other matters, with those circles devoted, as I believe, to the observation of clock-stars. It is from these that dates can be derived when we are sure of the star. I pointed out that we were not sure of the star, which might have been either Arcturus or Capella.

I must confess that although, as I have already said, there is no definite proof that the period of B.C. 600 is to be preferred to B.C. 1600 as the mean time of the setting out of the Aberdeen circles, such considerations as I then gave point to the more recent date. I may add that the N. circles, if used to determine the time at night, tell the same tale. With little knowledge of the heavens we can understand the importance of an exact alignment to Arcturus or Capella when, in my view, the astronomer-priest took his departure and told the curate left in charge to "keep her at that"; but when the stars were more familiar there would be less need to indicate the rising places of either Arcturus or Capella, and the four circles with due N. alignment indicate probably that there was no longer need for a rising star to be considered; the position of the brighter stars in relation to the Pole star in the circumpolar region itself could be used, and there can be little doubt that it then became a question of the nightly voyage of the Great Bear round Polaris. In such observations we have the beginning of the employment of the "night dial" used throughout Britain until a century ago, and of the system of observation by which the Arabs in the Soudan still tell the time at night to within ten minutes.

The question of the number of stones in the circles may also help us. The once existing condition of things at Crichtie, fully illustrated in Anderson's admirable book on Scotland in pagan times ("Stone Age," p. 105), is worthy of consideration. The circle consisted of six stones only; the meridian is clearly marked, and my observations made from the outstanding stone show that it was quite accurately laid off. This fact and the other that the cist was found in the middle of a north alignment are, in my mind, proofs of relative modernity. One question, then, is, May we accept all small circles, such as Crichtie and Tuack, as being more modern than those in Cornwall and even in Aberdeenshire, where the number of stones in the circle is greater? The many interments in these circles also favour this view.

And now a word about the May-year circles; from these astronomically we can get no date, but we know that in the south they preceded the solstitial circles, and perhaps it is permissible to make the same assumption for Aberdeenshire, but in this case we deal with recumbent stones, so again they are dissimilar, and therefore their date is probably not the same as that of those in the south.

<sup>1</sup> Continued from p. 489.

So far as my work has gone, we have alignments to the May year at Berry Brae and Hatton of Ardoyne; the remains of a May-year avenue at Ardlair and another marked on the Ordnance map near Kirkton of Clatt. The true azimuths of the May sunrise near Aberdeen are approximately:—

Sea horizon	...	...	...	...	N. 57 50 E.
Hills 1°	...	...	...	...	60
" 2°	...	...	...	...	61 30

In my reductions I have taken the magnetic variation at W. 18° 45' provisionally until the recent results obtained by the Admiralty and Ordnance Survey are known.

It is remarkable that either the recumbent stones or supporters, or both, have been disturbed in these May-year circles, suggesting a practice acted on by the Egyptian priests in regard to the worship of any other sun- or star-god than the one to which they were specially attached.

This is an argument in favour of the erection of the May-year circles before the solstitial ones at Midmar, Sunhoney and Stonehead, which have been left intact.

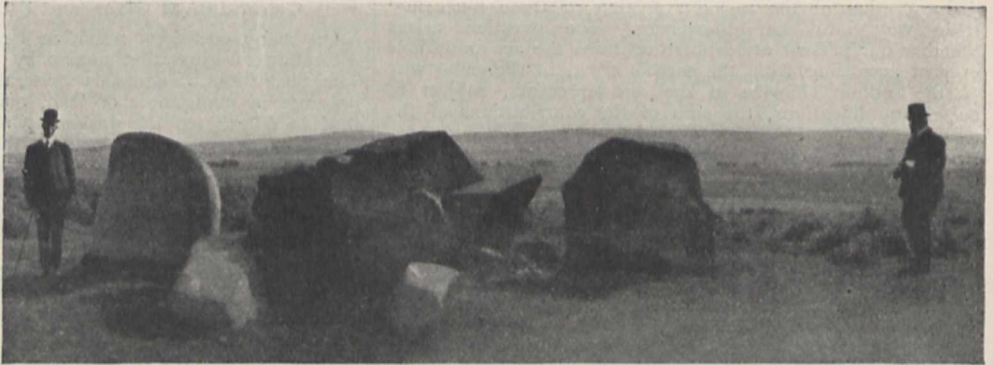


FIG. 22.—Contrasting the directing stone and supporters at Ardlair.

The most remarkable case of disturbance is at Ardlair, on the N.W. of the circle area.

This is one of the exceptional cases to which I referred in (2), where the only May-year avenue I have measured occurs, hence the circle may once have been a May-year one. With the single exception of Old Bourtree Bush, where the recumbent stone is due E. of the centre of the circle to define the place of the equinoctial sunsets, all the circles I have measured have the recumbent stone in the S.W. quadrant. This general condition has been previously noted by Mr. Coles, and also by Mr. Ritchie, who informs me that in the case of the only variation from this law he has noted, it is known that the recumbent stone, having been moved by the farmer, was *wrongly replaced* when he was compelled to restore it.

At Ardlair the recumbent stone is in the S.E. quadrant, but there are indications that this was not its original position. It is unlike any other recumbent stone I have seen; I believe its many sharp angles and cracks are due to the action of fire, and the angles and cracks are all the more striking since both supporters are rounded and crackless.

The removal of the stone from its position facing the May sunrise, subjecting it to the action of fire, and placing it between two stones in the circle, so that its length would lie in the direction of that sunrise, are all suggested as acts of the solstitial priests.

The mean of all my measures gives an azimuth



along the stone and its supporters of N. 61° 15' E.; the azimuth of the May sunrise with hills 2° high is N 61° 30' E.

The other exceptional case is at Garrol, where there has been great disturbance, and where, as at Ardlair, the length of the recumbent stone lies in the direction which points to the rise of the May sun, the mean of many measures giving N. 61° 45' E.

My measurements of the May-year circles were as follows:—

May-year. Sun's Declination 16° 20' N. (May 6, August 8).

Circle at—	Azimuths.		Elevation of the horizon.	Declination N.	Dates.	
	Magnetic, mean of observations.	True, at right-angles across circle.			May.	August.
Berry Brae .....	170	N. 61 15 E.	1	15 30	May 3	Aug. 11
Hatton of Ardoyne .....	166	N. 57 15 E.	1/2 (assumed)	17 8	May 9	Aug. 5
Mean of above...	...	...	...	16 19	May 6	Aug. 8

Some of the previous measures in Cornwall may be given for comparison:—

Monument at—	Azimuth (true).	Elevation of horizon.	Declination N.	Dates.	
				May.	August.
Boscawen-un—					
Circle to two large menhirs .....	N. 66 50 E.	1 0	14 55	May 1	Aug. 13
Merry Maidens—					
Circle to Fougou .....	N. 64 0 E.	0 30	16 21	May 6	Aug. 8
Tregeseal—					
Circle to Longstone.....	N. 67 20 E.	1 18	15 3	May 2	Aug. 13
Longstone (Tregeseal)—					
To W. Lanyon Quoit ...	N. 67 0 E.	0 0	14 3	Apr. 23	Aug. 16
Down Tor—					
Direction of avenue.....	N. 67 0 E.	0 30 (assumed)	14 23	Apr. 30	Aug. 15
St. Cleer—					
Holy well to Treveithy cromlech .....	N. 64 0 E.	0 30 (assumed)	16 21	May 6	Aug. 8
Lesquoit cromlech—					
Orientation of cromlech.	N. 64 0 E.	1 30	16 55	May 8	Aug. 6
Druids Altar (Pawton)—					
Orientation of cromlech.	N. 64 0 E.	1 30	16 55	May 8	Aug. 6
Mean of above .....	...	...	15 38	May 4	Aug. 10

In addition to these, I have found<sup>1</sup> that Lukis<sup>2</sup> and Borlase<sup>3</sup> give plans of a number of cromlechs in Cornwall which appear to be oriented to the May sun. They are as follows:—

Cromlech.	Authority.	Azimuth.
Lanyon Quoit .....	Borlase; plate xxi .....	N. 66 E.
Mulfra Quoit .....	Lukis; plate xix.....	N. 63 E.
Chywoone Quoit.....	Lukis; plate xx .....	N. 64 E.
Zennor Quoit .....	Lukis; plate xxi.....	N. 64 E.
Three Brothers Grugith .....	Lukis; plate xxiii .....	N. 64 E.
Mean of above...	...	N. 64° 12' E.

Assuming an elevation of the horizon between 1/2° and 1°, this mean value is the exact azimuth of the May sunrise in Cornwall.

I next give details touching the solstitial circles.

<sup>1</sup> See NATURE, No. 1987, vol. lxxvii., p. 84, November 28, 1907.

<sup>2</sup> The Prehistoric Stone Monuments of Britain—Cornwall.

<sup>3</sup> "Antiquities of Cornwall."

With these, accurate measurement is a difficult matter, and, as the determination of the date of erection from the variation of the obliquity of the ecliptic entails very precise measures, I content myself with pointing out that the declinations are probably solstitial and that they agree, in the mean, with the values previously obtained for the English solstitial circles.

Circle at—	Azimuths.		Elevation of the horizon.	Declination N.
	Magnetic, mean of observations.	True, at right-angles across circle.		
Sunhoney .....	155 15	N. 52 35 E.	4	22 25
Midmar .....	146 15	46 30	2	23 15
Stonehead (Insch).....	...	37 30	1	25 41
Mean of above...	...	...	...	23 47

I append some measures made in the south of England for comparison:—

Monument at—	Azimuth (true).	Elevation of the horizon.	Declination N.
Stonehenge—			
Direction of avenue from circle...	N. 49 34 E.	0 35	23 54
Stanton Drew—			
Great circle to N.E. circle.....	51 0	1 5	23 49
Boscawen-un—			
Centre of circle to fine menhir ...	53 30	1 15	22 58
Tregeseal—			
Centre of circle to holed stones...	53 20	1 15	23 2
Longstone (Tregeseal)—			
To Mén-an-Tol .....	50 30	0 34	24 7
* Mean of above .....	...	...	23 34

General Conclusions.

Should subsequent inquiries confirm the balance of argument against the use of Capella, we shall be led to the following conclusions:—

(a) Dealing with the circles already measured by me in the two localities, the Aberdeen circles are more than a thousand years younger than those of Cornwall and the west coast; and here we have one reason why the east-coast circles are dissimilar, and those at Callernish and Stennes to the west are similar, to the Cornish circles.

(b) With this great difference of time to deal with, we have also probably a difference of origin between the West coast and East coast swarms.

(c) As the May year is still supreme in Scotland generally, it is clear that the solstitial Aberdonians were at some point of time overpowered in influence by a return wave from the west of Scotland.

Since my return from Aberdeen Mr. Horton Bolitho, one of the hon. secretaries of the Cornwall branch of the Society for the Astronomical Study of Ancient Monuments, and whose knowledge of the Cornish alignments is second to none, has sent me the following information concerning the circles in Perthshire:—

"I examined six circles in Perthshire last year and this, but I found no trace of recumbent stones such as are associated with the Aberdeen circles. The Perthshire circles closely resemble the circles of Cornwall, showing traces of May-year and solstitial alignments with at least one clear use of a clock-star in azimuth N. 18° E. Trees prevented any fine measurements being taken, and local assistance in searching for outstanding stones was lacking. In two of the best pre-

<sup>1</sup> At Sunhoney, as the recumbent stone was curved and irregular, it was simpler to measure directly across the circle at right-angles to the length of the recumbent stone; the magnetic azimuth thus obtained was 71° 20'.

served circles I found a central or 'Gorsedd' stone, and in one case two central stones."

Mr. Bolitho's observations then intensify the purely local fashion of the Aberdeen circles.

One of the associated inquiries to which I have referred will be to trace the existence of recumbent stones in some part of Europe; another will be to see if the area of the recumbent stone has also special ethnological or craniological characteristics.

With regard to the first point, Anderson ("Stone Age," p. 124) tells us that in Norway and Sweden there is no example of a circle with a recumbent stone and supporters.

With regard to the second, the paper on British ethnology by Mr. J. Gray (*Man*, April, 1902) is full of promise.

A point worthy of notice is the great preponderance in the number of circles used to take the time at night over those enabling the seasonal changes and the sun's place throughout the year to be fixed. In Cornwall both were equally provided for.

We may, I think, include the circles with a north alignment with the clock-star circles as used to determine the time at night. They are respectively situated at Dyce, Whitehill Wood, Raes of Clune and Candle Hill (Insch). As before stated, they probably represent a later development when the observer's knowledge was so far advanced that he needed only the cardinal point in order to recognise the clock-stars which it was necessary for him to observe.

Judging by the trouble taken to determine time at night by the use of special circles in Aberdeen, religious services at fixed hours of the night are suggested to be as early as the time of the circle builders.

As these night observations were common to the two localities, we may conclude that in both, the circle associated with the *via sacra*, the chambered cairn, the holy well and the holy thorn, and the sacred festivals, represent the earlier form of the monastery buildings of later times.

