THURSDAY, SEPTEMBER 26, 1907.

THE GEOLOGICAL SOCIETY OF LONDON.

The History of the Geological Society of London. By H. B. Woodward. Pp. xx+336; illustrated. (London: The Geological Society, 1907.) Price 7*s.* 6*d.* (to Fellows, 6*s.*).

THE history of the Geological Society of London is rich in interest and instruction, as the society is unique in the extent of its influence on the science it was founded to promote. Geology had no chance of a satisfactory beginning, because of its immediate discovery of evidence inconsistent with the Mosaic account of Creation and the universality of Noah's deluge. Thus geology was driven at once into cosmogony, and started where it should have ended, and its immediate encroachment on the domain of dogma involved religious controversies that were not only tiresome, but demoralising. Classical and mediæval literature both contain some true descriptions of geological phenomena, but such observations were too occasional to influence the general trend of thought. The men who wrote the first general geological treatises, from Burnet's "Sacred Theory of the Earth" to Townsend, were essentially theologians, who failed owing to their application of spiritual laws to the natural world. The pioneers of geology were not free to choose their own ground and work on it at leisure; it was their misfortune rather than their fault that their views were often the illogical offspring of observations distorted by a cosmogonic squint. "A well-educated geognost" (a term then used as synonymous with geologist), according to Bakewell in 1813, "has lost the use of his own eyes."

This method did not suit the British mind, which, in the domain of natural science, preferred facts that could be verified by observation to the uncertain products of speculation. Mephistopheles, in Goethe's *Faust*, speaking as the evil genius of Continental science, sneers at the British respect for first-hand facts:—

> "Are Britons here? They travel far to trace
> Renowned battlefields and waterfalls."

The founders of British geology believed, above all things, in such field work, and most of them were interested in economic geology and were quite indifferent to cosmogony. Their studies were devoted to the distribution of soils, as by Lister in 1684, and the agricultural surveys begun by the Board of Agriculture in 1794; or to mining geology, such as the papers of Strachey of 1719 and 1725; while William Smith, engineer and surveyor, deplored "that the theory of geology was in possession of one class of men, the practice in another." Applied geology was, however, then of no general interest, and the science was judged by its contributions to cosmogony. It was prejudiced, according to Lyell, by "the imputation of being a dangerous, or at best but a visionary pursuit"; and it was the mission of the Geological Society to reform the methods of geological work so as to remove any justification for this reputation. Its founders were full of contempt for the vain wranglings between Neptunists and Plutonists, between naturalists and theologians, and it was their ambition to direct geological inquiry into useful channels and secure a foundation of positive knowledge, on which at some future date a geological system could be firmly based. This policy was proclaimed in 1811, when the society adopted as its motto a passage from Bacon, which recommended toil instead of talk. Its loyalty to this principle was remarked by Fitton in 1817, who, in an account of the society's transactions in the *Edinburgh Review*, said that they were limited to the record of "strict experiment or observation, at the expense of all hypothesis, or even of moderate theoretical speculation." According to Lyell, in 1832, the ideal of the founders was "to multiply and record observations, and patiently await the result at some future period . . .; and it was their favourite maxim that the time was not yet come for a general system of geology, but that all must be content for many years to be exclusively engaged in furnishing materials for future generalisations"; and he claimed for the society the credit of brilliant success as the reward of its consistency to that principle.

The Geological Society had two English predecessors, the Askesian Society and the British Mineralogical Society, founded respectively in 1796 and 1799, and amalgamated in 1806. The Geological Society dates from November 13, 1807, when a party of eleven men dining at the Freemasons' Tavern, according to one version (the diary of Wm. Allen), "instituted a Geological Society"; but according to another (a letter by Sir H. Davy) they established "a little talking Geological Dining Club." This misunderstanding led to conflict between those who held that the society should be a mere social dining club and should not encroach on the domain of the Royal Society by publication of important scientific work, and those who intended that the society should raise the status and advance the knowledge of geology by a strenuous, progressive policy. Scientific London had to face this problem, Is it better for each science to have its own society, or for all of them to unite into one great institution? Some of the leaders of the Royal Society thought that the inevitable competition and overlap between independent societies would be injurious; they proposed that the Geological Society should become a branch of the Royal Society, which was to have the right to publish in the Philosophical Transactions any papers it cared to select from those read before the Geological Society. The geologists, however, considered that scientific progress could best be secured by independent societies working in friendly alliance. Their rejection of the federal policy was probably the wisest course, but it cost them the fellowship of Sir Joseph Banks and Sir Humphry Davy, who resigned as a protest against the alleged trespass on the sphere of the Royal Society.

The dinner, though part of the original plan, appears to have been always of secondary importance, and was soon abandoned to an independent geological dining club. The early meetings, how-

ever, consisted of dinner at 5 p.m., the reading of papers from seven to nine, after which often followed an informal assembly, wherein, soothed by smoke and stimulated by wine, discussion was prolonged until after midnight.

The Geological Society quickly justified its independence by raising the standard of scientific publication. It issued its Transactions on a scale of magnificence which the society makes no attempt to maintain. They were one of the finest scientific serials of their day, and the style in which the Government now issues the memoirs of our national Geological Survey is beggarly in comparison. The extravagance in illustration was possible owing to the lavish generosity of the members. Many of them were wealthy men, and they freely spent their money in promoting the objects of the society. Thus Warburton advanced 1000*l.* towards the preparation of Greenough's "Geological Map of England," and some of the members contributed an equal sum towards its publication. Most of the founders and early leaders of the society were men of distinction and influence; they were peers, members of Parliament, city merchants, and men of that professional class of which London is preeminently the home. According to Leonard Horner, the council of the society elected in 1816 "was a Council fit to govern the world."

The young society was at first exclusive, and did not represent the whole of British geology. It elected forty-two honorary members, but the list did not include William Smith. This strange omission is not clearly explained by the author, who hints that it may have been due to social prejudice. Possibly it was partly due to the fact that William Smith, in spite of the immense theoretical value of his work, was essentially an economic geologist, and he, like the two other prominent workers at applied geology, Farey and Bakewell, did not join the society. They may have regarded it as too academic, and the society may have regarded them as too commercial. On the other hand, Robert Jameson kept aloof because the society despised his high soaring flights. He was elected an honorary member in December, 1807, but that was before the publication of his "Elements of Geognosy," of which the preface is dated "The College, Edinburgh, January, 1808"; if this work, a statement of Wernerian geology, had been published a few months before, it should have cost him his honorary membership. His election did not apparently affect him, for he promptly founded the Wernerian Natural History Society at Edinburgh in 1808, perhaps in order to combat the grovelling geologists of London, and he does not appear ever to have joined the London society or taken any part in its proceedings. Was it ignorance or irony that led to the selection of the society as trustee of the Jameson fund, established to commemorate its greatest British protagonist?

The early exclusiveness of the society was due to its enthusiasm as well as to its defined policy. The election of new members had to be unanimous; absence from meetings was to be punished by fines; and no one could attend more than twice as a visitor. Although the society was also a dining club, its first ordinances were animated by the severe zeal of a star-chamber. The members were delightfully confident of their mission; according to the first constitution "all questions on which difference of opinion may arise shall be determined by ballot at the next ordinary meeting," and according to the author (p. 23) this rule appears to have been intended for the summary settlement of geological problems, and not of the society's business. But the society was too successful for such regulations, which were burst by the rapid growth in its roll of membership and the immense influence of its scientific achievements.

All this early history of the society and a summary of its work is now accessible in Mr. H. B. Woodward's monograph, which has been prepared for the centenary meeting to be held on September 26 to 28. The council is to be congratulated on having entrusted the work to an author who has an unrivalled knowledge of the literature of British stratigraphical geology, and is possessor of a rich store of traditional personal information. Mr. H. B. Woodward has been aided by many helpers. Amongst others, Sir Archibald Geikie and Prof. Bonney have read the proofs, Mr. Monckton has contributed an account of the medals, Mr. Herries has edited the reprint of the charter, and Prof. Garwood has arranged the excellent series of photographs. The author has compressed into 336 pages of fairly open print a condensed account of the work of the society, a guide to the available materials as to its history, summaries of the lives of the founders and chief early members, and instructive reprints or summaries of important discussions, one of which shows the reception accorded to Buckland's announcement of the former glaciation of the British Isles. Numerous appendices give lists of early fellows, of the presidents and the subjects of their annual addresses, of the council, the officers and officials, the awards of medals and funds, and reprint of the charter. The information is condensed, but apart from the appendices it is never dull; it is enlivened by racy stories and witty epigrams; the materials have been wisely selected, and presented with Mr. Woodward's usual literary skill.

The author's personality comes out in selection rather than in comment. He is perhaps too discreet, for he hints at explanations where a definite statement of his opinion would have been valuable. The course of the society has not always run smooth, and it is interesting to find that some of the modern criticisms are similar to those made at intervals through its life. A society with a strong policy and a definite ideal cannot expect unanimous approval, and its traditions have always been radical. It secured on incorporation an unusually liberal charter, and it has repeatedly been the pioneer in important reforms. Amongst other innovations was the admission of women to the meetings in 1860, an experiment abandoned, however, in 1863.

Mr. H. B. Woodward's history is worthy of its subject. He naturally devotes most attention to British stratigraphy, but one chapter might perhaps have been devoted to the society's contributions to

foreign geology, so many of which are of first-class importance.

The author is gently sarcastic regarding the nomenclature of some modern palæontology published by the society. The artificial Linnean system was adequate for the biology of the eighteenth century, which was innocent of such principles as "heterogenetic homogeneity." The plastic terminology that is in process of development in correspondence with the variability of life has lost in simplicity, while it has gained in truth. Scientific names, like other words, must be allowed to change in meaning, even though the change may puzzle geologists as much as a lawyer is puzzled to define such common terms as mine or mineral. The author notes with apparent regret that a fossil should be called a "koninckophyllid cyathophyllum"; but the Geological Society would be untrue to its inspiring traditions if it closed its journal to those whose living faith in evolution is much more than a mere verbal creed, and must be expected to influence all their practice. J. W. G.

ANCIENT BABYLONIAN LETTERS.

Late Babylonian Letters. By R. Campbell Thompson. Pp. xxxvi+226. (London: Luzac and Co., 1906.) Price 15*s.* net.

OF all the ancient written matter that has been discovered by modern archæological research and deciphered by the professors of languages long dead, perhaps the documents most interesting to the general reader are those which reveal to us the daily life of the people who wrote them thousands of years ago. These "human documents" are always interesting reading. Royal instructions, reports of generals or of astrologers, ministers or caravan-leaders, diplomatic correspondence, and last, but not least, the ordinary letters from one man to another, whether anent business or pleasure, have been during the last half-century recovered from the past, and are now supplementing in a most remarkable way the formal annals of the historians. From Egypt we have the famous "Tell el-Amarna Letters" of 1400 B.C., the correspondence of the time of the priest-kings (1000 B.C.) published by Spiegelberg, and the interesting series of Greek letters recovered from the sands of Oxyrrhynchus by Drs. Grenfell and Hunt, not to speak of the Coptic epistles of the monks of Deir el-Bahari in the seventh century A.D., translated by Crum and by Hall. From far Turkestan we have the wooden tablets inscribed in Kharoshthi characters, discovered by Dr. M. A. Stein, which tell us of the daily life of the Indian kingdom of Khotan in the flourishing days of Buddhism; and now Mr. R. C. Thompson (late of the British Museum), of the University of Chicago, has published an edition of a series of late Babylonian letters, being "transliterations and translations of a series of letters written in Babylonian cuneiform, chiefly during the reigns of Nabonidus, Cyrus, Cambyses, and Darius," *i.e.* from about 550 to 480 B.C. These letters are preserved in the British Museum, and the original cuneiform texts have been published by the Trustees.

The book is published by Messrs. Luzac and Co. in their admirably got-up "Semitic Text and Translation Series." Print, paper, and binding are good and appropriate. As a frontispiece Mr. Thompson gives an adaptation (with English text instead of Babylonian) of a remarkable Babylonian map of the world, which we recommend to the attention of Mr. Beazley for comparison with other ancient maps. We do not believe, by the way, that this map, with its restricted knowledge, really represents the world as known to the Babylonians of the sixth century B.C. It is obviously a copy of a far more ancient map, dating from the days when the Babylonian knew of but little beyond the limits of his own fens, which he conceived as an island surrounded by the waters of the Persian Gulf.

The perusal of these letters will be useful to the modern historian who is not content merely to recapitulate the annals of his ancient *confrères,* but wishes to give a picture of the civilisation of an ancient people. With the exception of an occasional royal epistle, such as the very interesting one of Ashurbanipal (No. 1, a century older than the rest) ordering the collection of tablets for the royal library at Nineveh, now in its entirety preserved on the shelves of the British Museum, these letters were written by the ordinary Babylonian "man in the street," the ordinary middle-class inhabitant of Babylon, and his wife. For the ladies of Babylon were as busy with the stilus as those of London are with the pen, and many of Mr. Thompson's collection were written by women. They relate to the usual round of life of a civilised people as led in an Oriental country. The letters of the modern inhabitants of Cairo, Baghdad, Lahore or Delhi must be very like them. Perhaps at Benares, rather, we might get their very counterparts. For in Babylonia, as in modern India, the temples of the gods and the business of the priests were a great factor in the city life, and a large proportion of these letters "is connected with the business of the great temple of the Sun-god at Sippar," with the landed property belonging to the temple, from which the priests drew their revenues, and with the arrangements for the temple-dues, which were often paid in kind. This is an ancient touch, which we should only find paralleled now in India and the Far East. An Oriental trait is the correspondence with regard to the transport of food, goods, materials for building, &c., by beasts. The back of a beast of burden was then, as now in the same country, the only means of transport. Babylonia has not progressed a step in the direction of the improvement of transport since the days when these letters were written; and the completion of the Baghdad Railway seems still far off!