I am anxious to conclude by expressing our deep obligations to many helpers. First of all to Dr. Fraser for his invitation to come and do some more work, his generous hospitality, and the use of his motor-car for the examination of the circles within a radius of twenty miles of the Granite City, some of which we saw under his own guidance. That is the first point; next comes the local help in four distinct regions—Inverurie, Durrus, Buchan and Insch. For the Inverurie district Mr. Ritchie, of Port Elphinstone, gave up two of his precious Saturday holidays, during which he piloted us to many circles which he had most carefully selected from a much larger number as being best worth examining.

At Durrus Mr. Braid and his son took us to the circles at Eslie and the Raes of Clune, and, further, had prepared a careful plan of the latter circle, thus fulfilling a promise made last year.

On our arrival at Mintlaw for the study of the Buchan circles, we found the Rev. Dr. Forrest, Mr. Ainslie, and his assistant, Mr. Gall, at the station, and with their help several circles near Mintlaw and Lomway were measured.

Later on we proceeded to Insch, and passed two nights in the comfortable Railway Hotel there. The obliging landlord, Mr. Haddon, had taken immense pains to secure local information. Colonel Smith, and Mr. J. Graham Callander who had only returned two days from studying Greek inscriptions in Asia Minor, accompanied us on each of the days, and with their help we were enabled to measure seven circles, some of them many miles from our headquarters.

NORMAN LOCKYER.

## TREES.

AMONG the many excellent books which have been written about trees there are none, in our opinion, better than the present work. It is full of interest from cover to cover. The many beautiful photographs of the different parts of trees are strikingly true to nature, and, having been taken from fresh material, they show the salient features of the different species much more clearly than could be observed from dried herbarium specimens. We have also beautiful portraits of the various trees themselves in summer and winter condition, as well as special plates illustrating the appearance of the bark. The accompanying illustration will speak for itself.

In his introduction Prof. Groom has given a very interesting and clear account of the various members, both vegetative and reproductive, which make up the body of the tree. The special function of each part



Bark of Cork Oak. Part of an illustration in "Trees and their Life histories."

and the influence of the environment on its activity is described in a way which the non-botanical reader should have no difficulty in following and thus laying a clear foundation for the better understanding of trees and their life-histories. It is difficult to say which part of the book is best, but in the introduction the author has broken new ground. A great fault in many similar works is that they contain a mere accumulation of facts, and dry, formal descriptions of different trees and their various parts, which the non-botanical reader may learn and thus get to know the various species by head mark. This is all very well so far as it goes, but surely it will make

<sup>1</sup> "Trees and their Life-histories." By Prof. P. Groom. Pp. xvi+407; illustrated from photos, by H. Irving. (London: Cassell and Co., Ltd., 1907.) Price 25s. net.

the study of trees much more intelligible and interesting when the meaning of structure and form is clearly and simply described to the student, as in the present work.

After this excellently written and beautifully illustrated introduction, the author takes up the gymnosperms. He does not attempt to deal with every known species, but certainly there are few which are likely to be met with in various pinetums, parks, and forests in this country which have not been dealt with. The life-history of each is clearly and well described and illustrated by photographs. As Prof. Groom states in his preface, "Particular trees have been selected for more detailed discussion, so as to serve as types by which to demonstrate certain structural features or general phenomena observable in tree-life." The study of the conifers appeals to a vast number of people, and a distinct gap in the existing literature has been filled by this work. No doubt other books give descriptions of the different species, but these are too condensed and technical to be of any use to the general reader. The broad-leaved trees are similarly dealt with in an interesting and masterly manner. Analytical tables and diagnosis of families have been added. These, together with the numerous illustrations and the special mention of distinctive features which is prefixed to the account of every tree described, will certainly ensure facility and accuracy in identifying the different kinds of trees with which the reader is likely to come in contact.

The author is to be congratulated upon the production of a work which should certainly be in the possession of all those interested directly or indirectly in trees and their growth.

A. W. B.

DR. JAMES BELL, C.B., F.R.S.

WE regret to have to announce the death, on March 31, in his eighty-fourth year, of Dr. James Bell, formerly principal of the Somerset House laboratory. Dr. Bell was a native of County Armagh, and entering the Inland Revenue Service became, when a comparatively young man, an assistant in the chemical department of Somerset House, then under the charge of Mr. George Phillips. This department, the forerunner of the present Government Laboratory, was the outcome of the Tobacco Act of 1842, and was created with the object of supplementing the provisions of that Act in suppressing the adulteration of tobacco. For his chemical education Dr. Bell was mainly indebted to the late Prof. Williamson. Indeed, in the early days of the Somerset House laboratory a close association existed between it and University College, and a number of the first assistants were trained in theoretical and practical chemistry in the Gower Street laboratories, and some of them, like Duffy, Kay and Railton, were encouraged by Dr. Williamson, then in the full vigour of his scientific activity, to try their prentice hands at original investigation. In the first years of its existence the laboratory, the staff of which consisted solely of Mr. Phillips himself, was almost exclusively engaged on the objects for which it was founded, but as its utility became more and more apparent its operations were gradually extended, and eventually embraced the examination of practically every excisable article. The laboratory at this period was also largely concerned with inquiries as to the brewing values of various materials, and on the methods of determining original gravities, and on the denaturing of spirits of wine so as to permit its use for manufacturing purposes without danger

to the revenue—all of which work found its application in subsequent Acts of Parliament.

On the death of Mr. Kay, Mr. Bell became deputy principal, and he continued in that office until the retirement of Mr. Phillips in 1874, when he succeeded to the principalship, holding that position until his resignation in 1894. During the fifty years of its existence the operations of the laboratory had greatly extended, and it had contracted associations with practically every Government department which had need of chemical advice and assistance, in addition to the large extension of its work connected with Revenue matters. Much of this development took place during Dr. Bell's principalship. But to the public at large Dr. Bell's tenure of the office was mainly signalled by the association of the Somerset House laboratory with what is in reality one of the least important of its many duties, viz. the Food and Drugs Acts. This popular misapprehension of the proper functions of the laboratory is no doubt due to occasional newspaper references to the fact that a disputed case of analysis of some food-stuff, drink or drug has been referred by magistrates to the Commissioners of Inland Revenue for the opinion of their chemical advisers. As a matter of history, this connection of the Somerset House laboratory with the Food and Drugs Acts occurred at the very time that Dr. Bell succeeded to the principalship, as a result of a report of a Select Committee of the House of Commons on the working of the Act of 1872, and this circumstance caused the laboratory to be known to the public at large to a much greater extent than formerly.

The new responsibility thus thrown on Dr. Bell involved a very considerable increase of work on the department, not so much in actual analysis of referred samples as in investigations into the methods of food analysis in general and in the establishment of standards of quality. Thirty years ago the methods of food analysis were, for the most part, in a very unsatisfactory condition. The great teachers of chemical analysis, Berzelius, Rose, Wöhler, Thomson, Bunsen, Fresenius, and the men trained in their schools, were mainly concerned in the discovery and elaboration of the methods of mineral analysis, and very little attention had been paid to processes for the systematic examination of food with a view to the determination of its quality or to the detection of adulteration. The first Food and Drugs Act was largely ineffective owing to this circumstance. When the office of a public analyst was first created, practically each analyst had to devise his own methods, and at the outset no uniformity or agreement was possible. The condition of things to which this gave rise, with the consequent frequent instances of injustice, was indeed the cause of the appointment of the Select Committee above referred to.

As regards methods of analysis, Dr. Bell, as the referee eventually appointed under the Act of 1875, was in no better position than other analysts who held office under the Act, and he at once turned all the force and ability of his laboratory to the elaboration of the methods for the examination of such articles of food and drink as experience showed most frequently came within the purview of the Act. In this work he was assisted by some of the most competent analysts the laboratory ever possessed, notably Mr. George Lewin, the late Mr. Harkness, the late Mr. John Holmes, and Mr. Cameron, each of whom did yeoman service in getting together the material embodied in the work by which Dr. Bell is best known, viz. his "Chemistry of Foods." It was mainly in recognition of the service thus rendered to the community that Dr. Bell was elected into

the Royal Society in 1884, and was made, two years later, a graduate of the Royal University of Dublin. His official position further led to his selection as president of the Institute of Chemistry in 1888. He was one of the original members of the Institute, and took much interest in its operations. He was made a Companion of the Bath in 1889.

Dr. Bell enjoyed the respect and esteem of many successive Boards of Inland Revenue, who found in him a shrewd and astute adviser of ripened judgment and large experience, eminently cautious and sound. His *bonhomie* and geniality, his strong common sense and tactful sympathy, his fair-mindedness and obvious impartiality rendered him an admirable agent in the conduct of the occasionally complicated and difficult adjustments of the apparently conflicting interests of the "Trade" and the Revenue, which the head of the laboratory is now and again called upon to determine. He was loyally served by his staff, who entertained warm feelings of regard and affection for him. Many of them testified to their appreciation of his many good qualities by their presence at his funeral on Saturday last at Ewell.

T. E. T.

#### NOTES.

THE sixteenth James Forrest lecture of the Institution of Civil Engineers will be delivered at the institution on Monday, April 27, by Prof. Henry Louis, who has selected for his subject "Unsolved Problems in Metal Mining."

THE Geological Society of London is taking a poll of all the fellows resident in the United Kingdom to ascertain whether a majority is in favour of admitting women to the society, and, if so, whether as fellows or as associates.

DR. W. N. SHAW, F.R.S., and Dr. T. H. Warren, Vice-Chancellor of the University of Oxford, have been elected members of the Athenæum Club under the provisions of the rule of the club which empowers the annual election by the committee of three persons "of distinguished eminence in science, literature, the arts, or for public services."

DR. HENRI DESLANDRES, who since 1897 has been assistant director of the observatory at Meudon, has been appointed director to succeed the late Dr. Janssen.

DR. J. N. LANGLEY, F.R.S., professor of physiology in the University of Cambridge, has been elected a foreign member of the Royal Danish Scientific Society.

THE third International Congress of Philosophy will be held at Heidelberg from August 31 to September 5. Prof. Windelberg is to be president, and Dr. Elsenhaus Plock, of Heidelberg, is acting as secretary.

THE annual dinner of the Institution of Mining and Metallurgy will be held at the Hotel Cecil on Friday, May 8. The president, Mr. A. James, will preside, and many distinguished guests have already accepted invitations to be present.

WE learn from the *British Medical Journal* that the Town Council of West Ham has passed a resolution authorising the placing of a bronze tablet on the house in Upton Lane, Forest Gate, now St. Peter's Vicarage, where Lord Lister was born.

THE sixth International Congress of Psychology will be held at Geneva from August 31 to September 4, 1909. Prof. E. Claparède, professor of physiological psychology

in the University of Geneva, is the general secretary of the congress, and may be addressed at Champel, 11, Geneva.

A NEW Polar expedition is being equipped, under the auspices of the Russian Ministry of Marine, with the object of discovering a north-east passage between the Atlantic and Pacific Oceans, and thereby accelerating naval communication between Western and Far Eastern Russia.

A CORRESPONDENT sends us a page from "Wind und Wetter," by Prof. E. Lommel (Munich: R. Oldenbourg, 1873), containing a description of the dark cloud which covered Europe and a part of Asia in 1873 (see NATURE, March 5, p. 417, and March 26, p. 493).

THE body of Emanuel Swedenborg, who died in 1772 and was buried in the Swedish Church, Prince's Square, Ratcliff Highway, was removed on Tuesday from its place of sepulture and conveyed to Dartmouth, where it was placed on board the Swedish cruiser *Fylgia* for conveyance to Sweden.

A GENERAL meeting of the American Philosophical Society will be held at Philadelphia on April 23-25. The preliminary programme, a copy of which has reached us, shows that thirty-six papers on important scientific subjects will be brought before the meeting by leading men of science in the United States.

THE Back bequest for 1908 has been awarded by the Royal Geographical Society to Lieutenant George Mulock, R.N., on account of the survey work which he did on the National Antarctic Expedition, and the map in six sheets which he prepared after the expedition returned.

A MESSAGE from Stockholm states that it is the intention of the Swedish Government to ask the Riksdag to make a grant for a scientific expedition to Spitsbergen in the coming summer for geological and geographical research. Prof. Gerard de Geer, the Rector of the University of Stockholm, will be the leader of the expedition.

IT is proposed to hold a conference of meteorologists representative of the United Kingdom and of the British colonies and dependencies in the course of the summer in Canada on the invitation of the Royal Society of Canada. The meeting was originally fixed for the last week in May. We are now informed by Mr. R. F. Stupart, director of the Canadian Meteorological Service, that it has been postponed, and is to be held in Quebec in the last week of July, immediately after the celebration of the tercentenary of Champlain's landing.

AN adult living specimen of *Lepidosiren paradoxa*—the South American lung-fish—reached the natural history department of Glasgow University some months ago, and has remained in a healthy condition. To this—the first living specimen which has ever reached the Old World—there have just been added eight others obtained by Mr. W. E. Agar on his recent expedition. It is hoped that in time it may be found possible to induce them to breed in captivity.

THE summer meeting of the American Association for the Advancement of Science will be held at Dartmouth College, Hanover, N.H., during the week beginning June 29. A committee, under the chairmanship of Prof. R. Fletcher, has been appointed to make the necessary arrangements. An invitation has been received from the president of the Blue Mountain Forest Association for members of the association to visit the Blue Mountain Forest, otherwise known as the Corbin Blue Mountain Park or Preserve, covering about 40,000 acres, where the celebrated herds of buffalo, deer, mountain goats, boars, &c., may be seen.

AGRICULTURAL science in America has lost a promising writer and teacher by the death, in his forty-second year, of Prof. Willis G. Johnson. He was formerly an instructor in the University of Illinois, and was engaged in special investigations for the natural history laboratory of that State. Later he became State entomologist of Maryland, and organised the Maryland State Horticulture Department. Of late years he had written largely on fruit-tree pests and kindred subjects, and had edited the *American Agriculturist*.

WITH reference to his article in NATURE of March 26 on the proposed alterations in the calendar, the author writes:—"In p. 489, col. 2, line 13, for 'each 132nd year' read 'each 128th year.' Dropping a leap year at the end of each latter period would be equivalent to having in that time 97 common years and 31 leap years, or 46,751 days in all, differing from 128 tropical years by only 0.00160 of a day. This is much more accurate than the Gregorian rule; and, if the latter is a little more easy to remember, that is of little advantage for what can come at most once in a lifetime."

IN a letter to the Paris Academy of Sciences, Prince Roland Bonaparte announces his resolution to place the sum of 100,000 francs (3960*l.*) at the disposal of the academy for the encouragement of scientific research. This sum is not to be treated as capital, but is to be used freely in the form of annuities, not as rewards for work done, but to enable competent workers, who have already proved their capability, to carry out new researches which otherwise they would be unable to prosecute. In his letter to the academy—which appears in No. 9 of the *Comptes rendus* (March 2)—the Prince expresses the hope that his example may be followed to such an extent that a permanent fund, devoted to this end, may be established.

THE following are among the lecture arrangements at the Royal Institution after Easter:—Mr. Gerald Stoney, two lectures on the development of the modern turbine and its application; Prof. F. T. Trouton, two lectures on (1) why light is believed to be a vibration, (2) what it is which vibrates; Prof. W. Stirling, two lectures on animal heat and allied phenomena; Mr. W. Bateson, three lectures on Mendelian heredity; Dr. A. Scott, three lectures on the chemistry of photography; and Mr. G. F. Scott Elliot, two lectures on Chile and the Chilians. The Friday evening meetings will be resumed on May 1, when Prof. J. Larmor will deliver a discourse on the scientific work of Lord Kelvin. Succeeding discourses will probably be given by Dr. J. Y. Buchanan, Dr. H. T. Bulstrode, Prof. J. C. Kapteyn, of the University of Gröningen, and Sir James Dewar.

A REUTER telegram states that Captain Ejnar Mikkelsen, who jointly commanded the Anglo-American Polar Expedition, returned from Alaska on April 2. Captain Mikkelsen started from Flaxman Island on October 16 and journeyed along the northern shore of Alaska, proceeding thence along the Yukon River towards Fort Gibson. The expedition traced the continental shelf in Beaufort Sea. Information was obtained concerning ocean currents which will be useful when Captain Mikkelsen makes another attempt to reach the unknown continent. Beyond the continental shelf there is water of great depth, demonstrating that Beaufort Sea is not a shallow basin, as has been supposed. The journey north was made along the 149th meridian, and soundings were taken occasionally. At a distance of sixty-four miles from the land it was impossible to touch bottom with a 320-fathom line. Mr.

Ernest de Koven Leffingwell, the expedition's geologist, has remained at Flaxman Island to carry on scientific work.

IN NATURE of February 13 (p. 345) Dr. T. J. J. See gave a quotation from Strabo suggesting that Mochus of Sidon was the originator of the theory of atoms. Dr. Dreyer pointed out, however, in the following issue (p. 368) that the so-called book of Mochus is a literary forgery. Dr. See now writes to state that, though this is the case, it does not justify the inference that Mochus himself was not a real authority of weight. In reply, Dr. Dreyer asks why should it be necessary to accept the existence of Mochus as a historical fact, simply because Posidonius was taken in by the forgery? It is known from other evidence that his mind was not very critically inclined. The book of Mochus is only one of a number of apocryphal writings about Demokritus, most of which pretend to have been written by himself, and describe his skill as a sorcerer and magician. See Zeller, "Philosophie der Griechen," i., p. 842 (5th ed.), and Susemihl, "Geschichte der griechischen Litteratur in der Alexandrinerzeit," i., p. 483. Zeller points out that the roots of the philosophical doctrines of Leukippus and Demokritus are so clearly distinguishable in the earlier Greek philosophy that it is out of the question to deduce them from Eastern sources.

THE report of the Royal Scottish Museum for 1907 records a marked increase in the number of visitors, the total exceeding that for the previous year by 92,000. Although this increase may be partially accounted for by an extension of the hours during which the museum is open, it apparently indicates an increased interest in the institution on the part of the public. An unsatisfactory feature is the presence of a bonded whiskey store within less than a dozen feet from part of the west wing of the museum.

ACCORDING to the recently issued report, the Royal Zoological Society of Ireland enjoyed an unusually good season during 1907 in the matter of receipts, the gate-money showing an increase of nearly 1500*l.* over that of the preceding year. This satisfactory state of affairs is attributed in great part to the recent Dublin exhibition, aided, no doubt, by the improved attractions of the gardens themselves. On the other hand, the list of paying members shows a serious diminution. The report is illustrated by photographs of the new seal-pond and of several interesting animals. Lion-breeding continues to be carried on successfully and profitably. As the collection includes lions from both West and East Africa, as well as one from Persia, it would be interesting if the authorities would afford information as to the characteristics of these local forms.

A SHORT editorial note in the January number of the *Indian Forester* refers to the very important subject of forests and water supply, but no data from Indian territories are quoted. The extent to which camphor has been planted in eastern Asia, India, Africa, and the United States is summarised in an article on the subject, and the methods of producing camphor synthetically are indicated. A reprinted article by Mr. A. M. Smith discussing the correlation between the moon's phase and the period of felling bamboos bears out the view that the phenomena which have led to the belief are connected with the amount of water in the culms; the amount varies greatly with transpiration and with the conditions of light.

MISS E. M. FARR has compiled a catalogue of the flora of the Canadian Rocky Mountains and the Selkirk Range that is published as vol. iii., No. 1, of the Contributions

from the Botanical Laboratory of the University of Pennsylvania. Of conifers, *Pinus Murrayana* and *Picea Engelmanni* are dominant in the Rockies; *Larix Lyallii* is a conspicuous tree at high elevations, and *Tsuga Mertensiana* is another characteristic Alpine tree occurring in the west of the region. Among flowering plants, the grasses, sedges, Cruciferae, Rosaceae, and Compositae are the largest orders. Numerous interesting Alpine plants are found, as *Erythronium grandiflorum*, known as the glacier lily, *Aquilegia formosa*, *Anemone Drummondii*, various saxifrages, *Parnassia Kotzebuei*, *Lutkea pectinata*, and *Vaccinium myrtilloides*. The plants growing on Sulphur Mountain, so-called because of the hot sulphur springs, include *Primula Maccalliana*, *Saxifraga caespitosa*, *Draba nivalis*, and *Hutchinsia calycina*.

A SEMI-POPULAR account of light-emitting plants, by Dr. C. Müller, is published in the February number of *Himmel und Erde*. In 1815 Heinrich recorded the observation that light is evolved by the wood of certain trees, and later John Heller rightly ascribed the phenomenon to fungi. Hartig identified one mycelium as that of *Agaricus melleus*, and more recently Molisch showed that the mycelium of other fungi produce the same effect. The fruiting bodies of *Agaricus Gardneri*, *A. igneus*, and *A. olearius* emit light, also the Australian fungi *Panus incandescens* and *Pleurotus canescens*. The light observed in connection with dead animal matter, attributable to bacteria, is due in certain cases to the presence of *Bacterium phosphoreum*, and it is peculiar that this organism only exists at temperatures below 30° C.; other bacteria produce the luminous effect in connection with marine fishes and animals. The emission of light at sea has been variously attributed to bacteria, Peridineae, and Pyrocistae. A distinctly novel idea of utilising light-emitting bacteria to provide a lamp was devised by Dubois and Molisch.

WE have received from the president of the International Aeronautical Committee a summary of the places at which scientific kite and balloon ascents were made in the months September–December, 1907, in Europe, the United States, and at Helwan (Egypt). Heights of 20,000 metres and upwards were reached by registering balloons at Uccle, Brussels (25,990 metres on September 5), Strassburg, and Pyrtou Hill (Oxon). The meteorological results are not stated in the summary.

THE Deutsche Seewarte has published the results of meteorological observations for 1906 at the stations under its control, consisting of ten stations of the second order, fifty-six storm-warning stations on the coasts of Germany and hourly readings at four normal observatories. These results have been published in practically the same form for twenty-nine years, and owing to the great care bestowed upon all details connected with the service, the volume is one of the most valuable annual contributions to the meteorology of Europe.

PART III. of the year-book of the Meteorological Observatory of Agram contains the rainfall observations made in Croatia and Slavonia in the years 1903–6. In the last year there were 121 observing stations; the data form an important contribution to the climatology of those parts, the tables are worked out in great detail, and the precipitation is particularised by the usual international symbols. We note, however, that, contrary to the method obtaining in this country, the values are entered to the day of measurement instead of to the previous day.

THE usual annual summary of the climatology of the past year, based on observations made at Juvisy, appears

in the February number of the *Bulletin de la Société astronomique de France*. It is pointed out, in discussing the monthly temperatures, that only on five occasions since the commencement of the nineteenth century has the mean temperature for the month of July been lower than it was in 1907. The relation between sun-spot activity and terrestrial temperature is discussed, and it is shown that from 1879 until 1897 the annual temperature curve followed the sun-spot curve, with a maximum in 1893. The parallelism was not continued, however, during the period 1897 to 1900, but in 1901–2 there was a temperature minimum corresponding to that of sun-spots. The sun-spot maximum of 1905 was not accompanied, in these latitudes, by a thermic maximum, but it is suggested the excessive rain of that year, with its resulting lowering of temperature, was occasioned by the excessive evaporation in tropical regions.

WE have received from the Danish Meteorological Institute its report on the state of the ice in the Arctic seas for 1907. The report is in its usual form.

THE Bulletin of the American Geographical Society for January contains an article by Prof. R. De C. Ward on some problems of the tropics. Prof. Ward emphasises the bounty of nature in providing all the necessaries of life in tropical latitudes, and the tendency for natives of such climates to make no attempts to attain higher civilisation. None of the energetic and enterprising nations of the world has developed under the easy conditions of life in the tropics. In considering the labour problem, the marked social gulf which is certain to ensue if white men attempt to develop tropical countries by aid of indolent natives is discussed. The white residents constitute a caste, and tend to become despotic, while the country is governed on the standards of the temperate zone. Reference is made to the tendency of Europeans to become enervated in a tropical climate, and the problem of tropical government is illustrated by the example of British India. After briefly discussing the seats of primitive civilisation, Prof. Ward directs attention to the migratory movements in history from colder to warmer climates, mentioning the descent of the barbarous tribes of the Himalayas into India, and the invasions of Greece and Rome from the north.

AN account of the earthquake of January 2, 1908, by Mr. Maxwell Hall, is published in the Jamaica weather report. The principal origin of this shock lay in the western part of the island, near Ipswich and Appleton. Rocks were thrown down in a railway cutting between these towns; many houses suffered damage in the district between Falmouth and Montego Bay; at Black River it is said that goods on shelves and in windows of shops on the south side of the High Street were thrown into the street, but those on the north side were thrown inwards. At Chapelton, Mr. Maxwell Hall reports that undulations of the ground could be seen as well as felt; this observation is interesting, as the shock was not severe, no damage was caused, and the violence, as defined by Mr. Hall, corresponds to about the fifth degree of the Mercalli scale.

IN an article in a Stuttgart newspaper, the *Deutsches Volksblatt*, Mr. Schips endeavours to apply recent chemical theories towards elucidating the origin and formation of the diamond from quartz-bearing rocks. The diamond, he points out, is always associated with silicates, and one of the minerals with radium emanation is always present. He concludes, therefore, that the diamond has been formed by the influence of the emanation on silicon.

IN *Concrete and Constructional Engineering* for March Colonel J. Winn summarises recent progress in the development of reinforced concrete in Great Britain. During the past year steady advance has been made, and the decision to build the new General Post Office extensions and various small post offices of reinforced concrete will have a far-reaching effect. Another interesting article in the same issue, by Mr. W. R. Crane, deals with the use of concrete and reinforced concrete in mines. Details are given of concrete linings at several shafts in the United States. Other articles dealing with reinforced concrete in reservoir, aqueduct, and conduit construction, with a ten-storey reinforced concrete building in Pittsburg, with reinforced concrete bridges in Italy, sea defences in Holland, and leading jetty on the Manchester Ship Canal, illustrate in a striking manner the variety and number of the structures which are being executed in this material.