Of the ordinary letters between man and man on matters of interest only to themselves Mr. Thompson gives many specimens. Travellers in a far country write to their friends asking for news, and upbraiding their faithless correspondents, for then, as now, "one had not time to write." Husbands indite model epistles to their wives, like one, highly commended by the editor, which reads:—

"By the grace of the gods I am well, as also is Bêl-iddin. See, I am sending a letter to Iddina-

Marduk, the son of Ikiša-apli, that he may give thee the *gur* of wheat. Be not remiss in the housework, but be careful; pray the gods on my behalf, and speedily let me have news of thee by the hand of some traveller."

And so forth. In conclusion, we may congratulate Mr. Thompson on his interesting book, and, for the necessary *amari aliquid*, warn him against indulging in rather too breezy translations, such as "Why, an't please thee, have I and my daughters to pass the time in thirst for a letter from thee? Rack thy brains (for an excuse and then) by Šamaš, see why Bêl-uballit, an't please thee, hath taken away all my dates" (p. 175). Elsewhere (p. xxxii) Mr. Thompson presents an even more alarming version of the same epistle:—"Why, pray, am I and my daughters to pass the time thirsting for a letter from thee? Now, gather thy wits together, and then, by Šamaš, observe! Why, pray, hath Bêl-uballit taken away all my dates?" This style of translation is hardly sufficiently dignified, and is to be avoided. The lady Gagâ, who writes the letter to her father, was no doubt a very energetic female, but Mr. Thompson's version of her filial exhortation seems to us to be rather too energetic. The index and vocabulary at the end are very complete and useful.

PSYCHOLOGICAL SCIENCE.

Psychology—General Introduction. By Dr. C. H. Judd. Pp. xii+389. (New York: Charles Scrib- Price 7*s.* 6*d.* net.

The Major Symptoms of Hysteria. By Dr. Pierre Janet. Pp. x+345. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1907.) Price 7*s.* 6*d. net.*

THESE two books furnish yet one more proof—if further proof were needed at the present day—of the right of psychology to a place among the primary sciences. In Prof. Judd's book we have a concise and well-synthesised statement of the methods and principles of the science, in the form of a general introductory text-book; Dr. Pierre Janet shows the exclusive importance of those principles in the diagnosis and cure of a widespread disease.

Prof. Judd leaves his readers in no doubt as to his general standpoint or the guiding idea of his book. He develops his subject along the lines of "function" in contradistinction to "structure," and "objectivity" as opposed to the "subjectivity" of mere introspection, laying great stress throughout on "organisation" as the general explanation of mental products. In a well-worded preface he attempts to anticipate criticism by summarising the general principles of treatment which he has followed. Briefly they are: (1) "A functional view of mental life"; (2) the genetic method; (3) a coordination of physiological and psychological data; (4) an endeavour to make clear "the significance of ideation as a unique and final stage of evolution." These principles he follows faithfully in his book, the marked "objectivity" of treatment almost amounting to materialism in the earlier pages. Analysis of material conditions takes precedence of, and to a great extent supplants, introspective description of mental states; moreover, the absence of any definite discussion of the general relation of mind and matter tends to intensify this impression of materialism. But if such an illusion should arise in the reader's mind it is quickly dispelled by later chapters, more particularly by the chapter on "The Concept of the Self." The nature of this concept as ultimate and supreme for psychology, though admitting of a developmental history, is very well brought out. The chapter following this, on "Voluntary Choice," is rather disappointing.

Parts of the book are of outstanding excellence. The discussion of space-perception seems to the writer an ideal of what a treatment of this difficult subject should be The chapter headed "Experience and Expression" is also very good. It brings out well the importance of motor factors to the general structure of experience, not in the form of muscular *sensations*, as the first imperfect statements of the theory would have had one believe, but as forms of "motor organisation" in the central nervous system. In this chapter we have developed in greater fulness that central idea of organisation which dominates the whole book.

Two small points call for criticism. First on p. 97, to explain contrast effects as merely after-effects in the retina is surely a case of over-simplification. Undoubtedly the two classes of phenomena are closely connected, but the relation is more complicated than the text would have the reader believe. Secondly, what is called the Principle of Fusion (Association) on p. 223 should not be dismissed as self-evident and requiring no explanation.

On the whole, the book is an excellent treatment of the general principles of psychology, and may be confidently recommended to all earnest students of the science. It is a book that should be read more than once. On the title-page it is described as the first volume of "a series of text-books designed to introduce the student to the methods and principles of scientific psychology." We can only say that our experience of this volume encourages us to look forward with eagerness to the publication of the later volumes of the series.

Dr. Pierre Janet's book is a collection of fifteen lectures given in the medical school of Harvard University towards the end of last year. Much of the material, cases and explanations alike, is taken from previous publications of the author, as, *e.g.*, "Névroses et Idées fixes," "L'état mental des Hystériques," &c., but the form of exposition makes of it an independent scientific and literary achievement for which all who are interested in mental diseases will be thankful to its author. Prof. Janet is admittedly supreme in the domain of pathological psychology, and the present book will do still more to confirm that estimate of his position. His statement of the major symptoms of hysteria is no mere external classification. Taking somnambulism as the typical form of hysterical accidents, he shows with copious illustration and acute argument how such symptoms shade off into fugues, double personalities, convulsive attacks, contractures, paralysis, anæsthesias, &c., while exhibiting the same essential relations in all these various forms. By the

time lecture xiii. is reached, the evidence is overwhelming as to the extent of hysterical symptoms and the ground of their relationship to one another. "Dissociation" and "suggestibility" are the words employed to describe the underlying mental state, and their exact meanings are very carefully and thoroughly worked out. The final outcome is a definition of hysteria, an enumeration of its direct and indirect stigmata, and incidentally a theory as to the nature of personal synthesis, with which this disease is so closely connected.

To medical practitioners and psychologists alike the work should be of supreme value. W. B.

THEORY AND PRACTICE OF LUBRICATION.

Lubrication and Lubricants. A Treatise on the Theory and Practice of Lubrication, and on the Nature, Properties, and Testing of Lubricants. By Leonard Archbutt and R. Mountford Deeley. Second edition, thoroughly revised and enlarged. Pp. xxxii+528. (London: C. Griffin and Co., Ltd., 1907.) Price 21*s.* net.

THIS work may be divided into two parts, which, in fact, have little connection with one another. The first is that which deals with the chemical and physical properties of lubricants generally, and will appeal more particularly to analytical chemists, to whom samples of lubricants are submitted for the purpose of estimating their commercial value. So far as one can judge, this part of the work is particularly clear; full directions are given for carrying out any of the tests, in order to obtain such things as the free acids. This will, however, hardly appeal to the average user of lubricants, as what he requires is some simple mechanical test which will, more or less, indicate the value of the oil. The second portion of the work deals with the mechanical testing of oil, and also the design and construction of bearings generally, together with the general theory of friction, as given in chapter iv. This is particularly well written, and gives the full theory of lubrication as developed by Osborne Reynolds, Goodman, and Towers, and will repay a careful study. An account is given of the various oil-testing machines as designed by Thurstan, Smith, and Goodman. Judging from our own experience, while these machines when extremely carefully handled give trustworthy results, one is never quite certain as to what is really being obtained; whether it is a test of the lubrication itself, of the materials forming the bearing, or of the condition of the bearing. We should be inclined to say that it would probably be a small part of each, and, moreover, it does not give much idea as to the value of the lubricant for continuous use, which is now the rule for engine work generally. Doubtless, owing to the great length of the book, some 500 pages, the authors have been unable to devote a large space to the design and lubrication of bearings, although they give much useful information as to the composition of bearing metals generally, and also the admissible loads. They do not, however, give the attention to forced lubrication which we consider it deserves. The whole tendency of modern engine practice, either with enclosed or open engines, is to substitute pressure lubrication for gravity, and this has entailed wholly different construction of bearings from those with the ordinary drip lubrication.

The large subject of ball and roller bearings is dismissed in some three pages, and, considering the importance and growing use of the ball bearing in large sizes, we think this type of bearing deserved fuller attention. The mechanical lubrication by means of sight-feed lubricators, which allows the attendant to regulate exactly the quantity of his oil, is well illustrated, and rightly so, because this method is found in practice very considerably to economise the oil supply. Splash lubrication, as used by Willans and by many motor-car engineers, is alluded to, but its defects as regards the oil working up into the motor cylinders are not pointed out, nor is it shown that this method of lubrication is fast being driven out in favour of a pressure system. The authors, in the chapter on gas-engine cylinder lubrication, give some interesting analyses of the deposit found in the cylinders, and point out that the deposit is not wholly of a carbonaceous nature, but contains quite a considerable portion of sulphur obtained from the gas. They also recommend the use of pure mineral oils, as against the mixture of a small quantity of a neutral fixed oil. This wholly agrees with our own experience, namely, that a pure mineral oil is the only one possible to use when the compression of the engine is in the neighbourhood of 200 lb. per square inch. It would almost appear as if the whole difficulty of running at very high compressions is to prevent deposits of carbon. The only way to overcome this is to use an oil which will entirely burn, and in very small quantities. All those who are interested in lubrication generally will welcome Messrs. Archbutt and Deeley's work, more especially those in a consultative position, but we fear that, owing to its length and the predominance of the chemical and physical side, it will not be of the service to engineers generally that a smaller and less scientific work would be, as it must be borne in mind that the great majority of those who have to use lubricants have neither the time nor inclination to make accurate chemical tests.

F. W. BURSTALL.

OUR BOOK SHELF.

The Savage South Seas. Painted by Norman H. Hardy. Described by E. Way Elkington. Pp. xii+211. (London: A. and C. Black, 1907.) Price 20*s.* net.

To those who know the parts of Melanesia which Mr. Norman Hardy pictures, or who, like the writer, have seen much of his work, this book will come as something of a disappointment; and this from no fault of the artist, who is generally successful in reproducing, not only the physiognomy, but the musculature and the tricks of movement of the folk whom he portrays. The truth is that the tone of the reproductions (apparently made by the three-colour process or one of its modifications) of Mr. Hardy's water-colour sketches leaves much to be desired; in many of the reproductions there is a darkening of

the colour scheme, giving crepuscular and storm effects—where none are intended—to many of the landscapes, as plates 2 and 4. In the case of illustrations showing figures, the tone of the whole group may be so lowered that people, houses and utensils show up in scarcely differentiated tints of brown against a sky for the colour of which the writer knows no warrant (illustration 19).

But there are also many charming and realistic pictures, such as plates 3 and 33, though in the last the excellence of the drawing and colouring of the canoe and the figures seated therein is perhaps somewhat discounted by the excess of grey and brown in the landscape.

Plate 16 may be picked out for special praise. It gives a very real impression of the Rigo dubu, seen at midday, when the glare of the sun lightens the grey of its weather-beaten posts and renders the yellowish soil on which it stands almost white.

In spite, then, of defects of the kind mentioned, the illustrations of this book give a better idea of Melanesia than can be obtained by photographs or black and white drawings, and so the work must be pronounced a success. Mr. Hardy is also to be congratulated on the accuracy of his observation, for in so few instances are there ethnographical inaccuracies in the plates or their accompanying short descriptions that it may be useful to point out the chief of these in as far as they affect New Guinea. Probably no girl ever danced her way to "the dubu dance" flirting her petticoats the while, as is shown in the frontispiece. Kaivakuku masks do not exist among the Roro tribe, though they occur among the Waima and Kevori, both Roro-speaking tribes. The feather head-dresses of the girls (illustrations 14 and 15) are distinctly yellowish, not red as shown in the plates; indeed, red feathers are carefully excluded from this dancing head-dress, the parrots providing the feathers being subjected to special treatment in order that their feathers may be of the desired colour.

In this book the illustrations so far exceed the text in importance and quality that little need be said concerning the latter, which contains many inaccuracies and misprints, is written in poor English, and generally falls far below the level of other volumes contained in this series. C. G. S.

A Text-book on Hydraulics, including an Outline of the Theory of Turbines. By Prof. L. M. Hoskins. Pp. v+271. (London: Archibald Constable and Co., Ltd., 1907.) Price 10*s.* 6*d.* net.

THIS book is intended for the instruction of engineering students during their university or college course who have already acquired a good practical knowledge of pure mathematics, and possess a fair elementary acquaintance with the principles of mechanics. After a short introductory chapter dealing with definitions and principles, followed by a chapter on hydrostatics, the flow of water through orifices under different conditions is considered, and Torricelli's theorem is stated, and instances of its application explained. Bernoulli's theorem, which the author calls the general equation of energy, and upon which he bases his explanations of the problems of the steady flow of liquids, and its applications, form the subject of the next four chapters. Various formulas for the flow of water in pipes under definite conditions are then deduced from the general equation of energy; whilst a separate chapter is devoted to a discussion of the methods of estimating the frictional loss of head in pipes.