Two interesting papers were read before the Institution of Engineers and Shipbuilders in Scotland on March 17. Mr. H. A. Mavor discussed the electric propulsion of ships, giving a comparison of the results to be obtained on a ship of large size driven direct by steam turbines with what can be done by the application of electric gear. The ship, details of which are worked out, had a total of 17,000 horse-power delivered to the three propellers, and a speed of 20½ knots. The propellers were 8 feet 1½ inches in diameter, and the speed of revolution was 377 per minute. The maximum probable efficiency of these propellers is calculated to be 62 per cent. An electric equipment would, it is shown, permit of the use of propellers of about 14 feet diameter at 140 revolutions per minute, and an efficiency not less than 70 per cent.—an improvement more than sufficient to cover the loss in the electric motors. In the second paper Mr. W. H. Hatfield traced the evolution of malleable cast iron, and discussed its present position in the metallurgical world. He takes exception to the statement made in the report on the nomenclature of iron and steel that malleable cast iron should not be regarded as a variety of cast iron, inasmuch as it does not exhibit the extreme brittleness that characterises cast iron. He considers that it should properly be classed as cast iron. The nomenclature is, however, a matter of slight moment. The tests given by the author show that malleable cast iron can be produced giving a tensile strength of twenty-three tons per square inch with an elongation of 19 per cent., a reduction of area of 20.6 per cent., and a bending angle of 180°, results which are as good as those given by many samples of wrought iron. In structure, these castings are very similar to wrought iron.

IN a note reprinted from the *Atti* of the Venetian Institution (Venice: C. Ferrari, 1908), Dr. U. Cisotti applies elliptic functions to the problem of efflux of a liquid from an opening containing an internal mouthpiece, a particular case of two-dimensional discontinuous motion. The paper forms the sequel to one in the *Rendiconti del Circolo matematico di Palermo*, xxv. (1908), on discontinuous motion in general.

THE recently established Italian bi-monthly *Scienza pratica* contains a paper by Mr. Lorenzo d'Adda on the substitution of cement for steel in the armour of battle-ships. The idea was suggested to the writer by the way the Russian shells bounded off the batteries of the Japanese in the siege of Port Arthur without producing any great damage. Among the advantages suggested are a considerable saving of weight and cost; moreover, the author points out that efficient adhesion can be secured between the cement

and iron owing to the similarity of their coefficients of expansion. Other papers are an illustrated obituary notice of the late Emilio Rossetti, late professor of physics at Buenos Ayres, who was also a pioneer of engineering in the Argentine Republic, and papers on the steam turbine and the trans-Appennine canal. A considerable collection of science abstracts, mainly dealing with engineering, is another important feature of the new journal.

PROF. GRUNER, of Bern, has written a small pamphlet dealing with "The World of the Infinitely Small" at the instance of the Keplerbund of Godesberg, a society which aims at the spreading of a knowledge of science amongst the people. The author has succeeded in presenting his subject in a most fascinating manner. He approaches the infinitely small by a series of steps, one of which deals with ultra-microscopic vision, and may be mentioned as illustrating the author's method. The colour of ruby glass is due, he shows, to the presence in it of minute particles of gold too small to be seen with a microscope, under which the glass looks a uniform material. When, however, the glass is examined by the ultra-microscope the gold particles appear as points of light on a dark background like stars in the sky. What, he asks, would be the appearance of these particles if we could bring to bear on them a power which exceeded that of the ultra-microscope as much as the latter does that of the ordinary microscope?

THE December (1907) number of *Terrestrial Magnetism and Atmospheric Electricity* contains an article by van Everdingen on the life and work of the late Dr. M. Snellen, director of the Royal Meteorological Institute of Holland. It deals mainly with the scientific and organising work of Dr. Snellen. Apart, however, from the character and importance of the scientific work in which Dr. Snellen was engaged, and which secured him many friends throughout the scientific world, his perfect mastery of the English tongue, his genial character, and his fund of anecdote made him a most welcome visitor to these shores, and increased the number of his admirers. We are glad to add our tribute of respect to that of the Dutch Meteorological Institute.

IN the Bulletin of the U.S. Bureau of Standards for January, Messrs. W. A. Noyes and H. C. P. Weber give an account of their re-determination of the atomic weight of chlorine. The method consists in weighing the hydrogen absorbed in palladium and the chlorine in the form of potassium chloroplatinate. The hydrogen, on being passed over the heated chloroplatinate, combines with the chlorine to form hydrochloric acid, which is condensed and weighed. The mean result is 35.457, silver being 107.88. These values differ slightly from the 35.467 and 107.91 found recently by Prof. H. B. Dixon and Mr. E. C. Edgar by the same method.

ACCORDING to the February number of the Journal of the Röntgen Society, the committee of the society, which has under consideration the establishment of a standard unit of radio-activity, has made an interim report in which it recommends that 1 milligram of pure radium bromide be regarded as the standard, and that the ionisation produced by the  $\gamma$  rays from it, after passing through 1 centimetre of lead, be taken as a measure of the unit of radio-activity. There are, however, certain difficulties in the adoption of these suggestions which the committee has still under consideration, and will deal with in a future report.

THE Cambridge University Press has issued a fourth edition of "Petrology for Students: an Introduction to the

Study of Rocks under the Microscope," by Mr. Alfred Harker, F.R.S. The book has been revised, new figures have been added, and a few old ones have been withdrawn.

THE U.S. Department of Agriculture has issued, at the request of librarians and others interested in entomology, a complete list of the publications of the Bureau of Entomology and those of the Department of Agriculture in general bearing on the same subject, and published by members of the Bureau or under its auspices. The list has been compiled by the librarian, Miss Mabel Colcord.

A SECOND edition of "An Elementary Course of Practical Zoology," by the late Prof. T. Jeffery Parker and Prof. W. N. Parker, has been published by Messrs. Macmillan and Co., Ltd. The first edition was reviewed at length in the issue of NATURE for April 12, 1900 (vol. lxi., p. 559). In the present edition some parts have been slightly extended, and various modifications made throughout; in addition, short accounts have been introduced of *Monocystis*, *Nereis*, and *Obelia*, and several new figures added.

THE Carnegie Institution of Washington has published an "Index of Economic Material in Documents of the States of the United States: New York, 1789-1904." The index has been compiled by Mr. A. R. Hasse, of the New York Public Library, for the department of economics and sociology of the institution. The index runs to 553 large pages, and deals only with the printed reports of administrative officers, legislative committees, and special commissions of the States, and with governors' messages for the period since 1789.

#### OUR ASTRONOMICAL COLUMN.

COMET 1907*d*.—No. 4234 of the *Astronomische Nachrichten* (p. 159, February 22) contains Herr Kritzinger's continuation of his ephemeris for Daniel's comet. At present the calculated magnitude of this object is about 10.8, and the comet is situated about 2° north of  $\mu$  Virginis.

OBSERVATORY MAP OF THE MOON.—From Mr. Porthouse, of 6 Bates Street, Birch Lane, Longsight, Manchester, we have received a copy of his recently published map of the moon. This map is printed on a circle of 12 inches diameter, the different formations being shown very clearly in outline. At the side of the sheet is a printed list of the formations, with reference numbers and the diameters according to Neison. The map can be read easily in the dim light of the observatory, and can be obtained from the publisher for eightpence, post free.

THE RECENT MAXIMUM OF MIRA CETI.—From forty-one observations of Mira, made with an 8-inch telescope, a pair of field-glasses, and the naked eye, and extending from September 8, 1907, to January 29, M. Félix de Roy found that the maximum brightness occurred on November 1, 1907, with a magnitude of 3.41. From October 29.5 to November 4.5 the brightness of the star apparently remained constant. A comparison with M. Roy's observations of the 1906-7 maximum shows the period of fluctuation to be 318.5 days, some thirteen days shorter than it is given by Guthnick from the discussion of the observations made during the last three centuries; other observers of the recent changes place the maximum at dates varying from October 30 to November 9.

According to Chandler's computations, a maximum of Mira Cygni was due to take place on April 4.5. On March 9 and 26, respectively, M. de Roy estimated the magnitudes of this object to be 6.60 and 5.88 (*Gazette astronomique*, No. 4, March 31).

SUN-SPOT OBSERVATIONS.—In No. 4237 of the *Astronomische Nachrichten* (p. 205, March 6), Herr T. Epstein compares the results of his sun-spot observations made during the years 1905, 1906, and 1907. The figures for

the half-years show that the maximum daily frequency took place in the second semester of 1905, and the yearly values indicate a steady decrease during 1906 and 1907. The ratio of the number of groups in the northern to the number in the southern hemisphere was almost reversed during 1907, for whereas in 1906 it was 1.55:1, in 1907 it was 1:1.28.

MERIDIAN CIRCLE OBSERVATIONS OF PARALLAX STARS.—Lick Observatory Bulletin, No. 129, contains a list of forty-five stars which have been observed at the request of Dr. L. de Ball for use in his heliometer measures of parallax. The positions given are the results of 400 observations, made on twenty-five nights, by Prof. R. H. Tucker.

THE RECENT TOTAL SOLAR ECLIPSE.—From a note in No. 1, vol. ii., of the Journal of the Royal Astronomical Society (Canada), we learn that the Lick Observatory eclipse party arrived back at Mount Hamilton on January 25. Rain fell during a part of the total phase, but some good photographs were obtained, for although the instruments were wet, they worked perfectly.

A NEW EXPEDITION TO THE SOUTHERN HEMISPHERE.—With the object of extending Prof. Boss's fundamental catalogue work to the southern hemisphere, an expedition, under the direction of Prof. R. H. Tucker, of the Lick Observatory, is to be dispatched to either New Zealand, South America, or South Africa. The Carnegie Institution has offered to bear the expense of the proposed observatory, and it is expected that the work will take about three years to carry out. The large Pistor and Martins meridian circle of the Dudley Observatory (Albany, U.S.A.) will be employed for this work (*Journal R.A.S., Canada*, vol. ii., No. 1, p. 43).

THE HAMBURG OBSERVATORY.—Prof. Schorr's report of the Hamburg Observatory, for 1906, contains an account of the new buildings and instruments. The new observatory lies about 20 kilometres to the south-east of the present one, and is at an altitude of 40 metres above the Elbe. The buildings are in the shape of a T, and cover an area of 33,652 square metres. Among the new instruments is a Steinheil refractor of 60 cm. aperture and 9 m. focal length, to which is adapted a correcting lens for the purpose of photography, and a meridian circle of 19 cm. aperture and 2.3 m. focal length; the circles are of 74 cm. diameter, and are divided in 4' intervals. Reports, in brief, of the 1905 and 1907 eclipse expeditions and of the variable-star observations and time-service are also given in the volume.

#### THE ZIEGLER POLAR EXPEDITION.<sup>1</sup>

IN the introduction Mr. Fiala gives a somewhat scanty historical account of the expedition, a footnote referring the reader for details to his popular narrative "Fighting the Polar Ice." One gathers that the expedition was equipped by Mr. W. Ziegler, of New York—who died before its return—and that the vessel which conveyed the expedition to its objective, Franz Josef Land, in 1903 was lost, the party being eventually rescued in 1905.

Mr. Ziegler had the sagacity to leave the choice of a scientific leader to the National Geographic Society, and its selection of Mr. Peters seems justified by the results. Mr. Peters was himself to have prepared the scientific results for press, but shortly after his return to America he was appointed to the magnetic survey ship of the Carnegie Institution, and his duties as editor devolved on Mr. J. A. Fleming. The magnetic instruments, a unifilar magnetometer and a dip circle, were loaned by the U.S. Coast and Geodetic Survey, and a programme was prepared by Dr. L. A. Bauer. Meteorological instruments were lent by the U.S. Weather Bureau and the U.S. Signal Corps, and the completeness of the records obtained probably owes a good deal to the fact that one of the members of the expedition, Mr. Francis Long, was a trained observer of the U.S. Weather Bureau.

<sup>1</sup> "The Ziegler Polar Expedition 1903-5," Anthony Fiala, Commander. Scientific Results obtained under the direction of William J. Peters. Edited by John A. Fleming. Pp. vii+630; with maps. (Washington, D.C. Published under the auspices of the National Geographic Society, 1907.)



The results appear under six sections:—magnetic, pp. 1-360; auroral, pp. 361-8; meteorological, pp. 369-488; tidal, pp. 489-596; astronomical, pp. 597-622; and map construction and survey work, pp. 623-630. The pocket at the end contains a map of the Polar regions down to latitude 65°, indicating the routes of the chief Polar expeditions, and two charts of Franz Josef Land, one of the whole archipelago and the other of the part surveyed by the Ziegler expedition.

The magnetic work consisted mainly of observations at Camp Abruzzi, Teplitz Bay (81° 47'·5 N. lat., 57° 59' E. long.), from September 28, 1903, to July 1, 1904, and at Camp Ziegler, Alger Island (81° 21'·5 N. lat., 56° 5' E. long.), from June 26 to July 30, 1905. Miscellaneous observations were also taken at Tromsø, Archangel, Barents Sea, and *en route* from Teplitz Bay to Cape Flora. Teplitz Bay, in Rudolph Island, is in the extreme north of the group of islands forming Franz Josef Land; it was the station occupied by the Duke of the Abruzzi's Italian expedition in 1899-1900. Alger Island is towards the south of the group, while Cape Flora, in Northbrook Island (the site of the Jackson-Harmsworth expedition), is in the extreme south. Fig. 1 (from p. 604) shows the nature of the observatory at Teplitz Bay. Prefaced to the magnetic observations is a condensed narrative relating mainly to auroral appearances and observational details, but occasionally of more general interest, as the following extract from the February, 1904, record will show:—

"12:20:00 sky clear, no aurora; 12:22:56 bear trying to break into observatory; 12:23:20 aurora in south-east; 12:23:40 to 48 observer investigating outside to see if bear is gone." For some time after this incident the observer, following the example of the Nansen expedition, provided himself with a revolver, the presence of which is conscientiously recorded. Considering the absence of self-recording instruments, the magnetic results obtained are, thanks to Dr. Bauer's programme, remarkably extensive. Eye readings of the declination magnet were carried out, so far as the exigencies of the situation permitted, on the following plan. On one day each week readings were taken at two-minute intervals throughout the whole twenty-four hours; on a second day similar observations were made for eight hours, and on each of four other days for four hours. The observations on these last five days were so arranged as to cover all hours of the day; thus results were obtained in each week answering to observations at two-minute intervals for two complete days. Diurnal inequalities of declination were formed for each four-week period at Teplitz Bay, each hourly value being a mean from 4×2×30, or 240, readings. These inequalities are analysed in Fourier series and illustrated by curves. During the nine months at Teplitz Bay, the range of the regular diurnal inequality varied from 107'·1 in June to 26'·3 in February-March. The mean of the ranges from the two four-week periods November 29 to December 26 and December 27 to January 23 was 36'·7. The existence of so large a range in the Arctic mid-winter is noteworthy. Throughout the whole time the general character of the diurnal variation was an easterly movement (of the north end of the magnet) from about 8 p.m. to 5 a.m. The return movement to the west was fairly continuous and rapid in summer, but in winter there was usually a secondary east and west movement in the afternoon. The greater rapidity of the movement during the day, so characteristic in temperate latitudes, seems not to exist at Teplitz Bay except at mid-summer. The corresponding analytical feature is the relatively small amplitude of the twelve-hour Fourier wave. The diurnal inequality of declination observed at Alger Island in June-July, 1905, had a somewhat smaller

range, but was generally similar to that observed at Teplitz Bay at the previous midsummer. A satisfactory feature in connection with the declination observations is the frequency and consistency of the determinations of the true bearing of the distant marks employed.

More than fifty absolute observations of horizontal force and more than sixty observations of inclination (with two needles) were made at Teplitz Bay; at Alger Island there were sixteen observations of horizontal force and eight of inclination.

In accordance with the experience of previous Arctic observers, it was found that whilst magnetic storms and aurora were generally associated together, this was not always the case. Declination observations happened, fortunately, to be taken on November 1, 1903, during part of the great magnetic storm then in progress. In the course of 1h. 48m. the declination changed by 17° 18', or some thirty-two times the corresponding change at the Cheltenham Observatory (where the horizontal force is about three times that at Teplitz Bay). If the same proportion existed throughout the rest of the storm, the declination range at Teplitz Bay must have exceeded 50°.

The auroral data are mainly descriptive, and there is no attempt at trigonometrical observations or tabular details. There are, however, nineteen handsome plates,



FIG. 1.—Exterior of Observatory at Teplitz Bay.

based on chalk sketches made by Mr. Fiala, illustrating a number of auroral types, especially the corona. Plates VII. and VIII. show banded structures having in some respects a somewhat striking resemblance to those produced artificially by Villard.<sup>1</sup>

Of the meteorological observations, the longest series consists of hourly records of wind velocities from a Robinson cup anemometer at Teplitz Bay from September, 1903, to May, 1905. Allowing for possible differences between American and English estimates of wind velocity, we may safely characterise Teplitz Bay as a windy place. The average velocity for the whole period was 14·6 miles per hour. Monthly means varied from 8·2 in August, 1904, to 24·2 in February, 1905, and 24·6 in December, 1903. On four days the mean hourly velocity exceeded sixty; on December 28, 1903, the mean velocity was no less than 73·4 miles per hour. In winter, high gales were associated with a low barometer and a high temperature. Changes of temperature were notably large and rapid. Eye readings were taken thrice a day, at 8 a.m., noon, and 8 p.m., of barometric pressure, temperature (from ordinary and from maximum and minimum thermometers), precipitation, wind (velocity and direction), and cloud (amount, species, direction of motion). These observa-

<sup>1</sup> NATURE, vol. LXVI., p. 481.

tions lasted at Teplitz Bay from September 1, 1903, to April 30, 1904, and at Cape Flora from May 21, 1904, to July 30, 1905. Taking the mean of the three daily readings, the monthly mean temperature varied at Cape Flora from  $-19^{\circ}.9$  F. in January to  $+35^{\circ}.6$  in July; at Teplitz Bay, March had the lowest mean temperature,  $-19^{\circ}.7$  F. At Cape Flora, the precipitation during the year ending with May, 1905, was equivalent to 21.37 inches of rain. A recording thermograph and barograph were in action at Teplitz Bay from October, 1903, to April, 1904, and a barograph was run at Cape Flora from June, 1904, to May, 1905. From the records of these instruments diurnal inequalities are deduced for individual months, and Fourier coefficients calculated. Taking arithmetic means from individual months, the amplitudes (in thousandths of an inch) of the three first terms in the case of the barometric pressure were:—

	24-hour	12-hour	8-hour
Teplitz Bay (winter)...	14	6	3
Cape Flora (year) ...	13	5	3

Tidal observations were made at Teplitz Bay from April 1 to June 3, 1904, and at Cape Flora from May 21 to August 31, 1904. Readings, to 0.01 foot, were taken on a tide staff once an hour, usually throughout the whole twenty-four hours. Fig. 2, reproduced from p. 493, shows the arrangements at Teplitz Bay. The wooden frame

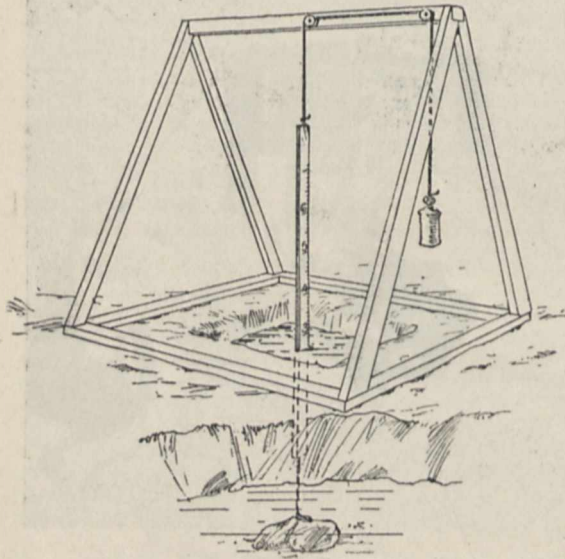


FIG. 2.—Tide Gauge at Teplitz Bay.

rose and fell with the ice it rested on, the heavy stone remaining on the sea bottom. There is an elaborate harmonic analysis of the data, following generally the methods of Sir G. H. Darwin. The mean difference between high-water and low-water level was fairly similar at the two stations, being 1.138 feet at Teplitz Bay and 0.966 foot at Cape Flora. There was, however, a difference of  $3\frac{1}{2}$  hours in the "establishment of the port" at the two places, and the conclusion is drawn (p. 596) that the tide from the Atlantic reaches Franz Josef Land by two channels, the deeper, between Spitsbergen and Greenland, chiefly influencing Teplitz Bay, the other, between Spitsbergen and Norway, chiefly influencing Cape Flora.

The astronomical observations served to fix the latitude and longitude of the stations and the azimuths of the declination marks. Considerable care was evidently given to them, but they call for no special remark.

As will have already been inferred, one can have nothing but praise for the zeal displayed. Magnetic observers who took observations at two-minute intervals for eight hours on end, at temperatures below  $0^{\circ}$  F., cannot be accused of treating Arctic exploration as a pretence for a picnic. It may also be added that no trouble has been spared in making the most of the material collected. Valuable, however, as the results are, they must be accepted with

several reservations. As the dates will have shown, the series of observations, especially the tidal ones, were short, and the representative nature of the results is thus exposed to more or less doubt. This consideration cannot but suggest itself to anyone who examines some of the data critically. Taking, for instance, the mean monthly data from the thermograph record at Teplitz Bay, we find that in March the 10 p.m., midnight, and 2 a.m. readings are the only ones of the two-hour readings to exceed the mean for the day, the maximum coming at 2 a.m.; but in April these are the precise hours to which the lowest temperatures are attached. Again, the diurnal inequality range is  $3^{\circ}.3$  in January, in the depth of the Arctic night, but only  $0^{\circ}.8$  in October. In the case of the magnetic data, there are other sources of uncertainty. There was appreciable local disturbance both at Teplitz Bay and Alger Island, and its precise effect, though probably not large, cannot be assigned. After the return of the magnetometer to America it was found that a cloth hood, believed to have been fastened to the end of the magnet box in 1899, had been attached with steel tacks. Observations at Cheltenham showed no effect on the declination, but a decrease of  $250 \gamma$  ( $1 \gamma \equiv 0.0001$  C.G.S.) in the horizontal force. A correction of  $+255 \gamma$  (or nearly 4 per cent.) was thence calculated and applied to observations made in the Arctic. In the case of the dip circle comparisons at Cheltenham before the expedition gave for the two needles corrections of only  $+0^{\circ}.2$  and  $-0^{\circ}.3$ , but the corresponding corrections obtained after the expedition were  $-4^{\circ}.1$  and  $-5^{\circ}.6$ .

In view of these uncertainties, and the lack of direct information as to diurnal change, the deductions made as to secular changes of horizontal force and inclination at Teplitz Bay by comparison with the results of the Italian observers for 1900 should be regarded with reserve.

Again, at Teplitz Bay there were only nine months' magnetic observations, and the deductions of diurnal inequalities for the three missing months, and thence for the year as a whole, are of somewhat doubtful value.

The deficiencies referred to are such as attach more or less to most expeditions, and there are probably few Polar observations which are not affected by at least as serious uncertainties. There are many points in connection with the observational programme and its execution which merit the attention of those contemplating magnetic or meteorological work in high latitudes.

C. CHREE.

#### SANATORIA FOR CONSUMPTION.

AS a supplement to the thirty-fifth annual report of the Local Government Board, Dr. Bulstrode has published an imposing volume on "Sanatoria for Consumption and certain other Aspects of the Tuberculosis Question." This report, copiously illustrated by photographs, plans, and charts, extends to 700 pages, and is an admirable exposition of the present position of the problem of prevention of tuberculosis.

In part i. is set forth a general review of the changes which have taken place in medical opinion as to the etiology of tuberculosis and as to the mode of its invasion of the human body.

The theory of infection by inhalation of dust infected by dried sputum, and the evidence on which it is based, is reviewed; also the theory of von Behring that infection can be usually traced to the ingestion of tuberculous milk in infancy, remaining latent until some debilitating influence causes the focus of infection to light up to the undoing of the organism. Calmette's theory that direct infection occurs mainly by the ingestion of food tainted by droplets of infective expectoration is also discussed, and finally we have the conclusions of the Royal Commission on Tuberculosis, that a material amount of human tuberculosis is attributable to infection of the intestinal tract by "tubercle of bovine origin."

The proportion of tuberculosis due to this source, unfortunately, has never been definitely ascertained, but the pronouncement of the Royal Commission is important in the light of Koch's dogmatic statements as to the essential difference between human and bovine tubercle, and all this difference entails.

Dr. Bulstrode gives us many tables of statistics which prove the gradual but steady diminution of tuberculosis, and emphasise the curious phenomenon that this declension is much more marked among females.

In this satisfactory state of affairs sanitary reform, improved conditions of living, and higher wages have all played their part, but the report does not help us much to estimate the relative value of the various methods of attacking the disease which have been tried.

The difficulty of estimating the value of sanatorium treatment is brought out, and we are told that until this method has had a longer trial figures of results will only lead to confusion and misconception.

Stress is, however, laid on the fact that to obtain the best results from sanatorium treatment cases of tuberculosis must be treated in their earliest stages, and further, that after treatment an easy path of suitable work must be provided until a life of full activity can be tolerated by the patient.

The problems which arise in the selection of a sanatorium site, and the conditions necessary in sanatorium buildings, are thoroughly discussed. Dr. Bulstrode concludes that, with foresight and care, the erection of sanatoria with all actual essentials might be provided at a smaller cost than has hitherto been the case. This is an important conclusion, for if we are to provide adequately for the tuberculous population, many more sanatoria must be erected, and the question of money has ever been the chief difficulty in the way.

One of the most interesting chapters, which is amplified in part iv., relates to the German system of compulsory insurance as a factor in the control of phthisis. The figures given are striking, and we see here admirably exemplified the value of coordinated effort as opposed to the haphazard methods of control employed in the British Isles.

The conclusion is thrust upon us that in the control of phthisis Germany is far ahead of us. We are set an excellent example, which we would do well to follow. Our comparative failure is largely due to this want of coordination, and the waste of money and energy thereby entailed.

This part of the report concludes with a chapter on the teaching of hygiene in the public elementary schools. Tuberculosis is associated with ignorance no less than with poverty, so that there can be no question as to the importance of teaching elementary hygiene, especially so far as food values are concerned, as a means to the reduction of tuberculosis both in childhood and adult life.