In treating of uniform flow in open channels, the author, after referring to Chézy's formula, $v=c\sqrt{rs}$, as the basis for calculating the mean velocity, and alluding to Bazin's experiments for determining the influence of the nature of the surface and the shape of the channel in modifying c, deals fully with the well-known, general, empirical formula for c deduced by Ganguillet and Kutter from the measurements of flow in a wide range of channels, which is a function of the slope, the hydraulic radius, and a coefficient of roughness depending on the nature of the surface of the channel. To facilitate the adoption of this complex formula, a table is given of the values of c computed for a certain range of conditions, and also a graphic diagram from which they can be obtained by measurement. The more complicated question of non-uniform flow in open channels is next discussed, deduced in the first instance from the general equation of energy for streams of variable cross-section; and the portion relating to hydraulics is concluded by a consideration of the different methods, direct and indirect, by which the discharge of streams differing greatly in volume can be measured.

The theory of turbines forms the subject of the last seven chapters of the book, under the respective headings dynamic action of streams, theory of steady flow through rotating wheel, types of turbines and water wheels, theory of the impulse turbine, and of the reaction turbine, the tangential water wheel, and turbine pumps. The book terminates with three appendices, in which the general equation of energy is applied to the steady flow of gases, relative motion is explained, and tables of conversion factors are given. The subjects dealt with are elucidated by one hundred and thirty-seven simple diagrams in the text, and examples are added in almost every chapter relating to its contents, for the student to work out, to which the answers are appended. This book will be valuable in training engineering students possessing a fair knowledge of mathematics to solve any problems in hydraulics they are likely to meet with in practice, and it will also furnish them with an insight into the principles on which the working and efficiency of turbines are based.

Flora of Sussex, or a List of Flowering Plants and Ferns found in the County of Sussex. By Rev. F. H. Arnold. Pp. xxii+154. (London: Simpkin, Marshall and Co., Ltd.; Arundel and Horsham: Mitchell and Co, 1907.) Price 5*s.* net.

THIS is a new and revised edition of the flora, including phanerogams, pteridophytes, and Characeæ, brought out by the author in 1887. The principal changes will be found in the additions to the species and many new localities. The introduction is not altered except for the increase in the list of contributors, to which are added the names of Mr. C. E. Salmon, Mr. W. Whitwell, Rev. E. Ellman, and Rev. E. S. Marshall. The last-named has been a most energetic worker, especially in West Sussex, and several of the new species were first discovered by him. A complete revision will be noted for the species of Rubus, for which the localities are provided chiefly on the authority of Messrs. Salmon, Marshall, and Rogers, and also a revision of the genus Salicornia. Among the species added to the county list are *Epilobium Lamyi, Wolffia arrhiza, Utricularia neglecta, Chenopodium botryoides, Spartina Townsendi,* and *Spartina alterniflora,* first found by the author. Most of these species were previously known from adjacent counties, as noted in the appendix, where the list has escaped revision. The author was not fated to see the publication of this book, which will be welcomed by all systematic botanists sojourning in Sussex; a note saying that he dictated the preface on the very day that he was taken ill is added by his daughter, who has also prepared the three illustrations which are included.

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.]*

Reconstruction of Diprotodon from the Callabonna Deposits, South Australia.

SOME years ago, under dates June 21 and June 28, 1894, NATURE contained a notice of an extensive deposit, at Lake Callabonna, South Australia, of fossil bones of Diprotodon, Phascolonus, various species of extinct kangaroos, and of a large struthious bird, since named *Genyornis newtoni*, in honour of the late lamented Prof. Newton, of Cambridge, and in recognition of much personal kindness received from him by the writer. Since that date various and more detailed references to some of the forms represented in this deposit have appeared in the Transactions and Memoirs of the Royal Society of South Australia; and now, at last, after a lapse of years, which may have seemed unnecessarily long to those unacquainted with all the circumstances of the case, we have lately completed at this museum a complete cast in plaster of the skeleton of *Diprotodon australis*. Some of your readers may be interested in the photograph of this cast which I now send you (Fig. 1), as well as in one which gives our idea of the reconstruction in the flesh of this marsupial (Fig. 2).

As has been previously mentioned in your columns and in the other publication referred to, the state in which the Callabonna fossils were originally found, and the injury which they suffered as the result of a long journey on camel back to the railway line, were such as to require the expenditure upon them of much detailed preparatory labour before they could be restored to a sound and enduring condition; but while the ultimate result has been quite satisfactory as regards the appendicular skeleton, there have been much greater difficulties, and not so completely a satisfactory result, in respect to the skull and vertebral column. In both these categories the bones were to a degree above all the others soft, friable, broken, and infiltrated with saline matter that was difficult to remove. In the skulls particularly, the constituent bones were both broken and greatly distorted. Those that had been found lying on their sides were laterally compressed to an extent that the whole cranial mass formed a flattened slab which in some instances did not exceed a few inches in thickness. In other cases the compression had occurred in a dorso-ventral direction with a like result of producing many fractures and much distortion of the proper relation of parts. Fortunately, the distortion has not affected every skull in the same way, so that in the construction of the cast it has been possible to utilise undisturbed parts of different skulls.

Nevertheless, even with the considerable mass of material available, both from Callabonna and from other localities, there were some parts of the skull which were never found in an intact condition, and it is in these respects that the cast is not to our satisfaction.

For the information of those who will, it is hoped, eventually possess a copy of this cast, it may be well now to mention those parts the correctness of which we cannot, unfortunately, for the above reasons guarantee. Coming under this category are the occipital region, with the exception of the condyles and the immediate boundaries of the neural foramen. In not a single skull from Callabonna or from elsewhere was this extensive region without such serious breakage and distortion as to render a faithful reproduction of its details impossible. Consequently, in our restoration we have followed as best we could the details of Owen's figure (Owen's "Fossil Mammals of Australia," Plate xix., Fig. 3). Then another part that was always greatly damaged was the anterior or malar pier of the zygomatic arch, the broken parts being generally telescoped; thus we are not quite satisfied that we have got this region as it should be, though in other respects the zygoma is correct. Also, as might be expected, the thin laminar edges of the lateral boundaries of the mesopterygoid fossa were always broken, so that we have been consequently devoid of objective guidance in their reconstruction.

For the vertebræ, many of which were also in a particularly fragmentary and friable condition, a set belonging to one animal which was numerically nearly complete was used as models. Where parts of these were deficient, as often occurred, they could generally be supplied by the corresponding segment from another animal, but not always so. We had no model for the neural spines of the sixth and seventh cervical vertebræ, which are thus parts added in conformity with what we conceive to be the serial plan of arrangement. Fourteen vertebræ bear ribs, and there are five of the lumbar series; four are fused to form the sacral mass, and there are nineteen separate segments in the tail. The ribs, with one exception, are those belonging to the vertebræ, but as most of them were considerably twisted or otherwise distorted, it was sometimes necessary that they should undergo the operation known to wheelwrights as "cutting and shutting" before they could be set properly both to their respective vertebræ and to one another.

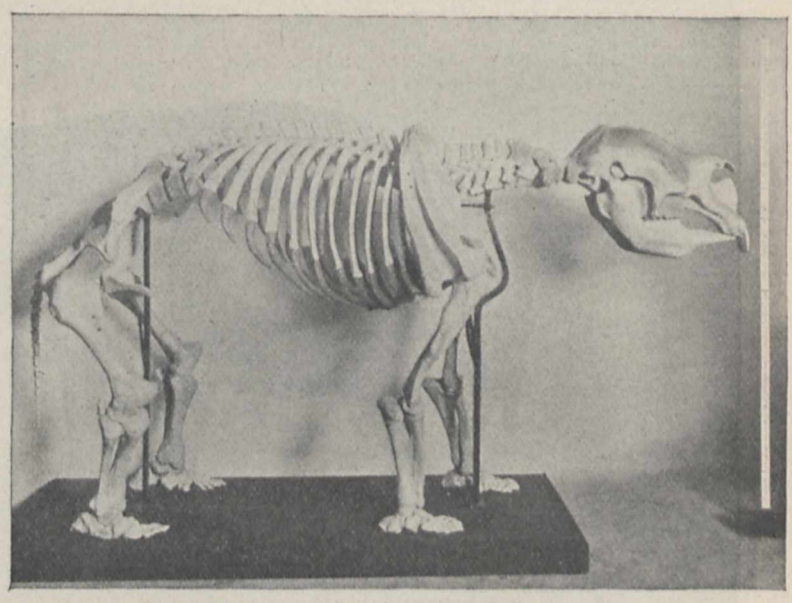

FIG. 1.—Plaster cast of the skeleton of *Diprotodon australis*.

As previously stated, the limb bones, from their fewer fractures and better texture, gave much less trouble in their restoration than those of the axial skeleton. Most of them belong to the same individual as the vertebræ, but some, in a damaged condition, have been replaced by other bones of suitable size. The peculiar feet, the structure of which was revealed by the Callabonna discovery, have been described (Memoirs Royal Society of South Australia, vol. i., part i.).

It is clear by reference to the bones of other skeletons in the Callabonna collection that the animal now represented was of medium size only, the height of the cast at the shoulder being 5 feet 6 inches, but unfortunately the skeletons of the very large individuals were much more incomplete than that which served as our model. I think it would be safe to place the height of the largest animals in life at 6 feet, or perhaps even a few inches more.

With regard to the restoration in the flesh, the photograph which I send you was made by my friend Mr. C. H. Angas, a skilful delineator of animals, with such help as we could give him from the anatomist's point of view. There can, I think, be little doubt that in its general build the Diprotodon had considerable resemblance to a gigantic wombat, and as such we have drawn him. Opinions may, however, differ as to our treatment of the muzzle. The huge overarching nasals, which greatly exaggerate the somewhat similar formation in the tapir, and the very massive bony internarial septum, must indicate some special, and probably some protuberant, development of the soft parts in this region. Bearing in mind the many cranial, as well as other skeletal, resemblances between Diprotodon and Macropus, we have consequently assigned to the former in our restoration a snout of the same type as that of the latter animal, but of greatly exaggerated size and prominence. In the case of the ears, we have compromised between the extremes of length of those organs as they occur in the kangaroos and wombats, with, however, a nearer approach to the former proportions. The result, on the whole, has been to make the head appear much more like that of a very massive and bulky kangaroo than of a wombat. In the original sketch we have presumed the animal to be covered with a very dark short fur of wombat type. For a setting we have delineated the Diprotodon amidst surroundings that represent some *present* characteristics of Central Australia. Thus in the background, to the left, is part of the white expanse of one of those large salt-encrusted clay pans of which Lake Callabonna, where the bones were found, is an example. In the distance beyond the lake is shown one of the flat-topped hills that are very characteristic of the "desert sandstone" region of the interior. The vegetation in the foreground is chiefly "saltbush" (Atriplex spp.), some species of which, together with allied plants, having apparently formed the principal food of the Diprotodon, just as these now supply the chief sustenance of the introduced Herbivora, while here and there is a trailing plant of "parakylia" (Claytonia spp.), so well known to travellers in the dry central regions for its moisture-holding properties.

I might add, though the information has already appeared in your columns, that a copy of this cast is in the possession of the Zoological Museum at Cambridge University, and that portions of it, together with some original bones, have been sent to the Natural History Department of the British Museum. Replicas of it have also been sent to the museums of Melbourne, Victoria, and of Perth, Western Australia.

E. C. STIRLING.

The Museum, Adelaide, South Australia, August 6.

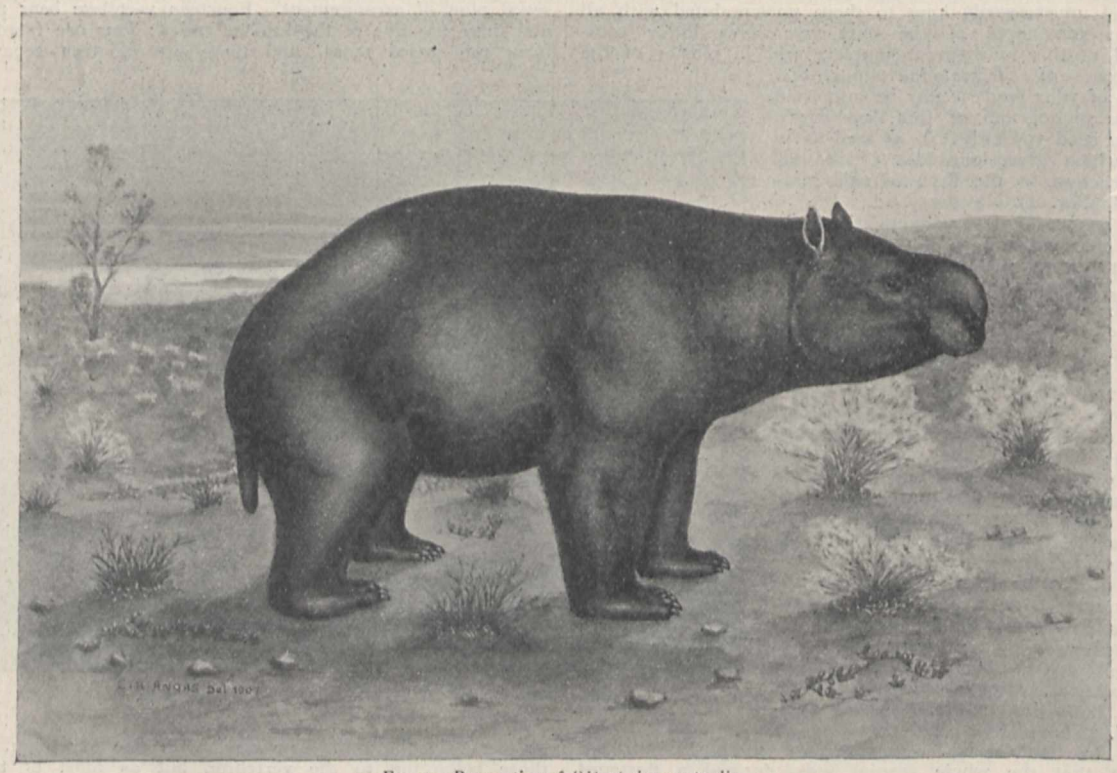

FIG. 2.—Restoration of *Diprotodon australis*.