In part ii. we are given a well-illustrated directory of all the public sanatoria in England and Wales, which should prove of much value for reference. This part of the report has been provided with an index, which might mercifully have been extended to the whole volume.

Part iii. is devoted to a discussion of notification of tuberculosis (voluntary and compulsory). There are as yet no data available by which the substantial utility of notification can be tested, and we must await a more extended experience before a decided opinion can be formed.

The whole volume is an admirable and comprehensive piece of work, which should be read by all those interested directly or indirectly in the problems of tuberculosis.

R. FIELDING-OULD.

**THE SOCIETY OF DYERS AND COLOURISTS.**

THE twenty-fourth annual general meeting of the Society of Dyers and Colourists was held at Bradford on Friday, April 3, in the large hall of the Technical College. The president, Prof. Meldola, having taken the chair, the Lord Mayor of Bradford, on behalf of the town, welcomed the meeting, and especially the distinguished foreign visitors, Prof. Liebermann and Dr. Schreiner, who were present. The president then, on behalf of the society, awarded the Perkin medal, which for this occasion had been duplicated, to Profs. Graebe and Liebermann for their synthesis of alizarin in 1868. The medal was founded by the society in 1906 in honour of the late Sir William Perkin, and in celebration of the jubilee of the discovery of mauve, the

first of the coal-tar colouring matters, the terms of its award being "for investigations, discoveries or inventions of high scientific or industrial importance applicable to or connected with the tinctorial industries."

In presenting the medals, which Prof. Liebermann received on behalf of himself and colleague, the president pointed out that this first presentation was in recognition of a discovery which, although made forty years ago, was still practically effective in enabling the tinctorial industry to be supplied with some of the most important of the artificial colouring matters. The synthesis of alizarin was of extreme scientific interest as having been the first case of the artificial production of a natural colouring matter, and it was also of particular importance as having exerted a marked influence on Perkin's career as a manufacturer and scientific investigator. Prof. Liebermann, on behalf of Prof. Graebe and himself, acknowledged the honour which had been conferred upon them, and in eloquent terms paid tribute to the memory of the late Sir William Perkin.

The president then delivered an address on the founding of the coal-tar colour industry, in which he reviewed Perkin's life-work from the technical side, and gave a history of the foundation and development of the Greenford Green factory, where all Perkin's industrial operations were conducted. On the motion of Mr. Hindley, seconded by Dr. Hertz and supported by Sir Robert Pullar, the president was thanked for his address, which was ordered to be published in the journal of the society.

In the evening the members and their guests dined at the Great Northern Victoria Hotel, the president occupying the chair, and being supported by Prof. Liebermann, the Lord Mayor, the ex-Lord Mayor, Sir Robert Pullar, Dr. C. Dreyfus, and representatives of most of the great dyeing and printing firms of the district, as well as by well-known authorities connected with the educational and scientific side of the tinctorial industry, such as Profs. A. G. Green (Leeds), W. M. Gardner (Bradford), Dr. J. C. Cain (London), Dr. Knecht (Manchester), and Mr. C. Rawson (Leicester), &c. All the officers of the society, which has its headquarters in Bradford, with sections in Manchester, the West Riding, and London, were also present. The toast of the society was proposed by the Lord Mayor, and responded to by Sir Robert Pullar. The president gave the toast of the medallists, which was enthusiastically received in both German and English forms, and to which Prof. Liebermann responded. The toast of the president was proposed by Mr. Ald. Godwin, the ex-Lord Mayor, in a humorous speech, and replied to from the chair. Dr. Schreiner, the inventor of the well-known process for "Schreinerising" fabrics, also addressed the meeting in acknowledgment of the honour done to his distinguished countrymen and to himself as a guest. As Prof. Graebe was unable through indisposition to be present at the gathering, a telegram was dispatched in the name of the society expressing regret at his absence and wishes for his speedy recovery.

**ENCKE'S COMET.**

THE observations of Encke's comet made at the Heidelberg Observatory deviate so strongly from the predicted places that Dr. Backlund, the director of the Pulkowa Observatory, has thought it necessary to investigate the cause. He finds that the perturbations by Jupiter, which were calculated in duplicate by H. Kamensky and Fraulein Karolikowa, have been correctly applied, so far as they depend on the first power of the disturbing force, but that in the period 1901-4 the comet approached Jupiter almost as closely as is possible, and that in consequence perturbations of the second order are very sensible. The corrections to the several elements, depending on the action of Jupiter, were as follows:—

	1st Order	2nd Order
Mean anomaly ... ..	+ 11 55.2	- 3 34.1
Long. perihelion ... ..	- 0 8.5	- 0 15.7
Long. node ... ..	+ 0 4.8	- 1 0.2
Inclination ... ..	+ 1 2.0	—
Excentricity ... ..	+ 2 39.8	- 1 7.6
Mean motion ... ..	+ 0.9255	- 0.3210

The corrections to the ephemeris, after applying the improved value of the perturbations, and taking into

account the influence of the acceleration, are, for the three days:—

	1908, Jan. 3	Jan. 11	Jan. 19
$\Delta\alpha$ ...	+0° 49' 25"	+0° 40' 31"	+0° 27' 50"
$\Delta\delta$ ...	-2 24' 75"	-2 21' 69"	-2 21' 65"

whereas the corrections to the published ephemeris, found by Dr. Kobold from Dr. Max Wolf's observations, are of quite a different character:—

	$\Delta\alpha$	$\Delta\delta$
1907 Dec. 25 ...	+34' 5"	-24"
1908 Jan. 2 ...	+35' 2"	-24"
" " 13 ...	+47' 0"	-4' 9"
" " 14 ...	+47' 2"	-3' 6"
" " 15 ...	+47' 0"	-2' 4"
" " 18 ...	+45' 3"	+0' 5"
" " 19 ...	+44' 3"	+1' 4"

It will be seen that the neglected perturbations in no way explain the deviations between the computed and observed places. In declination these differences are particularly striking, and no permissible alterations to the elements will reduce them to the order of errors of observation.

Prof. Backlund makes two suggestions by way of explanation:—(1) that the object observed from December 25 to January 19 was not Encke's comet; (2) that this comet has divided itself into two parts, and that the part that has been observed has, by the process of dislocation, been deflected from the original orbit. Observations in the southern hemisphere, which will be possible in June, will decide this point. Dr. Backlund further points out that, previous to this year, the comet has never been observed before perihelion passage when the date of perihelion falls between April and July.

Dr. Ebell has computed a parabolic orbit from the observations made at Heidelberg, and the result is sufficiently surprising. The dates selected were January 2, 13, and 19, and the middle place is fairly well represented, but the outstanding errors on December 25 were  $\Delta\alpha + 32'.40$  and  $\Delta\delta + 12'.19$ . The elements are as follows:—

T ...	1907 Dec. 6° 0569 Berlin M.T.
$\omega$ ...	39° 25' 59" } 1908° 0
$\Omega$ ...	317 7' 25" }
$i$ ...	10 26' 99" }
$\log q$ ...	0.58448

The node and inclination are not very different from those of Encke, but the perihelion distance is rivalled only by the comet of 1729. The material is not sufficient to derive an ellipse. It will probably be found that the Heidelberg object is not the comet of Encke.

### UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

LONDON.—The report of the committee of University College for the year 1907-8 has just been issued. During last session there were 1191 students, of whom 171 were registered as post-graduate and research students. The report deals, among other matters, with the work of the faculties for the past year, and gives a list of the researches and original papers published during that year. That list occupies thirteen octavo pages. Among the departments that seem to have been specially productive may be noted the department of applied mathematics under Prof. Karl Pearson, from which no fewer than twenty-eight papers were issued during the year. Seven of these were from the Francis Galton Laboratory of National Eugenics. The departments of chemistry under Sir William Ramsay and Prof. J. Norman Collie produced twenty-four original papers, while the subdepartment of spectroscopy issued seven. The list of post-graduate courses is valuable as an indication of the extensive provision for higher work that is now to be found in London. The report concludes with a summary of the urgent needs

of the college if it is to meet the demands made upon it; they include the following:—

	Estimated Cost	Money Available
New buildings for anatomy, physiology, and pharmacology ...	£ 50,000	£ 15,250
New buildings for the department of chemistry. (The scheme could be carried out in two sections, costing 40,000l. and 30,000l. respectively) ...	70,000	nil
Building alterations and new equipment for botany and pathological chemistry ...	5,000	nil
Re-fitting of general library and completion of science library ...	5,000	nil

DR. J. M. FORTESCUE BRICKDALE has been appointed director of the public health laboratory of University College, Bristol.

THE Fishmongers' Company has given 1000l. towards the fund for carrying out the scheme of incorporation of King's College with the University of London.

MR. CARNEGIE has given a further donation of a million pounds sterling to the Carnegie Foundation for the Advancement of Teaching. Attention was directed in our issue of March 12 (p. 452) to the admirable work done already by the foundation, which was two years ago inaugurated by Mr. Carnegie and endowed by him with two millions sterling. The fund, which now amounts to 3,000,000l., is intended primarily to serve for providing retiring allowances for professors and others in universities and colleges in the United States, Canada, and Newfoundland. Originally the benefits of the foundation were confined to privately endowed educational institutions, and Mr. Carnegie has increased the fund so that professors in State institutions may also be eligible to participate in the benefits of the scheme.

THE seventy-fourth annual report of Bootham School (York) Natural History, Literary, and Polytechnic Society, that for 1907, provides excellent evidence that in some English secondary schools at least the out-of-school hours are opportunities in which the boys may follow their natural bent and cultivate their individuality. The boys band themselves together in societies for the outdoor study of numerous branches of natural history; they record meteorological data, study the archæology of the neighbourhood, practise photography, work in metal and wood, and besides these and other practical pursuits they take part in a flourishing literary society. Boys and masters are to be congratulated upon the report, and the boys also on the fact that they are allowed to manage the societies largely by themselves.

It is well known, says the Journal of the Royal Society of Arts, that American employers give much more attention than has been the practice in this country to affording facilities to their managers and workpeople for obtaining technical knowledge. For example, a large organisation of spinners and manufacturers at Atlanta (Georgia) has adopted the following scheme for keeping their employees up to date in commercial and technical knowledge of the textile trade. A librarian is employed to secure all the latest books dealing with spinning, weaving, and textile engineering; all periodicals from all parts of the world bearing on the subjects are purchased or otherwise secured. The librarian prepares brief descriptions of the books, to which anyone may refer to get a quick idea of the contents. In some instances the whole periodical is filed; in others special articles are cut out, and sometimes foreign articles are translated and pasted in scrap-books. Everything is carefully indexed, and the library is open to any employee.

A NATURE-STUDY course for women is to be given again this year at the Horticultural College, Swanley, Kent, during the summer holidays. The course will extend from August 1 to 12. Weather permitting, most of the instruc-

tion will be given out of doors, rambles in the country under the guidance of experienced teachers being the chief feature. It is hoped to combine the natural history excursions with points of antiquarian and other interest in outlying districts, and an endeavour will be made to render the course useful, both for home life and school work. The report for 1907 on the work of the college as a whole shows that good progress continues to be made. The chief feature of the year was the establishment of a course in natural history, which has for its object the training of third-year students who have passed the ordinary gardening course at the college and wish to increase their knowledge of natural history subjects in order to qualify as teachers of gardening and nature-study.

The third International Congress for the Development of Drawing and Art Teaching is to be held in London from August 3 to 8 next. Previous meetings in Paris in 1900 and in Berne in 1904 proved very successful in stimulating the application of art to industry. The promoters of the London meeting direct attention to the fact that as a nation Great Britain compares unfavourably with her commercial competitors in the attention paid to applied art in technical schools. On these grounds, with others, an appeal is made to educational authorities and employers of labour to assist in making the forthcoming congress a success, both by contributions to the necessary funds and by interesting administrators and teachers in the scheme. Drawing should be allied with all subjects of study, but it is especially useful to the student of science, and it is to be hoped that the congress will lead to an improvement in the methods of teaching drawing in our schools, as well as to a recognition of its importance in a complete scheme of education. Full particulars of the London meeting can be obtained from the secretary of the congress, 151 Cannon Street, London, E.C.

The second International Congress of Popular Education is to be held in Paris from October 1 to 4 next. It is being arranged by la Ligue française de l'Enseignement. Invitations have been sent to various educational associations in different parts of the world to send delegates to the congress. All expenses in connection with the congress are to be borne, we understand, by the league. Among the subjects to be introduced and discussed at the meetings in Paris may be mentioned:—Societies for the encouragement of the education of the masses, popular lectures and libraries, the education of women in household and maternal duties, professional education, the international exchange of children for educational purposes, and the system of visits by teachers for the study of foreign methods. It is hoped to publish the addresses and discussions at the congress, and in this way to bring together much valuable experience gained in different countries in the direction of solving difficult educational problems. There is every reason to hope that the meetings will prove even more successful than those of the first congress, held at Milan in 1906. All inquiries should be addressed to M. Léon Robelin, general secretary of la Ligue française de l'Enseignement, 16, rue de Miromesnil, Paris.