The Origin of Radium.

IN a communication published in NATURE of November 15, 1906, I described some experiments which had given results indicating the growth of radium in a preparation of thorium which had been previously precipitated in a solution of a uranium mineral. I had found from other experiments that the thorium after this treatment contained a radio-active body which did not decay appreciably in the course of several years. It was a simple matter to demonstrate that this active substance was not radium, uranium, or polonium, and I therefore assumed that it was actinium, since Debierne has stated (*C.R.*, cxxx., 906) that the chemical properties of actinium are similar to those of thorium, and since, moreover, an emanation which completely lost its activity in less than half a minute was evolved in small amounts from the oxides of the thorium treated in this manner. I therefore suggested that actinium was the parent of radium and the intermediate product between uranium and radium.

Rutherford has recently given an account (NATURE, June 6) of some experiments in the course of which a solution of actinium was successively precipitated with ammonium sulphide in order to remove the radium present. From the results obtained he concludes that the parent of radium is distinct from actinium, and is separated from the latter by precipitation with ammonium sulphide.

For the past ten months I have been continuing my

experiments with the object of determining more definitely the properties and chemical behaviour of this elusive parent. The general manner of proceeding has been to obtain as complete a solution as possible of known weights of different uranium minerals. These solutions have been treated in the manner described in my earlier communication, with special precautions and modifications. The growth of radium in the solutions of the rare earths finally obtained was determined by measurements of the amount of radium emanation present at frequent intervals, and the rate of growth was calculated by an expression which took into account the rate of production of the emanation by the radium. The minerals used included carnotite, Joachimsthal pitchblende, gummite, uranophane, and a specimen of very pure uraninite from North Carolina containing only 0·03 per cent. of material insoluble in dilute nitric acid.

The space available in these columns will permit of only a brief mention of some of the more interesting results. In confirmation of Rutherford's statement it was found that the rate of production of radium was not influenced appreciably by the presence of radio-actinium and its products, which were completely absent from most of the solutions at the start. Continued observations of the growth of radium in the first solution prepared indicate that the rate of production of radium has been constant, within the limits of experimental error, for a period of more than 500 days.

I have attempted with one of my preparations to repeat the separation of the radium parent from actinium by the ammonium sulphide treatment which Rutherford has described. No separation could be detected when freshly prepared, pure ammonium sulphide was used. It was found that the radium parent can be quite completely separated from actinium by repeated precipitation with sodium thiosulphate under the conditions usual for the precipitation of thorium. In the case of a solution of the parent substance with thorium and other rare earths treated in this manner, less than 1 per cent. of the parent present remained in the filtrate, as was shown by the growth of radium in the two fractions obtained in this process. Since ammonium sulphide is always open to suspicion unless freshly prepared, and since on standing in loosely stoppered bottles it ultimately changes wholly into ammonium thiosulphate, it appears probable that the separation noticed by Rutherford was due to the latter reagent.

An interesting relation has been noticed between the growth of radium and the activity of the substances other than thorium in my solutions containing the radium parent. This proportionality is quite striking in those solutions containing the more completely purified salts. The activity of the substance present in these salts is comparatively high, and is about equal to the activity of the radium (itself) with which it is associated in the mineral. More significant still is the fact that this radio-active substance does not appear to possess any of the characteristic properties of the recognised radio-active elements. It is impossible that it is uranium, thorium, radium, or polonium. It has none of the properties that have been given as characteristic of actinium. About four-tenths of a gram of thorium oxide, containing an amount of this new body sufficient to give a leak of 500 divisions per minute in an α-ray electroscope, did not produce sufficient actinium emanation to permit its detection in another electroscope of greater sensitiveness. The thorium oxide had been prepared some weeks before by the gentle ignition of the oxalate, and was very porous. A strong current of air, about four litres per minute, was drawn over the preparation. There was no difficulty in measuring the thorium emanation evolved by this material under these conditions.

That the active substance is not actinium is also indicated by the fact that from a solution more than five months old no active substances other than thorium products could be separated by treatment with ammonia, by the formation of finely divided sulphur from sodium thiosulphate, or by the precipitation of considerable quantities of barium sulphate in the solution. The first process should have separated actinium X, and the two last should have separated radio-actinium had these products been present. The solution contained about 3 grams of thorium and a quantity of the new substance having an activity equal to that of about 35 grams of pure uranium.

Another important matter is the behaviour of the oxides obtained by strongly igniting the hydroxides precipitated by ammonia from a solution similar to the above. The activity of these oxides remains nearly constant for long periods, showing only a slight initial rise corresponding to the formation of thorium X in the thorium present. No rise corresponding to the formation of actinium X can be observed, but if actinium were present a separation of this product would be expected.

For these and certain other reasons I think that there is good cause for believing that uranium minerals contain an element emitting α rays, which is different from the other elements that have been identified, which produces no emanation, and which resembles thorium in its chemical properties. The activity of this element appears to be about the same as that of the radium (itself) with which it is associated in minerals. It is without doubt a product of uranium, and is probably the immediate parent of radium. It is very likely that this body is contained in Debierne's actinium preparations and in Giesel's "emanium" compounds, especially in the former, and its presence may perhaps explain the confusion which has resulted from Debierne's earlier assertions that actinium accompanied thorium as opposed to Giesel's positive statements to the contrary (*Chem. Berichte*, xl., 3011). The proportion of the total activity of a mineral due to the actinium present is very small, for the activity which can be attributed to actinium is less than 9 per cent. of the total.

The rate of disintegration of radium as determined from its growth in preparations similar to those described above, separated with great care from very pure North Carolina uraninite, indicates that the half-value period of this element is about 1900 years. It is hoped that certain experiments now in progress will make it possible to determine this factor with a satisfactory degree of certainty.

BERTRAM B. BOLTWOOD.

Sloane Laboratory, Yale University, New Haven, Conn., September 9.

The Body of Queen Tii.

IN NATURE of September 12, p. 494, a summary description was given of the remarkable discovery made by Mr. Theodore M. Davis, of Newport, R.I., of the tomb of the famous Egyptian Queen Tii, Thyi, or Teie, mother of the heretic-king Akhenaten, at Thebes. A remarkable point with regard to this discovery has been raised by an "Occasional Correspondent" of the *Times*, who informs us that the supposed remains of the queen, after having been examined by Dr. Elliot Smith, turn out to be those of a young man, at most twenty-five years of age! It is concluded therefrom that the discoverers were mistaken in their attribution of these remains, and that the coffin is not that of the queen at all, but of Akhenaten, whose name appears on it; but this cannot be the case. On the catafalque the inscription definitely states that it was given by Akhenaten to his mother Tii, and the mention of Akhenaten's name only on the coffin need mean also no more than this. The coffin is that of a queen; the diadem and necklace and other objects found are also the parure of a queen, not of a king, and the heads of the canopic jars are portraits of Tii.

The fact that the body found with these things is that of a man would mean simply that, as Prof. Sayce says in a letter on the subject published in the *Times* of September 17, "the mummy of the Queen had been torn to pieces like that of the King; and that, subsequently, when an attempt was made to put the tomb in order, the first mummy that came to hand was thrust into the Queen's jewelry wrappings, and coffin. It was not the first time that the Egyptians resorted to similar measures, and it would explain the otherwise puzzling absence of funeral furniture in the tomb."

In an article published in the *Graphic* of September 14 describing the tomb, I assumed that the weight of Dr. Elliot Smith's medical authority was decisive, and that therefore the body must be regarded as that of a man,

at the same time suggesting reasons for this fact more or less similar to those advanced by Prof. Sayce; but the discoverer is by no means convinced that Dr. Smith is right at all. Since penning my article in the *Graphic* I have received a letter from Mr. Davis, giving his reasons for his sturdy belief, in the same terms as one received by Prof. Sayce, who communicates its gist to the *Times* as follows:—"Immediately after the opening of the tomb he had the mummy examined by Dr. Pollock, of Luxor, 'and a prominent American obstetrician. . . . In the presence of the doctor and surgeon, Mr. Ayrton, and one or two other persons, the mummy was opened and the bones exposed. In fact, the mummy had absorbed so much moisture that it could not be unwrapped, but it yielded to the touch and disintegrated to such an extent that there was no difficulty in exposing the bones from end to end. The pelvis was admitted to be the criterion of the sex. Both doctor and surgeon instantly agreed that it was the pelvis of a woman. The surgeon made a most thorough examination, and explained to us why it was a woman's pelvis, and what the difference is between the pelvis of a man and a woman. He practically stated that the 'greater breadth of the pelvic arch gives one of the most easily appreciable points of contrast between the male and female pelvis; the pelvic arch in the female forms an angle of from 90° to 100°, while in the male it averages from 70° to 75°.'" To me Mr. Davis writes:—"In any event, I shall exhaust the question of the sex of the pelvis before conceding Dr. Smith's opinion."

If, however, Dr. Elliot Smith is really right, and the body is that of a man, the fact does not in any way affect the discovery. The tomb, catafalque, coffin, canopic jars, diadem, &c., are those of Tii, and the bones found were in some way substituted for hers. They cannot be those of Akhenaten, as he must have been a middle-aged man when he died. H. R. HALL.

Use of the Word "Telephotography."

NATURE of August 29 contained an article by Dr. Shelford Bidwell entitled "Practical Telephotography." May I enter a protest against the use of the word "telephotography" to describe the method of transmitting pictures to a distance? Without wishing to go into the merit of the term, I would point out that it has been applied for years to photography by means of a lens consisting of a negative as well as a positive element, as in the well-known "telephoto" lens of Dallmeyer. There is already an extensive literature in which the term "telephotography" is used with this meaning, and to employ it now to describe something totally different can only ultimately result in confusion. Would it not be better to employ the term customarily employed, viz. "phototelegraphy"? R. CHILD BAYLEY.

20 Tudor Street, London, September 7.

I BELIEVE that the word "telephotography" was coined by myself, and first appeared at the head of an article published in NATURE on February 10, 1881, in which an account was given of the earliest attempt to transmit photographic pictures by electrical means. The term was at the time generally adopted by the Press, and has found its way into several books of reference. In the "Century Dictionary" (1900) telephotography is defined as "the art (not yet attained) of producing a photograph, distant and invisible from the camera, by means of electrical connections with a suitable apparatus near the object." No other meaning is given.

The word was not employed in the sense in which it appears to be now current among photographers until at least ten years later, the date of Mr. Dallmeyer's invention being 1891; but I have no great affection for my neologism, and propose in future to write "telegraphic photography," thus avoiding the possibility of confusion. "Phototelegraphy" I take to mean signalling by flashes of light, as in heliography. SHELFORD BIDWELL.

Beechmead, Oatlands Chase, Weybridge, September 13.

DOUBLE STARS.[1]

PROF. BURNHAM tells us in the preface to the first mentioned of these works that when he was attracted to the subject of double stars he had to draw the main part of his information from an early edition of Webb's "Celestial Objects." A useful book, no doubt, and one which has given many an amateur his first insight into a fascinating study, but its modest dimensions compared with those of the ponderous tomes the titles of which appear at the foot of this column may serve to remind us of the progress that has been made since that book occupied a prominent place as a recognised authority. It is in no small measure due to the difficulties arising from this scantiness of information that Prof. Burnham experienced in his early days that we owe this magnificent compilation. In those far-away times it was necessary to collect the history of double stars, to make manuscript copies of all the catalogues that could be obtained, to note carefully all that was published; and though this necessity may no longer exist, these manuscript catalogues have been kept posted up to date, and it is the final and complete outcome of this long-continued work that has now found its way into the printers' hands. We therefore get the results of accumulated experience in the form that the author has found most useful.

The catalogue gives the approximate coordinates of 13,665 stars, the position angle and distance at a given epoch, the magnitude of the components, and such other information as can be pressed into a single line. The value of such a work consists in its completeness. It may be confidently assumed that some information concerning every star recognised as double within the area under review previous to 1906, will be found here. All who have worked with incomplete or disconnected catalogues will know how to appreciate the usefulness of this compilation. In no department of astronomical research is the literature more scattered. Amateurs have contributed much to double-star measurement, and their observations are necessarily distributed through many channels. To collect and make available these many sources of information is a task of no common difficulty, and is perhaps only possible to one who has narrowly watched the growth of the material and sifted the details as the observations appeared. Alertness, industry and a keen interest in the subject were as necessary as access to publications or orderly method of arrangement. No one was better equipped for the task than Prof. Burnham, and we may be grateful that he has accomplished it.

The notes to the catalogue will be of greater interest to those who are concerned in the attainment of astronomical results than is the catalogue itself. Here are recorded a sufficient number of measures to show the motion where there has been any relative change, and so far as possible its character and amount, or to exhibit the unchanged relation of the components where no motion has been detected. References to the original places of publication, which would be used in subsequent calculations, are given for each star. The author gratefully acknowledges that he has been given a free hand in the selection of observations and comments, and he adds that he "has omitted nothing that in his judgment would be worth giving." Here the author assumes the position of a critic, a position for which he is admirably fitted by his long training and close study. Many will be prepared to surrender their judgment

1 "A General Catalogue of Double Stars within 121° of the North Pole." By S. W. Burnham. Pp. lv+256. (Washington, D.C.: Published by the Carnegie Institution, 1906.)