The accounts for the year ending July 31, 1907, of the various London polytechnics show that the total ordinary receipts of all the institutions amounted for the year to 293,952*l.* The grants of the London County Council amounted to 77,358*l.*, or 37.93 per cent. of the total receipts. Grants from the Board of Education reached 32,844*l.*, or 16.11 per cent.; the amounts received from City Parochial Foundation were 28,330*l.*, or 13.89 per cent., and from City companies, &c., 5917*l.*, or 2.90 per cent. The total ordinary expenditure on revenue account of all the institutions amounted to 207,519*l.* Large increases occurred under two heads, viz. "teachers' salaries," 10,317*l.*, and "apparatus and other educational appliances and furniture," 3116*l.* Taking the results as shown by the accounts, it is seen that, so far as ordinary income and expenditure are concerned, there was a deficit of 3567*l.* on the institutions as a whole. With regard to items of an exceptional nature—principally new building works and special equipment—the total income was 15,089*l.*, of which the London County Council's grants amounted to 9401*l.*, and the expenditure was 9113*l.* Of

the total amount of revenue, it is interesting to note that the fees of students and members of the various polytechnics amounted in all to 47,255*l.*, or 21.57 per cent., and what are called in the accounts voluntary subscriptions reached 9161*l.*, or 4.18 per cent., nearly twice as much as in the previous year, though other percentages were practically the same in both years.

## SOCIETIES AND ACADEMIES.

LONDON.

“Royal Society, December 5, 1907.—“On the Structure of *Sigillaria scutellata*, Brongn., and other Eusigillarian Stems, in Comparison with those of other Palæozoic Lycopods.” By E. A. Newell **Arber** and Hugh H. **Thomas**. Communicated by Dr. D. H. Scott, F.R.S.

This paper contains the first full account of the structure of the Eusigillariæ or ribbed Sigillarias of the Rhytidolepis section. The stele has a well-marked pith, bounded by a continuous ring of scalariform tracheids—the primary wood—the outer margin of which is crenulated. The ribs are really formed of cortical tissues, and not by fused leaf-bases. They consist largely of phloem, and externally what is probably a small zone of primary cortex, which lay without the region of secondary meristematic activity, still persists. The leaf-bases, consisting of thin-walled parenchymatous elements, merely form bracket-like projections from the ribs.

The presence of a ligule and a ligular pit has been detected for the first time. The course of the leaf-traces in the leaf-bases and cortical tissues has been followed with important results. The bundle is collateral, and without secondary wood. In the leaf-bases the trace consists of a *double xylem strand*, the two xylem groups being widely separated. These two strands unite as they pass through the phloem. The structure of the trace is almost identical with the foliar bundle of the leaf *Sigillariopsis sulcata*, which is obviously simply the leaf of a eusigillarian stem.

The parichnos increases greatly in size as we pass from the exterior of the stem to the inner margin of the periderm. The two strands further unite, first below and then above the trace, so that, at a deep level in the periderm, the trace is completely surrounded by a broad zone of this tissue.

January 16.—“The Conversion of Diamond into Coke in High Vacuum by Kathode Rays.” By the Hon. C. V. **Parsons**, C.B., F.R.S., and Alan A. Campbell **Swinton**.

The apparatus employed consisted of a Crookes tube furnished with two concave cup electrodes of aluminium which, when supplied with high-tension alternating current, acted alternately as kathode and anode, and accurately focussed the kathode rays on to the diamond, which was supported on a plate of iridium.

As the proper degree of vacuum was reached by means of mercury pumps, and as the volts were raised, the diamond in each of the two experiments made became red, and then intensely white hot, until with about 9600 volts and 45 milliamperes passing through the tube it commenced to become black.

Finally, with 11,200 volts and 48 milliamperes (537 watts), a rapid disintegration of the diamond took place with considerable increase in volume, the residue having much the appearance and consistency of coke. As measured by a Féry optical pyrometer, the disintegration took place at the temperature of 1800° C.

Observations of the spectra of the residual gases in the tube before and after the conversion of the diamond into coke showed differences, but these were not thought sufficiently marked to determine with exactitude any variation in the nature of the gases present.

January 23.—“Report on the Eruptions of the Soufrière in St. Vincent in 1902, and on a Visit to Montagne Pelée in Martinique. Part ii.—The Changes in the Districts and the Subsequent History of the Volcanoes.” By Dr. Tempest **Anderson**. Communicated by Prof. T. G. Bonney, F.R.S.

The principal points of interest in the observations made

during the author's second visit lie in (1) the changes wrought by denudation on the deposits left by that eruption; (2) the light thrown by those changes on the operation of the forces which had moulded the features of this island in its earlier history; (3) the information he was able to collect with regard to the volcanic disturbances subsequent to the great eruption of May, 1902; and (4) the return of vegetation to the devastated areas.

In the 1902 eruption a certain amount of the ejecta overtopped the Somma ring, i.e. the remains of the original great crater, and descended some of the valleys to the north of it; but by far the greater portion was discharged into the transverse depression which extends right across the island and separates the Soufrière from the mountain known as Morne Garu, about three miles to the south. The water from the crater lake was discharged at the beginning of the eruption down the Rabaka and Wallibu rivers, while the solid and gaseous ejecta, in the form of the incandescent avalanches and black clouds, descended to both sides of the island.

The most important geological phenomena were observed in the Wallibu district. These phenomena have been fully described in the published report, as also the subsidence of part of the coast. To this district, therefore, attention was especially directed in 1907 with the view of observing the further progress of the changes and the return of vegetation.

A description of the Wallibu valley is given in the full paper. In that district the beds of newer date have been dissected into flat-topped plateaux by small rivers running in deep gorges, which have again been filled in places by ejecta of eruptions and re-excavated in different degrees, and sometimes on different lines, leaving plateaux and terraces of different ages and heights. This action is well exemplified in the lower valley of the Wallibu. In the 1902 eruption this part of the valley was filled by the incandescent avalanche to a depth of at least 100 feet in the upper part, and less towards the sea, and it was in this deposit of hot ash that the explosions of steam and hot ash, flows of boiling mud, and other secondary phenomena took place. In 1907 almost the whole of this ash had been washed away, but a fragment remained in the shape of a terrace 60 feet to 80 feet high, situated on the north side of the valley. The ash of which it is formed is unstratified, and contains very few ejected blocks or fragments of any kind. The floor of the valley is all composed of water-sorted material, chiefly gravel and coarse sand, but with a good many blocks as big as a man's head. They represent ejected blocks and fragments of lava derived partly from the ash of 1902 and partly from older beds, the fine ash in each case having been washed away. The surface of the gravel bed showed marks of quite recent running water, and during the last winter, 1906-7, the river ran along the foot of the north bank of the valley. When examined in March, 1907, it ran along the south side of the valley, and had already in those few months excavated a new channel about 30 feet in depth. The stratification, as exposed in the side of this new valley, is very distinct, and the sorting by water, mentioned above, is very evident. Further up the mountain the remains of the avalanche became more abundant in the valley bottoms, and here they were also often better preserved, so that traces of the feather pattern erosion, so noticeable in 1902, were still visible on the surface. This was mainly due to the surface of these ash deposits, like those to be presently mentioned on the plateaux and on the ridges, having consolidated into a crust almost like a cement pavement which resists the action of the rain.

Another interesting point was observed with regard to these massive ash deposits. Instead of one stream re-establishing itself along the centre of the deposit, the tendency is for a new stream to form on each side at or near the junction of the new ash with the old valley slopes; and, as these streams deepen themselves, two new valleys are formed where only one previously existed, and the walls of each are composed on the one side of the new ash and on the other of older tuff, with occasional terraces of new ash. It appears to be due to the fact that the water from the old slopes, in running down into the original valley, meets the soft new ash, and at once

turns down along the valley and so starts the new stream, and it seems likely that the chief cause of its so turning is that the surface of the deposit tends to be higher along the middle of the valley than at the sides, as is usual with mud-streams or glaciers. A good example of the action above described is to be found in a wide valley to the north of and parallel with the lower Wallibu valley, and bounded on the south by the Wallibu plateau. Before the 1812 eruption the Wallibu river flowed down this valley, but its course was changed after that eruption. The floor of the valley is now occupied by the gorges of two small rivers, divided by a very narrow ridge, formed of ash different from and less consolidated than that composing the walls of the main valley, and considerably lower than the Wallibu plateau. In 1902 both these gorges were filled with new ash to the level of the main valley floor. One of these, the Trespé gorge, now emptied of the 1902 ash, shows its north wall to be much higher than the south, and also formed of older and more consolidated tuff. The same conditions, with sides reversed, are seen in the other gorge, the higher bank in that case being the Wallibu plateau to the south.

The Wallibu plateau is composed of ash older than that dividing the above two small rivers, but still comparatively new, and its flat top and precipitous sides, both north and south, proclaim it to be in an early stage of denudation, while the south bank of the Wallibu river on the south of the plateau is composed of older tuff and lava, and shows a much more mature type of denudation, viz. sloping hills with rounded or ridged tops, and a good deal weathered into valleys or gullies. The north face of the plateau, like the south, is precipitous, and obviously much less advanced in weathering than the slopes of the Soufrière on the opposite side of the broad valley of the Wallibu Dry, and Trespé rivers to its north. The mass appears to be the remains of an avalanche, or succession of avalanches, of hot ash poured into the depression between the Soufrière and Morne Garu, on an enormously larger scale than anything formed by recent eruptions. It may be that the present bed of the Wallibu to the south and the broad valley to the north are enlarged and deeply excavated developments of the valleys that were formed at the sides of this prehistoric avalanche.

Descriptions of the changes in the fans and low plateaux subsequent to 1902, of the shore subsidence, and of the upper slopes of the mountain, are given in the full report, as well as a detailed description of the crater as seen in 1907.

The topography of the old crater is still correctly represented on the Admiralty Chart (published with the report, part i.). The whole of the interior of the crater is still quite bare, without any trace of returning vegetation; small patches of moss appear about the rim and on the slopes outside, then grasses, herbaceous plants, and large sheets of ferns, and lastly, below a height of about 1500 feet, luxuriant tropical vegetation. It is interesting that this sequence presents many points of resemblance with that observed on Krakatoa.

The present condition of the devastated areas is described fully in the report, which contains also a history of subsidiary eruptions which followed the great one of May, 1902. The difference in character between the eruptions of the Soufrière and Montagne Pelée, referred to in the report of 1902, appears to have continued since that year, the outbursts from the former volcano being generally less frequent but more violent than from the latter.

The report also contains an account of a subsequent visit to the volcano of Montagne Pelée, in Martinique, with a description of the crater as the author then found it; a discussion of the phenomena of the remarkable extrusion and subsequent destruction of the dome and spine, which have been described by Lacroix and others, and a comparison of the sequelæ of the great eruptions in the two islands of Martinique and St. Vincent.

**Entomological Society, March 18.**—Mr. C. O. Waterhouse, president, in the chair.—*Exhibits.*—Dr. T. A. Chapman: Photographs of the empty egg-shells and young larvæ of *Papilio homerus*.—G. C. Gahan: (1) A remarkable larva of the Trictenomidæ, which, though heteromerous, was wholly different in character to the larvæ of that group;

(2) a larva of *Dascillus cervinus* from Ireland.—**President**: Photograph drawing of the larvæ of Coniopteryx, a small neuropteran common enough in its perfect state, but rarely found as a larva, when it may be beaten out of fir trees.—**W. J. Kaye**: Three Pereute species from the Chanchamayo district of Peru, viz. *P. leucodrosime*, *P. callinice*, and *P. callianira*, together with specimens of the Nymphaline *Adelpha lara*. These Pierines and Nymphaline occurred together at an elevation of from 2500 feet to 3000 feet. It was wrong to suppose that any *Heliconius melpomene*-like species entered the association, as *Heliconius* species of this pattern did not ascend to such an elevation, or if they ever did it was only as a rare exception. On the under-side, if when both Pereute and *Adelpha* are at rest they conceal the coloured portion of the fore-wing, the hind-wing would then give a very strong similarity of one to the other.—**L. W. Newman**: A long and varied series of *Smerinthus populi* bred from wild Bexley parents in June, 1907, the series ranging from extreme dark specimens (about 6 per cent.) to very light (about 10 per cent.), and pink shaded or tinged (about 20 per cent.), the remainder being intermediate forms.—**Paper**.—The larvæ of *Tricentotoma childreni*, Gray, and *Melittomma insulare*, Fairmaire: **C. J. Gahan**.