"A General Catalogue of Double Stars." Part ii. Notes to the Catalogue. Pp. viii+257-1086. (Published by the Carnegie Institution, 1906.)

and accept his ruling. All will be cautious how they dissent from his expressed opinions. But it seems to us that to recommend the wholesale rejection of a large number of published measures of double stars is a drastic proposal, from which a less stern critic than the author might well recoil. It may be admitted that the possessors of small telescopes have always struggled to measure objects for which their instruments were unfitted. Indeed, a double-star observer never seems happy unless he is trying to measure something he can see very imperfectly. But simple dissatisfaction with the manner in which an observation has been made does not offer any adequate criterion for the rejection of doubtful observations, and we can hardly accept the assertion "that there need be no difficulty or hesitation in deciding as to the proper material to be used." This, as it stands, is a hard saying, and we may very well doubt if we have correctly understood the author.

He is on safer ground when he declines to deduce any inferences which might be based on the grouping of statistics. He is at present content to collect facts and to regard as premature any attempt to establish, or even suggest, theories on the limited information at command. The remark is made that very little has been done in the way of finding close pairs below the ninth magnitude, and that the effect of recent discovery in this direction may controvert the conclusions drawn from the older measures. This may doubtless be true, but the lack of sufficient data has seldom prevented the adoption of a working hypothesis. Certainly when Prof. Burnham sums up what has been accomplished in a century of double-star observing the results seem somewhat meagre for theory building, and emphasise the necessity for that careful and systematic measurement upon which he insists. There are only eighty-eight systems for which orbits have been found, and of this number only thirty-four can be regarded as of any value. As to the remaining fifty-four systems, the periods and "all the elements of the orbits are wholly uncertain and worthless. They cannot be regarded even as approximations . . . and in some instances it is not certain that they are physical systems at all." This severe criticism can be justified. Perhaps some of these indecisive results and the eagerness to build upon unsuitable observations may be traced to the influence of Herschel, and the apparent success that attended his ingenious device for deriving an approximate orbit. More rigorous methods have, however, given results of scarcely greater trustworthiness, and the tendency now is to leave double-star orbits severely alone.

It may be of greater practical utility to note that our knowledge of double stars has suffered from the want of organisation among observers. As the author puts it, "Since the observations of Struve the work of micrometrical measurement of double stars has not been wisely distributed. A vast amount of time has been practically wasted in the duplication of measures of the prominent and familiar pairs and in observing objects which need no attention except at long intervals." But Prof. Burnham may here be reminded that it is not enough to suggest that the working lists of double stars should be more carefully selected. What is wanted is authoritative leadership and sympathetic guidance. Such an influential position the writer of these books might worthily occupy. His competency no one would question. The necessity for cooperation among astronomers and the judicious husbanding of resources is becoming more and more recognised. The beneficial effect of organisation in coping with large masses of work is acknowledged. Isolated and unmethodical labour is accompanied by many evils, but none more noticeable than that of overlapping and needless duplication. These evils cannot be entirely avoided, but they can be reduced to a minimum.

Overlapping may to some extent be beneficial. An example is supplied by the very admirable work which Mr. Lewis has lately published through the Royal Astronomical Society. But it is not often that two experts work on so nearly parallel lines. Mr. Lewis has done in a very thorough and masterly manner for the Struve stars what Prof. Burnham has accomplished for a larger number. Mr. Lewis's work may be the more efficient, in the sense that it enables us to dispense with a larger number of original authorities, but there would have been no great difficulty and some advantage in combining the merits of both compilations. It is not necessary to give illustrations of the way in which observations are duplicated. It is difficult to quote instances in which independent lines of investigation are being pursued. The Lick Observatory has made the search for close double stars of feeble magnitude peculiarly its own. In this department is doubtless found an admirable employment for large optical power. Mr. Burnham has added many new doubles to our catalogue, but apparently finds a sufficient field for his energy in the re-measurement of recognised doubles. Throughout the United States a vast number of observers are interested in double stars, but in their work it is impossible to recognise any well-developed plan. On this side of the Atlantic, besides the excellent work that is being done at the Royal Observatory, which again demands large aperture, we have an army of amateurs, headed, we may say, by Mr. Maw, the late president of the Royal Astronomical Society, whose contributions to the general store would be increased in value if designed to form part of a definite scheme. Too often double-star measurement is the refuge of the leisured amateur, who finds in this kind of work an agreeable occupation. Such irresponsible observers stand particularly in need of direction, and if some scheme of cooperation could be formulated, Prof. Burnham's intimate acquaintance with the subject would be of immense assistance. He has admirably arranged the material that is to be observed; he has made us apprehend the extent of the field of labour and the abundance of the harvest; he has shown what can be done by unwearying industry and painstaking perseverance; let him complete his work by organising the labourers and infusing into their work system and continuity.

FOOD INSPECTION AND ADULTERATION.

SIR JAMES CRICHTON BROWNE, as president of the Association of Sanitary Inspectors, delivered last week the customary address at the annual meeting of the association. His remarks, devoted largely to the question of purity in foodstuffs, were a forcible presentation of matters which, well known to those concerned in the problem of food-control, deserve the serious attention of a wider circle, since as consumers and as citizens all are interested in the points brought forward.

The most important topic dealt with was that of a pure milk supply. It is "the primary and paramount food question." There is no need to enter here into details of adulteration, but it may be stated that according to the Local Government Board reports ten per cent. of our milk is either adulterated with water or impoverished by the abstraction of fat, or both; whilst a much larger proportion is so manipulated as to leave it only just within the official limits taken as criteria of genuineness. Moreover, the practice of sophistication appears to be extending.

Unfortunately, however, milk is a product which, naturally, varies much in quality. As a consequence there are difficulties, well known to those who administer the Sale of Food and Drugs Acts, in the way of preventing the manipulation mentioned. To avoid punishing the innocent some latitude must be allowed to the guilty—and the guilty take full advantage of it. It does not follow that less latitude should be given. Careful consideration will show that as regards the official "standards" by which milk is judged, the balance is held as evenly as is practicable between the consumer on the one hand and the producer on the other.

At the moment, what seems to be the most pressing question of milk supply is the matter of cleanliness. Whether the milk is genuine or whether it is watered, at least the introduction of filth ought not to be tolerated. Dirty byres, dirty cows, dirty hands; an atmosphere of dust and micro-organisms; tuberculous udders and uncleanly churns; these may each and all have a part in contaminating the foodstuff which, as Sir James puts it, "enters into the diet of a vast majority of the population, and forms the almost exclusive food of its most susceptible units." There is here a very real need for improvement. Nor does it appear certain that any new legislation is necessary. The Public Health Act and the Dairy, Cowsheds, and Milkshops Order would perhaps suffice as regards the machinery; but there is often local reluctance to put the machinery in motion.

In the matter of butter, to which Sir James devoted a part of his address, the hands of the authorities will be materially strengthened by the new Butter and Margarine Act. It was quite time. The chief malpractices to which this article of food is subjected were described some months ago in the columns of this journal (NATURE, vol. lxxiii., p. 466). One or two examples from the report of the principal chemist of the Government Laboratory may be cited to illustrate the recent history of the matter. During last year a creamery in this country was visited under the authority of a search-warrant, and the process of adulterating butter with lard was found in full swing on the premises. Other such places are known to use condensed milk for incorporation with butter. Again, an unscrupulous individual was found offering for sale a process for the "scientific" manipulation of butter by blending it with beef-fat or lard; and eventually he was indicted for inciting to commit a misdemeanour. He was sent for trial, but the Old Bailey never saw him; the authorities had to be content with estreating his bail for 800*l*.

As remedial measures Sir James Crichton Browne mentions provisions that were either previously existent or have been included in the Butter and Margarine Act of last session. The importer is held responsible for the genuineness of the butter he imports, and must find his remedy against the foreign producer. All butter factories must be registered, and be subject to inspection. Any oils or fats found that are capable of being used in the adulteration of butter are to be considered as intended to be so used unless the contrary is proved, and their presence constitutes an offence under the Act. Though not all that could be wished, the measure will be a valuable one in many respects, and should do much to check fraudulent manipulation of butter.

But a much more drastic and far-reaching enactment is just now coming into force in the United States, and the working of one of its provisions in particular will be watched with much interest in this country. Its effect is to ensure that articles of food and drugs shall be labelled so as to show the purchaser, within limits, exactly what the articles are. The description must not "be false or misleading in any particular," whether as to composition, quality, origin, or what not. Thus an article must be stated on the label to be "prepared with glucose," "coloured with sulphate of copper," "dyed with aniline dye," or to be "composed of fragments and scraps from a mushroom cannery," and so on, as the case may be. Moreover, in the case of certain drugs—morphia, cocaine, chloral, chloroform, and others—the proportions must always be stated on the label. If the preparation is found not to agree with the description it is deemed to be "misbranded," and offends against the Act. It is too early yet to say exactly what the effect of this compulsory candour will be, but obviously it affords a powerful means of enforcing commercial honesty. This, however, is not all that is being done. So long as a substance is left undefined, so long is it possible for a "trade custom" to be alleged in defence of malpractices. Witness, for instance, the discussions upon "what is whisky?" and "what is brandy?" which have recently arisen in this country. Hence the new American law is being supplemented by a series of schedules defining the various food products and fixing certain "standards" in respect of them. The appointment of a committee to draw up similar regulations for the United Kingdom has been urged, but at present little more has been done in the matter.

Another point of much importance touched upon by Sir J. Crichton Browne is the open or veiled antagonism of some local authorities to anything like reforming zeal on the part of their medical officers, analysts, and inspectors. The personal interests of influential councillors may clash with the public welfare, and an official may find his tenure but short if he becomes too zealous. How, it is asked, can a public official act impartially if the fearless performance of his duty brings him into the position of having to prosecute his employers?

"Vice," says Sir James, "is mind in the wrong place." Perhaps our present system of local government often puts men in the wrong place.

C. SIMMONDS.

SCIENTIFIC WORK IN INDIA.

THE Asiatic Society of Bengal continues to make satisfactory progress, its membership having increased from 343 in 1904 to 407 in 1906. In his annual address for the latter year the president, Sir A. Frazer, Lieutenant Governor of the Province, expressed his disappointment that so few civilians and members of other services have joined the society. He suggested that the society did not make itself sufficiently known; that the increasing use of English in Bengal discourages the use of the vernacular tongues; but he chiefly attributes the lack of official interest in the work to what he calls "the prevalence of mere officialism." He therefore proposes to appoint a joint committee of savants and officials to investigate the question, and to endeavour to bring about more satisfactory relations between the society and the services.

It is well that the attention of the authorities has been directed to this important subject. Such a committee is, however, hardly likely to throw much new light on the matter. The causes enumerated by the president have no doubt tended to increase the prevailing indifference felt by Indian officials to scientific inquiry and the study of the people, their languages, superstitions, and beliefs. But, in spite of the cheerful optimism of the Lieutenant Governor, the causes of this failure lie nearer home than he would be disposed to admit. All services naturally take their tone from their leaders, and, as a matter of fact, the Indian Government has always regarded

investigations, scientific or literary, beyond the immediate range of official routine, with some degree of suspicion. They claim all the time and powers of mind which their servants possess for their own special work; they have hitherto been unable fully to realise the value of a personal knowledge of the country and its people; they suppose that any studies of this kind tend to divert attention from the continuous desk work, the compilation of statistical reports which they consider the main duty of the civilian, or the supervision of his men which is the business of the soldier. With this is combined the impression that men of genius are out of place in the Indian bureaucracy, which prefers the safe person, who meekly follows the codes and circulars of the Revenue Board, to one who is disposed to raise awkward questions and inquire into matters beyond the narrow range of official duties. Hence the scientific inquirer, the linguist, naturalist, or anthropologist, rests under a certain suspicion that he is neglecting his real duties.

Fortunately, the present political situation is tending to modify this old-fashioned official view, and it is becoming obvious that the Government servant needs, above all things, an insight into the little-known beliefs and prejudices of the peasantry, while an officer destitute of scientific training, with no interest in the country and its development, is an unprofitable servant. It may reasonably be suspected that many of the present difficulties in Bengal are due to a fact which Sir A. Frazer mentions incidentally, without apparently realising its importance—that junior officers in Bengal fail to master the vernaculars of the people because most of their work on municipal and other boards is done in association with native gentlemen who prefer that the business should be conducted in English.

In spite of this lack of cooperation on the part of the official classes, the out-turn of the society's work for the past year is excellent. Dr. Annandale continues his studies of the fresh-water fauna, discussing the little-known Polyzoa which are found in fresh and brackish pools, with some undescribed fresh-water sponges from Calcutta and other parts of the country. He also deals with a specimen, recently discovered by accident in the museum, of that rare cat, *Felis tristis*, and Major Anderson describes *Breynia Vredenburgi*, a new Echinoid from the Indian Ocean. Botany is represented by Mr. Burkill's notes on the pollinisation of Indian flowers, with a special account of *Gentiana coronata*. In the zoological field Lieut.-Colonel Phillot deals with various varieties of falcons, and translates the chapters on hunting dogs and cheetas from an Arabic treatise on falconry of the tenth century. The chemical laboratory of the Presidency College contributes notes on a new way of preparing mercurous iodide, and on nitro-ethane as a solvent of iodoform.

The anthropological and numismatic supplements are as interesting as usual, and the materials collected in the late Tibetan expedition are being worked up by Rai Sarat Chandra Das and other native scholars.

The society also continues its useful series of independent memoirs. M. M. A. Gruvel contributes a learned monograph on "Cirrhipèdes operculés de l'Indian Museum de Calcutta," and Mr. E. R. Watson discusses the fastness of the indigenous dyes of Bengal. On the ethnographical side Mr. E. H. C. Walsh contributes a paper on the coinage of Tibet, and Dr. Annandale and Lieut.-Colonel Phillott, in the second part of their "Miscellanea Ethnographica," deal with Malayan weapons and the plan of a Persian gentleman's house. The most important contribution to this department is the monograph by Mr. R. B. Bainbridge on the Saorias of the Rajmahal Hills. These are but an isolated fragment of a widely-spread, broken tribe found in Orissa, Chota Nagpur, Western Bengal, Madras, and the Central Provinces. The author speaks rather vaguely of their ethnical character. He seems to identify them with the Malé, and he adds that the Santals call them Munda and the Hindus Paharia or hillmen. He notes that they combine, as many Dravidians do, a high nasal index with dolichocephaly, but, in opposition to Sir H. Risley, he endeavours to distinguish them from typical Dravidians, like the Santals and Oraons, and suggests that among the Saorias the original Dravidian type has become modified by admixture with Aryan blood. But considering the isolation of their territory from the plains of Bengal, cross-breeding with high-caste Hindus does not seem probable. The author is obviously well acquainted with the people whom he describes, but his lack of literary skill and of anthropological training makes his memoir disappointing in comparison with the accounts of the same people by Sir H. Risley and Colonel Dalton. At the same time, he has collected much useful information on their social customs and religion which will furnish a basis for a full account of the tribe by some more competent writer.

THE CULLINAN DIAMOND.

THE Cullinan diamond, which the Transvaal Government, acting upon the proposition of the Prime Minister, General Botha, has recently decided to present to the King, was discovered at the Premier Mine near Pretoria, in the Transvaal, on January 25, 1905. The stone was found projecting from the side of the open-working or excavation in the "pipe" area about 18 feet from the surface. After a preliminary cleaning it was found to weigh 3024¾ carats, or 1·37 lb. avoirdupois; consequently it is more than three times the weight of the largest diamond previously known—the famous stone found in 1893 at Jagersfontein, in the Orange River Colony, which weighed 972 carats. A few days after its discovery the stone was examined and measured by Dr. F. H. Hatch and Dr. G. S. Corstorphine, who published a description of it in the Transactions of the Geological Society of South Africa (vol. viii., pp. 26–7, 1905) and in the *Geological Magazine* (April, 1905, pp. 170–2).

According to this description the stone measures 4 by 2½ by 2 inches. It is bounded by eight surfaces; four of these are faces of the original octahedral crystal, and four are cleavage faces parallel to the octahedron. Evidently the stone is a portion only of the original crystal, which had the shape of a distorted octahedron. The original octahedral faces are distinguished by typical striations, the bands varying in width from 0·1 to 0·4 centimetre, by mammillations and by triangular pittings, like deeply-etched figures, the largest of which has a side of 0·65 cm. On the other hand, the cleavage surfaces are characterised by greater smoothness and consequently by a more perfect reflection of light. Parallel to the largest cleaved surface there is an air layer between two internal cleavages, producing a "rainbow" or Newton rings.

The crystal is of remarkable purity. Two spots are visible, one on the surface, the other about 1 cm. within the crystal. The colour approximates to a blue-white. The stone was named after the chairman of the Premier Diamond Company. It is the joint property of the company and of the Transvaal Government, the latter being entitled to a share in the profits made by the company.

NEW LABORATORIES AT QUEEN'S COLLEGE, BELFAST.

ON Friday last, September 20, the buildings recently erected to provide much-needed additional accommodation for the scientific departments of Queen's College, Belfast, were formally opened. These buildings include the Donald Currie laboratory and lecture-room for chemistry, the Musgrave laboratories for pathology and bacteriology, the Jaffé laboratory for physiology, the Harland laboratories of physics and engineering, and rooms for the departments of biology, pharmacology, and surgery.

Lord Kelvin had promised to visit the city of his birth and early life in order to perform the opening ceremony. Unfortunately, a few days before the date fixed, the sudden and serious illness of Lady Kelvin made it impossible for him to fulfil his engagement. Lord Kelvin sent to Belfast the text of the address which he had prepared for the occasion, and this was read to the meeting by his nephew, Mr. James Thomson, whose father, Prof. James Thomson, formerly occupied the chair of engineering in the college. The buildings were declared open by Sir Otto Jaffé, chairman of the committee in charge of the "Better Equipment Fund," and a prominent benefactor of the college. The meeting was afterwards addressed by Sir Christopher Nixon, vice-chancellor of the Royal University of Ireland, and by Prof. Letts.

In the beginning of his address Lord Kelvin traced the development of university education in Belfast from the foundation, about 1815, of the "Academical Institution," of which the collegiate part was afterwards merged in the Queen's College. He expressed the hope that the college would soon receive the full status of an independent university. After enumerating the laboratories to be opened on that day, the address proceeded as follows:—

Now that you have them open and ready for use, what are you going to do with them? Your chiefs in the different departments, professors, assistant professors, assistant workers, and students, will, I am sure, soon give very good and useful answers to that question. None of your chiefs will be likely to follow the example of a good old university professor of a bygone age in the sister island, who was the happy official possessor of many very fine and costly instruments, in which he took great pride. He devoted himself whole-heartedly to keeping them in order.

Your seven laboratories extend over the whole field of lifeless matter and of matter associated with life. We may be sure that in none of them will there be any lack of useful occupation. Personally, I need hardly say, I envy most the workers in the laboratories of physics, chemistry, and engineering.

At the present stage of the era which commenced with Henri Becquerel's discovery of radio-activity in salts of uranium and in metallic uranium, the very thought of physics and chemistry, a now united science, compels us to think of radium, in which Madame Curie discovered the element of Becquerel's wonderful radiation. I hope the physical and chemical laboratories of Queen's College, Belfast, will try to find if the radium element does occasionally explode into fragments. If they find that it does, the laboratories will, I trust, hold an official conference with the professors of Greek and logic, and come to a conclusion whether or not it is a convenient fiction to call the radium element an atom. It may remain quite convenient to continue calling radium an element. Indeed, I well remember a time in Belfast when we used to call earth, air, fire, and water "the four elements."

Whatever may betide, I hope the physical and chemical laboratories of Queen's College will be full of radio-activity until we have more intimate knowledge of radium than we have of iron, with its magnetic quality.

I have many happy recollections of Queen's College in the 'fifties and 'sixties, when my brother was professor of engineering there. What would he not have given for the admirable and useful engineering laboratory of which Queen's College takes possession to-day?

I have somewhat later recollections of Queen's College, full of personal and scientific interest, when Thomas Andrews was making his immortal discoveries in it regarding the continuity of the gaseous and liquid states, now celebrated throughout the scientific world. I well remember, too, his showing me, on a promisingly practical scale of magnitude, the electrical transmission of power through a pair of copper wires, from one Gramme dynamo driven by hand to another taking the work from it. No doubt Andrews showed this to his students at a time when, by most engineers and scientific men, engineering applications of electromagnetism were looked on as chimerical fancies of ingenious, non-practical professors or other weak persons. Who can say whether the seed thus sown, about 1870, or 1871 or 1872, through university action in the north of Ireland, may not have germinated in the Portrush electric railway, which has given to Ireland the first historic title to the utilisation of water-power by electric transmission to many miles, instead of to a few yards, as shown to the students of Queen's College in Andrews's lecture-room?

PROF. L. F. VERNON-HARCOURT.

THE death of Prof. Vernon-Harcourt, following so soon after that of Sir Benjamin Baker, not only deprives the civil engineering profession of another illustrious member, but leaves experimental science the poorer for the loss of one of her most devoted sons. The branch of civil engineering work with which Prof. Vernon-Harcourt was most closely associated was that concerned in the maintenance and construction of waterways. Harbours, docks, rivers, canals—all and everything, in fact, which appertains to the provision and improvement of routes and termini for water-borne traffic is included under this head. In this special domain Prof. Vernon-Harcourt was an acknowledged authority, and the treatises thereon which came from his pen, and the opinions which he expressed, invariably carried with them that conviction which is the rightful due of sound knowledge and ripe experience.

He came of distinguished ancestry. The son of an admiral, the grandson of an archbishop, he could scarcely fail to leave his mark in any profession he might take up. A brilliant career at Oxford (he graduated in 1861 with a first class in mathematics, and the following year in natural science) was followed by three years of steady, persevering study in the practice of civil engineering under the late Sir John Hawkshaw. Then came ten years of responsible executive work, first at the South-West India Dock, then on Alderney Breakwater, on Rosslare Harbour, and the railway to Wexford. Finally, in 1878, he established himself as a consultant, with offices in Westminster, and four years later he was appointed professor of civil engineering at University College, London. His active connection with University College was maintained practically up to the time of his death.

Prof. Vernon-Harcourt will perhaps be best remembered by his writings, which have won for their author a deserved and unquestioned reputation. In 1882 appeared "Rivers and Canals" (second edition, 1896), followed in 1885 by "Harbours and Docks," in 1891 by "Achievements in Engineering," and in 1902 by "Civil Engineering as applied to Construction." All these works are characterised by lucidity of style and soundness of thought, and they are to be found to-day on the bookshelves of most practising engineers. In addition thereto, Prof. Vernon-Harcourt contributed to the "Encyclopædia Britannica," and wrote copiously for various learned societies—the Institution of Civil Engineers, the Royal Society, the

Society of Arts, and the International Association of Navigation congresses. He was president of the mechanical section of the British Association meeting of 1895, and a number of distinctions were conferred upon him from time to time, including a commandership of the Imperial Franz-Josef Order of Austria-Hungary, in recognition of his services on an International Jury on Canal Lifts.

There is no novel or startling departure in theory or practice, no gigantic masterpiece of constructive skill, associated with Prof. Vernon-Harcourt's career, but his name will long be held in respectful remembrance by those who can understand and appreciate the solid and enduring character of his unobtrusive work. His investigations in 1886 in regard to the Seine estuary, and the patient care with which, from a number of artificial models, he deduced the probable effect of various systems of training works, commanded the attention and interest of the profession, such that his position as an expert authority on fluvio-maritime works henceforward became preeminent. In 1896 he made an inspection of the River Hooghli, and drew up for the Calcutta Port Commissioners a valuable report on the means of improving the navigable channel. Only last year he was consulted by the Mersey Docks and Harbour Board in regard to certain training works proposed for the estuary of the Mersey.

Prof. Vernon-Harcourt did not reach the allotted span of man, and the announcement of his death at the age of sixty-eight is received on all hands with unfeigned expressions of sorrow and regret.

NOTES.

THE celebration of the centenary of the Geological Society of London is to commence this morning with a reception of delegates by the president, Sir Archibald Geikie, K.C.B., F.R.S., at the Institution of Civil Engineers. The history of the society is traced in a review which appears elsewhere in this number, and we hope to give an account of the centennial celebrations in our next issue. The president will deliver an address this afternoon on the state of geology at the time when the Geological Society was founded, and a banquet will be held at the Hôtel Métropole this evening. To-morrow will be chiefly devoted to visits to museums, galleries, &c., concluding with an evening reception at the Natural History Museum. On Saturday, short excursions will be made to places of geological interest within easy reach of London; and on Monday the visitors will divide into two sections, one of which will go to Oxford, the other to Cambridge. At both universities there will be further hospitalities, and honorary degrees will be conferred upon a few of the guests.

THE fourteenth International Congress of Hygiene and Demography was opened at Berlin on Monday in the presence of the Crown Prince and representatives of the Diplomatic Corps, the Prussian Ministry, the Berlin Municipality, and other official bodies. The congress was formally welcomed in the name of the Emperor William by the Prussian Minister of the Interior, Herr von Bethmann-Hollweg.

THE Scottish Arctic Expedition under Dr. Bruce arrived at Tromsö on September 22, all well. Dr. Bruce's companion, Mr. H. Johansen, will stay at Spitsbergen for the winter, together with Mr. Lerner. The *Times* correspondent at Ottawa reports that Dr. Stefansson, of the Anglo-American Arctic Expedition, has arrived at Victoria. He left Captain Mikkelsen and the other members of the expedition well on Herschel Island in July.

A CONFERENCE for the purpose of discussing subjects connected with the work of museums and art galleries and kindred institutions will be held at the Royal Museum and Art Galleries, Salford, on Friday, October 18, and will be attended by members of the Museums Association and other persons interested in museum work.

THE Berlin correspondent of the *Globe* states that during the ensuing four months, that is, from now to January 15, the German Army authorities intend to carry out an important series of experiments in wireless telegraphy at Metz and Strasburg, and at the six leading fortresses of Königsberg, Thorn, Danzig, Posen, Cologne, and Mainz. One thousand reservists, who have served as military telegraphists, have been called up to work with the military telegraphists now serving with the Army.