**Chemical Society**, March 19.—**Sir William Ramsay**, K.C.B., F.R.S., president, in the chair.—A new form of pyknometer: **W. R. Bousfield**.—The action of heat on  $\alpha$ -hydroxycarboxylic acids, part iv., racemic- $\alpha\alpha'$ -dihydroxyadipic acid and meso- $\alpha\alpha'$ -dihydroxyadipic acid: **H. R. Le Sueur**.  $\alpha\alpha'$ -Dihydroxyadipic acid, melting at  $146^\circ$ , has been resolved into its optical antipodes by fractional crystallisation of its cinchonidine salt. The acid melting at  $174^\circ$ , when heated, forms a lactone-lactide, and must be regarded as the meso- or internally compensated variety.—The spontaneous crystallisation of sodium sulphate solutions: **H. Hartley**, **B. M. Jones**, and **G. A. Hutchinson**. The authors have examined the spontaneous crystallisation of sodium sulphate solutions, and have found that if the solutions are subjected to mechanical friction three of the four possible solid phases, viz. ice,  $\text{Na}_2\text{SO}_4 \cdot 7\text{H}_2\text{O}$ , and  $\text{Na}_2\text{SO}_4$ , are produced spontaneously at different temperatures. The spontaneous crystallisation of the fourth solid phase,  $\text{Na}_2\text{SO}_4 \cdot 10\text{H}_2\text{O}$ , is of rare occurrence.—Constitution of hydroxyacetate compounds. Action of diazomethane and of mercuric acetate: **C. Smith** (and in part **A. D. Mitchell**).—*Orthobromophenols* and some bromonitrophenols: **P. W. Robertson**.—The constitution of thiocyanates containing an electronegative group: **A. E. Dixon** and **J. Taylor**.—The quantitative conversion of aromatic hydrazines into diazonium salts: **F. D. Chattaway**. All primary aromatic hydrazines can be quantitatively converted into the corresponding diazonium salts either by chlorine or by bromine. The operation can be most easily carried out by dissolving the hydrazine in glacial acetic acid, cooling the solution to about  $-15^\circ$  by the addition of crushed ice, and either passing in a rapid stream of chlorine or adding the calculated quantity of bromine dissolved in acetic acid and similarly cooled by ice.—Quantitative separation of thallium from silver: **J. F. Spencer** and **Miss M. Le Pla**. A quantitative separation of the salts of silver and thallium is effected by a stream of chlorine, whereby the thallium is oxidised to the very soluble thallic chloride and the silver is precipitated as silver chloride. The thallium is eventually precipitated and weighed as thallic iodide.—Molecular volumes of the nitrites of silver, mercury, and the alkali metals: **P. C. Rây**.—Lithium nitrite and its decomposition by heat: **P. C. Rây**.—The existence in aqueous solutions of a univalent cadmium ion, a subvalent thallium ion, and a bivalent bismuth ion: **H. G. Denham**.—Note on the oxidation of phenylhydrazine by Caro's acid: **J. C. Cain**.—Some reactions of keten: **F. Chick** and **N. T. M. Wilmore**.—*Para*- and *meta*-nitrosoacetanilide: **J. C. Cain**.—Labile isomerism among acyl-salicylamides and acyl-hydroxyamines: **A. W. Titherley**.

**Royal Microscopical Society**, March 18.—**Lord Avebury**, F.R.S., president, in the chair.—A series of fourteen mounted specimens of the rarer species of fresh-water Polyzoa, mostly foreign species from Lake Tanganyika, Rhodesia, northern India, America, and Japan: **C. F.**

**Rousselet**.—Annual address: seeds, with special reference to British plants: the **President**. Attention was confined to the dicotyledons, the consideration of seeds of the conifers and monocotyledons being deferred until next year. The subject was treated from the point of view of the dispersal of the seeds and fruits by various agencies.

**Royal Anthropological Institute**, March 24.—**Prof. W. Ridgeway**, president, in the chair.—Sinhalese magic: **Dr. W. L. Hildburgh**. The paper dealt with a variety of subjects, including charming ceremonies, astrology, and devil dancing. The charms were of various kinds, protective, for instance, to keep off evil spirits, or to guard the house, in which category amulets were included; love charms, charms to secure the favour of anyone, for example, a judge, and the like. A number of horoscopes were exhibited, which almost invariably take the form of a roll, as it is considered necessary to write each on a single leaf, which is best preserved in the roll form. The language in which horoscopes are written can only be read by the initiated, and consequently they are often translated, and the translations may be written in ordinary books without prejudicing the results. On the subject of devil dancing, **Dr. Hildburgh** exhibited a number of slides showing the different devils represented, and also a collection of the masks and costumes worn. Some of the devils represented are those who actually afflict the patient; others are powerful devils by whom the afflicting devils are controlled, while others again are devils who are afflicted as the patient is afflicted.

## EDINBURGH.

**Royal Society**, March 16.—**Dr. R. H. Traquair**, F.R.S., vice-president, in the chair.—The lamellibranch fauna found in the Millstone Grit of Scotland, and the lamellibranchs from the Silurian rocks of Girvan: **Dr. Wheelton Hind**. The first of these important papers contained an account of the lamellibranchs found by the staff of the Geological Survey of Scotland in beds of the Millstone Grit series, between the Castlegary Limestone and the Coal-measures. The fauna is quite unique, containing, for example, the remarkable genus *Prothyris*, not hitherto recorded from British Carboniferous rocks. The specific form seems to be identical with that found in the Upper Coal-measures of Nebraska. Although a few members in the newly discovered fauna of the Scottish series have been found in the Millstone Grit of Hazel Hill, Yorkshire, and in beds immediately below the Coal-measures of Bristol and South Wales, yet the fauna as a whole bears a striking resemblance to the fauna of the American Coal-measures. The second paper dealt with the fine series of lamellibranchs collected by **Mrs. Robert Gray** from the district of Girvan. Many of the shells were in remarkable preservation, enabling the details of the hinge plate and interior to be examined. It was interesting to note such a fine development of lamellibranchs in these early rocks. A great proportion of the species are probably new, and many of the genera are described for the first time from British specimens. Here again the resemblance to certain American faunæ, especially those from the Trenton and Hudson groups of Minnesota and New York, is very striking.—A test for continuity: **Dr. W. H. Young**.—The theory of Hessians in the historical order of development: **Dr. Thomas Muir**.

## PARIS.

**Academy of Sciences**, March 30.—**M. H. Becquerel** in the chair.—Various properties of the curves expressing either by their envelope, or directly, the coefficients of yield  $m$  of a thin-walled vertical weir, without lateral contraction, as a function of the relative pressure  $N'$  exercised under the sheets at the level of the sill: **J. Boussinesq**.—The determination of the time, both on land and at sea, with the aid of wireless telegraphy: **Bouquet de la Grye**. With the present installation at the Eiffel Tower, wireless signals can be sent a distance of 2000 kilometres, and it has been estimated that by increasing the electric energy this distance could be doubled. It is suggested that a special signal should be sent exactly at midnight, and it would have to be the subject of an international arrangement to avoid possible confusion by multiplication of such signals. Such a time signal would

be of the greatest service to navigators within its radius.—On the proposal of the president, the examination of the proposition in the preceding note was referred to a committee composed of the members of the sections of astronomy, geography, navigation, and physics, together with MM. Darboux, Poincaré, and Cailletet.—The earthquake of March 26, 1908 (Chilapa, Mexico), registered at Paris: G. **Bigourdan**.—The manuscripts of Evariste Galois, catalogued by M. J. Jannery, and kept under this heading at the library of the Institute of France.—The relations between lecithin and tubercle bacilli and tuberculin: A. **Calmette**, L. **Massol**, and M. **Breton**. Using the hæmolytic action of snake poison in presence of lecithin as a test, the authors prove that the tubercle bacillus has an affinity for lecithin, and tuberculin behaves in a similar manner. The bearing of this on the reaction of tuberculin on the body is discussed.—The present state of the problem of the dispersion of light rays in interstellar spaces. A first attempt at the application to provisional determinations of stellar distances: Charles **Nordmann**. Discussing the recently published results of M. Tikhoff, the author points out that both their methods, although quite independent, lead to the same qualitative results, namely, that there is really produced a dispersion of light in interstellar space, and that it has the same sense as ordinary refractive media.—A phenomenon attributable to positive electrons in the spark spectrum of yttrium: Jean **Becquerel**. The experimental study of the Zeeman effect in the spark spectrum of yttrium gives results which may be most simply explained by assuming the presence of positive electrons.—The number of electrons in the atom: J. **Boesler**.—The determination of the factor of ionisation in solutions of hydrochloric acid: E. **Doumer**. A study of the ratio of the volumes of hydrogen and oxygen evolved during the electrolysis of solutions of hydrochloric acid of different concentrations with anodes of silver or mercury.—The density of the vapour of propionic acid: A. **Faucon**. By the method of Dumas the vapour density of propionic acid was found to vary from 3.27 at 123° C. to 2.57 at 210° C., the theoretical vapour density being 2.55. Two thermodynamical formulæ are applied to the results to calculate the heat of vaporisation of propionic acid.—The  $\text{OH}(\text{I})\text{Cl}(2 : 4 : 6)$  trichlorophenol and its transformation into chloroquinones: E. **Léger**. The trichlorophenol is prepared by the action of a strong solution of sodium hypochlorite upon phenol; nitric acid (1.41) converts this into a mixture of trichloroquinone and tetrachloroquinone.—Styrolene oxide: MM. **Tiffeneau** and **Fourneau**.—The  $\beta$ -*aa*-dialkyl-ketone alcohols: E. E. **Blaise** and I. **Herman**.—The magmatic parameters of the series from the volcano Monte Ferru, Sardinia: M. **Deprat**.—Researches on the development of *Gloeosporium nervisequum*: A. **Guilliermond**.—The Lagoa Santa race in the precolombian populations of the equator: M. **Rivet**.—The American Synalpheæ: M. **Coutière**.—The tectonic of the littoral of the Algero-Moroccan frontier: Louis **Gentil**.

DIARY OF SOCIETIES.

THURSDAY, APRIL 9.

ROYAL INSTITUTION, at 3.—The Animals of South America: R. Lydekker, F.R.S.  
 INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Electric Supply Prospects and Charges as affected by Metallic Filament Lamps and Electric Heating: H. W. Handcock and A. H. Dykes.  
 INSTITUTION OF MINING AND METALLURGY, at 8.—The Electrical Equipment of Gold Mines: H. J. S. Heather.—Addendum to Paper on Earth Temperatures on Witwatersrand Gold Fields: H. F. Marriott.—The Carat Weight: E. J. Valentine.—An Electro-magnet for Testing the Suitability of an Ore for Magnetic Separation: L. H. L. Huddart.—The Gold Alluvials of the River Drau in Hungary: A. von Gernet.

FRIDAY, APRIL 10.

ROYAL INSTITUTION, at 9.—The Carriers of Positive Electricity: Prof. J. J. Thomson, F.R.S.  
 ROYAL ASTRONOMICAL SOCIETY, at 5.—Measures of Southern Double Stars in 1907: J. L. Scott.—Tables of the Hypergeometrical Functions  $F(1/6, 5/6, 2, \sin^2 \frac{\alpha}{2})$ , and  $F(-1/6, 7/6, 2, \sin^2 \frac{\alpha}{2})$  between the Limits  $\iota$  equals 90 and 180 Degrees: C. J. Merfield.—On Dr. Roberts's Method of Determining the Absolute Dimensions of an Algal Variable Star: Rev. J. Stein.—On the Orbit of  $\Sigma_2$ ; Secchi 2= $\Sigma_2$ 481 BC;  $\beta$ 58r AB; and  $\gamma$  Velorum = Copeland 1: T. J. J. See.—Note on the Adopted Coordinates of the Bombay (Colaba) Observatory: A. M. W. Downing.—*Probable Papers*:—Description of a Long-focus Celestial Reflector: J. H. Reynolds.—Note

on the newly-discovered Eighth Satellite of Jupiter: Royal Observatory, Greenwich.  
 PHYSICAL SOCIETY, at 8.—An Experimental Investigation of the Nature of  $\gamma$  Rays: Prof. W. H. Bragg, F.R.S., and Mr. Madsen.—Experiments on Artificial Fulgurites: Miss D. D. Butcher.—Short-spark Phenomena: W. Duddell, F.R.S.  
 INSTITUTION OF MECHANICAL ENGINEERS, at 8.—The Governing and the Regularity of Gas-engines: J. Atkinson.—The Effect of Mixture Strength and Scavenging upon Thermal Efficiency: Prof. B. Hopkinson.  
 SATURDAY, APRIL 11.  
 ROYAL INSTITUTION, at 3.—Electric Discharges through Gases: Prof. J. J. Thomson, F.R.S.  
 MONDAY, APRIL 13.  
 ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Explorations on and Around Prince Charles Foreland, Spitsbergen: Dr. W. S. Bruce.  
 TUESDAY, APRIL 14.  
 ROYAL STATISTICAL SOCIETY, at 5.  
 INSTITUTION OF CIVIL ENGINEERS, at 8.—Further Discussion: The King Edward VII. Bridge, Newcastle-on Tyne: F. W. Davis and C. R. S. Kirkpatrick.  
 WEDNESDAY, APRIL 15.  
 GEOLOGICAL SOCIETY, at 8.—The Geological Structure of the St. David's Area (Pembrokeshire): J. F. N. Green.—Notes on the Geology of Burma: L. V. Dalton.  
 ROYAL METEOROLOGICAL SOCIETY, at 7.30.—Report on the Phenological Observations for 1907: E. Mawley.—The Anticyclonic Belt of the Southern Hemisphere: Colonel H. E. Rawson, C.B.  
 ROYAL MICROSCOPICAL SOCIETY, at 8.—On Dendritic Growths of Copper Oxide in Paper: J. Strachan.—Nature's Protection of Insect Life: F. Enock.  
 VICTORIA INSTITUTE, at 3.30.—The Assuan and Elephantine Papyri: Dr. L. Belleli.

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