SPEAKING at Liverpool on September 19, at the Liverpool Imperial Products Exhibition, Mr. Haldane, M.P., again took the opportunity of urging the importance of a scientific foundation for our Empire. He reminded his hearers that the secret of prosperity, the secret of winning the fruits of the earth, lies in mind, in knowledge, and in the direction applied to the energies which abound around us, and can be turned to the service of man. What is true of ordinary industry is true of the great enterprise of making the best of the possibilities of those vast tracts of the world which constitute the British Empire.

THE official results of the International Balloon Race of September 15 show that six balloons travelled more than 800 kilometres before descending. The following particulars are given, among others:—

Order	Name of Balloon	Cubic capacity, metres	Nationality	Hour of ascent	Hour of descent	Distance travelled, kilometres
				Sunday	Monday	
1	Pommern ...	2,200	Germany ...	17 48	22 30	935
2	Le Cognac	1,700	Switzerland ...	18 02	18 03	870
3	Zéphir ...	2,200	Great Britain	17 09	17 30	860
4	Britannia ...	2,200	Great Britain	17 43	18 06	840
5	Bamler ...	1,437	Germany ...	18 37	18 30	830
6	Milano ...	2,000	Italy	17 07	14 30	810

THE autumn meeting of the Iron and Steel Institute was opened at Vienna on Monday in the hall of the Austrian Society of Engineers and Architects. The Ministers of Commerce and Agriculture, with their Under-Secretaries of State and many prominent officials, as well as the general managers of the principal Austrian iron works, were present to welcome the institute. Sir Hugh Bell, the president, returned thanks for the cordial welcome extended to the members by the Austrian Government and the civic authorities. A selection of papers was then read and discussed. On Monday evening a special performance at the Imperial Opera House was arranged. On Tuesday the morning was devoted to the reading and discussion of papers, and the afternoon to a visit to the Imperial Palace at Schönbrunn. To-day, September 26, will begin the excursions to the works to be visited in (1) Bohemia; (2) Styria; and (3) Moravia and Silesia.

THE second Engineering and Machinery Exhibition at Olympia was opened on September 19 by Sir Alexander Kennedy, F.R.S. The body of the hall and part of the annex are filled with the stands of engineering and other firms closely connected with engineering, but the chief feature of the exhibition is the fine collection of machine tools. The British machine-tool manufacturers are well represented, and hold their own with the American and

Continental firms, which could not have been said of the previous exhibition. The importance and adaptability of electric driving is well illustrated by the machine-tool section, and individual operation is greatly in evidence. This is especially the case in one exhibit, as the whole of the machines are individually driven, and the absence of complicated belting as compared with neighbouring exhibits adds greatly to the attractiveness of the machines. Modern electric-tool equipment of every description is well represented, and the heavier machines are also provided in most cases with electric motors, such as plate-bending, girder notching, shearing machines, as well as pumps, winches, &c. Motor starters, iron-clad switches, and electric fittings suitable for workshop use are also exhibited. The exhibition should do much towards helping the electrical industry in workshop practice. Power is obtained for all the motors driving the various machinery shown from the local borough supply, and no independent steam units are employed, their place being taken by single-phase motor generators supplied direct at 2200 volts, converting to 220 volts continuous current.

We learn from the Allahabad *Pioneer Mail* of September 6 that the programmes of work of the various scientific departments for the current year, as settled by the Board of Scientific Advice, have been published. The following points are of general interest:—(1) schemes have been completed for the establishment of a central research station and agricultural colleges at Poona, Lyallpur, Cawnpor, Bhagalpur, Coimbatore, Nagpur, and Mandalay, and a staff of three European specialists has been sanctioned for each; (2) new agricultural stations are to be started (*a*) at Aligarh for the improvement of cotton, (*b*) at Partabgarh for the study of rice and sugar-cane, (*c*) at Jullundur, (*d*) at Bassein, and (*e*) at Bhagalpur and Bankipur (Bengal). The special investigations connected with the improvement of Indian cottons and wheats will be continued, but the scheme for the improvement of Indian tobacco will largely remain in abeyance until the appointment of a specialist for this purpose. The study of sugar-cane diseases and of practical measures for the suppression of cotton boll-worm in the Punjab will also be continued. The lead mines of the southern Shan States, the tin deposits in Mergui, Tavoy and Karenni, the oil beds in the Irrawaddy valley and the Arakan districts, the volcano of Popa in the Myingyan district, Burma, the copper beds of Singhbhum, and the manganese mines in the Central Provinces, are all to be the subject of geological investigation.

Dr. A. Graham Bell has erected on his estate at Benin Breagh, N.S., a tower, 80 feet in height, built of the tetrahedral cells which he invented to secure great strength and lightness in the construction of kites. The engineer was Mr. F. W. Baldwin, of Toronto, who stated at the opening ceremony that the tower weighs less than five tons, and will carry a weight of 50,000 lb.

From the report for last year we learn that the collections in the Albany Museum, Cape Colony, are making exceptionally rapid progress, the number of specimens received in the zoological department being in excess of that in any previous year. It is likewise stated that the value of the institution as a means of education is also steadily increasing.

We have received a copy of a report on trials of the South African locust-fungus in India, by Messrs. E. J. Butler and H. M. Lefroy, issued by the Agricultural Research Institute, Pusa (Bulletin No. 5 of 1897), and published at the Government Press, Calcutta. Unfortunately, little or no success has attended the attempt, the effects of the fungus on several species of locust being *nil*, while in the case of the migratory locust of the north-west such effects as were produced appear to be of no practical value. As regards the last-mentioned species, the authors observe that "the conditions of nature are much more in favour of the insect, and against the fungus, than those under which the experiments were made, and if we can only anticipate a small percentage of infections the method will certainly fail."

The trophy shown in the accompanying illustration is offered by the *Scientific American* for competition for heavier-than-air flying machines. In order that the competition might be held under the auspices of experts, the trophy has been given under a deed of gift to the Aëro Club of America, to be competed for annually by both American and foreign inventors. The first competition was announced to be held at the Jamestown Exposition on September 14 for a flight of 1 kilometre in a straight line, but the result has not yet reached us. The competition is to be progressive in character, that is to say, if the flight of the predetermined distance has been accomplished this year, next year a longer flight will be required. After every competition the name of the winner will be inscribed on the trophy. If it is won three times in different

The *Scientific American* flying machine trophy.

years by any competitor, the trophy will become his personal property. This fine example of the silversmith's art is of real beauty. From a green onyx base with a silver cartouche rises the massive silver trophy, measuring 32 inches over all. At the summit, projected away from the earth, is an aëroplane in high relief, standing away from the silver globe, with its frame held together by silver guy ropes. The trophy is valued at 500*l*.

THE life-history of a trypanosome infesting the alimentary canal of a leech (*Pontobdella muricata*) parasitic on skates and more rarely angler-fish is discussed by Miss M. Robertson in the Proceedings of the Royal Physical Society of Edinburgh, 1906–7, part iii. Possibly, despite a marked disparity in point of size and appearance, this trypanosome may be the earlier stage of *Trypanosoma raiae*, but this has still to be confirmed. After describing in detail (with a number of coloured illustrations) all that is at present known concerning the development of the trypanosome in the leech's intestine, the author proceeds to discuss its methods of division, which exhibit considerable diversity. Some of such divided individuals suggested the conjugation of a male and female element (gamete), but further examination negatived this interpretation, and showed that division is the sole factor in the phenomenon. This suggests caution in regard to other alleged instances of conjugation among Protozoa, although theoretical considerations render it probable that such a process really occurs at some stage of development.

IN connection with the preceding paragraph, reference may be made to a paper by Miss H. D. King, in the June issue of the Proceedings of the Academy of Philadelphia, on a new sporozoan parasite (*Bertramia bufonis*) found in "Bidder's organ"—a rounded body at the fore-end of the testis—of the common American toad. The interest of the discovery lies in the fact that hitherto scarcely any sporozoans have been recorded in amphibians; but, as the author observes, these creatures are probably as much subject to parasitic infestation as other vertebrates, and they may accordingly be expected to yield many new forms if thoroughly examined.

FROM an article on the history of the tomato, contributed by Mr. W. Dürkop to *Naturwissenschaftliche Wochenschrift* (September 1), it appears that the plant was introduced into Europe, probably into Spain or Portugal, from Peru, shortly before the year 1560, and was first cultivated for its ornamental appearance. Fruits of different colours and shapes were grown in the sixteenth century, but the cultivation declined until the last century, when the fruit came into favour as an esculent.

MR. T. H. GATES has published in the *Botanical Gazette* (February and July) two interesting papers dealing with the cytology of *Oenothera Lamarckiana* and the mutant *Oenothera lata* raised by de Vries. The author investigated the development of the anther in *Oenothera lata*, but was unable to discover why the pollen fails to mature, although it appears to be connected with the early disintegration of the tapetal cells. The pollen of *Oenothera Lamarckiana* was used for raising a hybrid in which the sporophyte stage showed twenty or twenty-one chromosomes, thus differing remarkably from the parents, which both contain only fourteen chromosomes in this stage.

THE July number of the *Indian Forester* opens with a brief appreciative notice, contributed by Mr. S. Eardley-Wilmot, referring to the work of the late Sir Dietrich Brandis, the founder of the Indian Forest Department, and friend of many senior officers in the service. A record of the flowering of the bamboo *Cephalostachyum pergracile* in Lower Burma is reported by Mr. E. V. Ellis. The flowering, although not quite complete, was observed over several hundred acres, and the plants were of two different ages, but neither mature. Gregarious flowering over a few acres had been noted previously. Mr. A. M. Burn-Murdoch communicates a note on damar collection in the Federated Malay States, and Mr. M. Hill provides an account of the introduction of the mahogany tree, *Swietenia mahagoni*, into India.

THE first translator into modern Persian of Morier's famous novel, "Haji Baba," was Haji Shaikh Ahmad-i-Kirmani, a member of the so-called "heretical" sect of the Babis. He retired from Persia to Constantinople in order to continue his studies, and when the Sultan became alarmed at the assassination of the late Shah, Nasr-ud-din, the Turkish authorities basely surrendered the Babi to his hereditary enemies, by whom he was slain at Tabriz. When his version of "Haji Baba" reached Ispahan, it was welcomed with enthusiasm by the Persians as the first great novel written in their language; but when they became acquainted with the English original it ceased to be popular, and was regarded as a satire on all grades of Persians from the Shah downwards. This translation has now been reprinted in Calcutta by Lieut.-Colonel Phillott, Secretary to the Board of Examiners, who has added a brief grammar of modern Persian and a body of valuable notes explaining, not only the slang and popular expressions which abound in the book, but many usages, superstitions, and beliefs of the people. In its present form the book is certain to become popular among all who desire to learn, not so much the classical language, as that now spoken in Persia.

AN exhaustive monograph on the asbestos and manganese ore deposits of Ilocos Norte, by Mr. Warren D. Smith, is published in the *Philippine Journal of Science* (vol. xi., No. 3). The deposits occur in the northern portion of the island of Luzon, and are of considerable extent. The region is of special interest from the varied character of the geology. More diverse features are exhibited than in most parts of the archipelago. The region is primarily one of metamorphism, and this metamorphism is regional rather than local.

AN interesting note by Prof. Omori on the tilting of the ground during a storm appears in the August Bulletin of the Japanese Imperial Earthquake Investigation Committee. On October 10 and 11, 1904, a cyclone, the centre of which passed over the sea to the east of Tokio, was accompanied by a tilting of about $3\frac{1}{2}''$ towards the area of low pressure; on January 10 and 11, 1906, the track of a cyclone centre passed over land, close to Tokio, from south-west to north-east, and was accompanied by a tilting, first to the east and afterwards, as the low pressure passed eastwards, to the westward, the total change of inclination being about $2''.87$. In the latter case the ground rose under the area of low pressure, in the former it sank. The difference is attributed to the fact, recorded in a previous paper, and noticed in NATURE of November 3, 1904, that the sea-level commonly rises by more than the amount necessary to compensate for the diminution of barometric pressure, so that the resulting pressure on the sea bottom is actually greater with a low than with a high barometer. This number of the Bulletin also contains, among other papers, a note on the long-distance records of the Turkestan earthquake of August 22, 1902, in which we notice that the word "mean" seems to

have a peculiar significance in Japan, as the mean value is tabulated of a group of two observations, one of which is excepted!

THE engineering experiment station of the University of Illinois has published a Bulletin (No. 13), by Dr. N. Clifford Ricker, professor of architecture, describing an extension of the Dewey decimal system of classification applied to architecture and building. The decimal classification has been largely adopted in libraries in Europe and America, and the proposed extension should prove useful to architects and engineers for classifying collections of lantern-slides and photographs, and for a card index to technical periodicals.

THE Director-General of Indian Observatories has issued a memorandum, dated August 8, with reference to the probable monsoon rainfall during August and September, 1907, based on data obtained since the publication of the previous memorandum of June 8. Among the chief factors taken into consideration were the excess of pressure in South America in July, while in the Indian Ocean the deficiency still persisted. It has previously been pointed out that these conditions are favourable to Indian rainfall, and Dr. Walker thinks it likely that the total amount during August and September will reach or exceed the average.

SEPTEMBER has so far proved exceptionally fine over the entire country, and the whole period since the 5th or 6th of the month has been almost entirely rainless. At Greenwich rain fell on each of the first five days, the aggregate measurement being 0·44 inch, but no rain has fallen subsequently, the dry weather continuing practically for three weeks. At Yarmouth the rainfall to September 25 was 0·23 inch, whilst the average for the month is 2·41 inches, and at both Clacton-on-Sea and at Dover the rainfall amounts to 0·27 inch. The rain has been heavier and more frequent in the north, and at Sumburgh Head there have only been three days without rain, the total measurement to September 24 being 2·64 inches, which is only 0·68 inch short of the average for the whole month. Much mist or fog has prevailed during the past week in many parts of the country, and radiation frost has occurred at night. At Greenwich the exposed thermometer on the grass fell to 24°·7 on the morning of September 23, and there have already been four frosts in the open, as shown by the exposed thermometer, since the commencement of the month. A change in the type of weather is in progress, and the steadily falling barometer foreshadows the setting in of unsettled conditions.

IN accordance with the decision of the International Union for Cooperation in Solar Research that a re-determination of the wave-lengths of certain standard lines should be carried out by independent observers by the interference method of Drs. Fabry and Perot, Mr. A. H. Pfund, of Johns Hopkins University, has, according to a note in the *Physical Review* for August, recently measured the iron lines, and has obtained values which differ from those of Fabry and Perot by less than one part in a million. Mr. Pfund is now engaged in measuring the wave-lengths of the titanium lines.

THE *Zeitschrift für Instrumentenkunde* for August contains a short account, by Dr. von Rohr, of the life and work of the late Dr. S. Czapski, of Jena, so well known for his masterly article on Abbe's theory of optical instruments in Winkelmann's "Handbuch der Physik." He was born in 1861, and after a university education became Abbe's private assistant in 1885. He possessed a wonderful power of grasping the essential points of anything new brought to his notice, and Abbe found in him a friend to whom he ultimately entrusted the publication of his theories.

TWO papers from the pen of Dr. L. A. Bauer which have appeared recently serve to remind us of the prominent position which the United States is taking in the extension of our knowledge of the magnetic state of the earth. The first, in the *Technology Quarterly* for June, summarises the recent results obtained from a detailed survey of the United States and from the voyages of the survey ship *Galilee* across the Pacific. The second is the official report of the department of research in terrestrial magnetism of the Carnegie Institution of Washington, and deals with the voyages of the *Galilee* from October, 1905, to October, 1906, in greater detail. From the latter we gather that the charts of the Pacific at present in use give variations of the compass less than the true value by 1° or 2°, a very serious defect from the navigator's point of view.

SOME curious observations made a few years ago by Dr. A. Heydweiller as to the electrification of the human body by the bending or stretching of the knee or elbow joint receive their explanation in a paper by Drs. S. Tereschin and A. Georgiewsky in the *Physikalische Zeitschrift* for September 1. According to the latter, the electrification produced is due entirely to friction of the foot of the person experimented on on the insulating stand on which he is placed, or, if he is clothed, to the friction between body and underclothing or between under and overclothing. For the electric charges produced in these circumstances the human body is comparatively a good conductor.

IN the *Revue scientifique* for August 31, Dr. C. Féry gives a short illustrated account of the new methods of determining high temperatures in industrial operations. For temperatures up to 700° C. he recommends a thermo-electric couple of iron-constantan, from that to 1300° C. one of platinum and its alloys, in each case in combination with a self-registering arrangement. Where the thermo-couple would be injured if brought into direct contact with the source of heat, he advocates the use of his own pyrometer, in which the radiation from the source is concentrated by a concave mirror on to the thermo-junction. For sources of small dimensions at temperatures above 900° C., optical pyrometers, *e.g.* Wanner's, are the most useful.

THE question of the improvement of the "small power load," to which electric supply companies and borough electricity committees are perforce paying more attention at the present time than heretofore, is raised in an article by Mr. H. S. Hatfield in the *Electrician* of September 13. The difficulties attendant on the development of the small power load, and the inability of the private lighting consumer to avail himself of the offer of cheap power, have been up to the present very great, owing to the fact that the supply must be separately metered, and it is necessary either to instal duplicate wiring or to use submeters. The cost of a separate service generally bars the use of heating and power appliances by the small consumer. The submeter system is free from the objection of first cost to a great extent, and the meters may be removed and used elsewhere, but so far this system has not been adopted to any extent. The objections to the submeter system have been that, although the capital expended on meters would not be irrecoverable, still the cost of four or five

trustworthy meters would be considerable; also the average electricity meter is very unsightly. A new submeter which overcomes a great many of the objections of the existing meters is, however, now obtainable, and should help largely towards the development of the small power load. The meter is of the mercury-electrolytic type, and has been proved to be very accurate; it fits over the ordinary two-pin wall plug. It is an inexpensive matter to fix this meter in several rooms wherever a consumer may wish to employ a heating appliance, and he is able to read the meter without trouble and know exactly what his radiator or kettle—as the case may be—is costing him.

UNDER the title "Probleme der katalytischen Forschung" (Leipzig: Veit and Co., price 1.20 marks) Dr. Gertrud Woker has published in pamphlet form an inaugural address delivered at the University of Bern. A suggestive review is given of such questions as the nature of the catalytic changes occurring in the oxidation of sulphur dioxide by nitrous fumes in the chamber process of making sulphuric acid, the problems of autoxidation, the action of the so-called oxydases within the organism, and the nature of the transformations brought about by enzymes in general; finally, the relationship between toxins and anti-toxins is discussed as a phenomenon of physical chemistry governed by the law of mass action.

THE first meeting of the new session of the Entomological Society of London will be held on Wednesday next, October 2, when a paper will be read on the butterflies of Mauritius and Bourbon by Lieut.-Colonel N. Manders.

WE have received from Messrs. F. Darton and Co. their illustrated price list of standard meteorological and other instruments. Some useful notes are given for the benefit of students and others, together with a list of text-books recommended; the latter might be revised with advantage. Before establishing new stations, observers would do well to consult recognised meteorological authorities, especially as regards the installation and proper exposure of the instruments.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN OCTOBER:—

Oct. 1. 18h. Jupiter in conjunction with the Moon. (Jupiter 1° 11′ S.).
2. 12h. 58m. Minimum of Algol (β Persei).
4. Saturn apparently without rings.
5. 9h. 47m. Minimum of Algol (β Persei).
8. 6h. 36m. Minimum of Algol (β Persei).
14. 17h. Mars in conjunction with the Moon. (Mars 1° 47′ S.).
18. 6h. Saturn in conjunction with the Moon. (Saturn 2° 13′ N.).
18–22. Epoch of October meteors. (Radiant 92°+15°.)
22. 22h. Mercury at greatest elongation, 24° 20′ E.
26. 19h. Venus in conjunction with α Libræ. (Star 0° 5′ S.).
28. 8h. 18m. Minimum of Algol (β Persei).
29. 9h. Jupiter in conjunction with the moon. (Jupiter 1° 41′ S.).

SPECTRUM OF DANIEL'S COMET (1907*d*).—Photographs of the spectrum of comet 1907*d*, taken with a Zeiss prismatic camera, were obtained by Herr H. Rosenberg at the Göttingen Observatory on August 9, 11, and 14, with exposures of twenty-five, twenty-eight, and eighteen minutes respectively. The results of the measurements of the spectrograms are uncertain to about ±10 Ångström units, but certainly show that the spectrum includes the chief hydrocarbon and cyanogen bands, with a continuous spectrum extending from about 505 μμ to 370 μμ. The brightest bands are those coinciding with the two heads of the third cyanogen band at λλ 3883 and 3872 respectively; the third strongest band of the seven measured coincides with the fourth carbon band at λ 4737. Two bands at λλ 4055 and 4035 are as yet unidentified. The photograph of August 9 showed bands at 473, 438, 423, 404, and 388 μμ in the spectrum of the comet's tail, all of which were apparently of equal length and strength.

A continuation of the ephemeris of this comet, computed by Herr J. Franz from Dybeck's elements, appears in the same journal (*Astronomische Nachrichten*, No. 4200, p. 401, September 12); the following is abstracted therefrom:—

Ephemeris 12h. (M.T. Berlin).

1907	α (true) h. m.	δ (true) ° ′	log *r*	log Δ	Brightness
Sept. 25	11 4·8	+5 47·1	9·8550	0·2085	4·89
29	11 21·9	+4 32·1			
Oct. 3	11 37·7	+3 20·7	9·9264	0·2453	3·00

THE LOWELL EXPEDITION TO THE ANDES.—A second communication from Prof. David Todd to Dr. W. J. S. Lockyer gives additional information concerning the work of the Lowell expedition, of which Prof. Todd is in charge. It appears that at the chief station of the expedition, Alianza, more than 7000 photographs of Mars were obtained during the period June 17 to August 1. Prof. Lowell's discussion of these will form a most important addition to areography, as they show, covering a complete round of the planet, the changing appearances of the two polar caps, a multitude of "oases," and hundreds of the "canals," many of which are plainly in the geminate form.

The photographed images of the planet, as enlarged by the Gaertner camera, are of about three-sixteenths of an inch diameter, and will admit of much further enlargement. Exposures of about two seconds were given on Seed and Cramer plates.

SEPTEMBER METEORS.—The appearance of several bright meteors during the present month is reported from various quarters, but no details of the paths are given. One very fine one was seen at South Kensington by Mr. H. E. Goodson at 11h. 20m. on September 9. The meteor itself disappeared behind a house-top, but left a splendid trail which persisted for fully one-quarter of a minute. Judging from this trail, the direction of the meteor's flight was along a line from β Ursæ Minoris, passing half-way between θ and *i* Draconis. The meteor was very brilliant and swift, and was followed almost immediately by a less bright one, which pursued nearly the same path.

PHOTOGRAPHS OF PHŒBE.—Using the 30-inch reflector of the Greenwich Observatory, Mr. Melotte has obtained a series of photographs of Phœbe, Saturn's ninth satellite. The results derived from provisional measurements of the plates show that Dr. Ross's ephemeris, published in the second edition of the American Ephemeris for 1907, is essentially correct (the *Observatory*, No. 387, p. 366, September).

SOLAR ACTIVITY AND TERRESTRIAL PHENOMENA.—We have received from MM. Cirera and Balcells, of the Tortosa Observatory, Spain, a discussion of the relations observed to exist between the variations of solar activity and of terrestrial magnetism and electricity during the first three months of this year.

From this discussion the observers arrive at the following conclusions:—(1) the solar activity increased in January, passed a maximum in February, and decreased during March; (2) the regions of activity exhibited motions in the opposite direction to the sun's rotation; (3) the variations of activity often commenced in the chromosphere. Regarding the correlation of these variations with magnetic and electrical perturbations, the following conclusions were arrived at:—the perturbations either coincided with the appearance of a region of activity on the eastern limb of the sun, with the passage of such a region over the sun's central meridian, or with an extraordinary increase of activity near to the central meridian.

On March 22 an observed strong perturbation coincided, in time, with the central-meridian passage of a region which had been active during the previous rotation of the sun, and on certain dates in January and February the

perturbations were more intense on the meridian passage of a region which, having been active before, was increasing in activity.

Three excellent drawings of the great January to April (1905) sun-spot made by Prof. Mascari are reproduced in No. 7, vol. xxxvi., of the *Memorie della Società degli Spettroscopisti Italiani*.

THE JUVISY OBSERVATORY.—An interesting description, illustrated with photographs, of the Juvisy Observatory appears in the August and September issues of the *Bulletin de la Société astronomique de France*. The observatory was founded in 1883 by M. Flammarion, and is principally engaged on planetary observations.

BOTANY AT THE BRITISH ASSOCIATION.

THE time of Section K was considerably occupied in joint meetings with other sections. Thus there was a joint discussion with Section D on "The Physical Basis of Heredity," of which an account will be found in "Zoology at the British Association" (NATURE, September 19, p. 530), and another with Sections D and L on "The Teaching of Biology in Schools," which is described in "Education at the British Association" (NATURE, September 12, p. 505).

A third joint meeting was held, with Sections C, D, and E, to hear an address by Prof. Conwentz, the Prussian State Commissioner for "Naturdenkmalpflege," on "The Preservation of Natural Monuments." Prof. Conwentz explained that the phrase "natural monuments" was new in Germany as well as in England, but we should recognise that there could be monuments of nature as well as of art. The constant inroads of cultivation and of industrial undertakings have led, and are leading, especially in countries with crowded populations, to the disappearance of scientifically interesting and even unique natural objects and types of scenery. A widespread feeling has arisen that as much as possible should be done to prevent such destruction, and this has recently led, not only to much local effort directed towards this end, but in Prussia to the institution of a special State department under the Minister of Education for the purpose of directing and coordinating such efforts. This department (of which the lecturer is the head) has no funds allotted to it for the actual purchase of land bearing natural monuments, nor is it considered that purchase is the right procedure except in special cases. The aim is rather to get private owners interested in the natural monuments on their property, and to induce them to be responsible for their safeguarding and preservation. In the case of Government land, the Forestry Department cooperates by making regulations prohibiting the felling of unique trees, the total clearance of particular types of woodland, &c. Prof. Conwentz's department is prepared to initiate all effort of this kind in Prussia. Its activity has already, during the single year of its existence, met with considerable success. Many areas of primitive marsh and water, heath and woodland, often containing rare and interesting characteristic species of animals and plants, have been saved from destruction, and arrangements made for their permanent preservation. The necessary work falls under three heads:—first, the cataloguing of the natural monuments of the country; secondly, the mapping and scientific description of such monuments; and thirdly, the undertaking of appropriate means for their preservation.

Prof. Conwentz directed attention to the numerous organisations in this country the work of which tends towards this general object, but pointed out that none of them have precisely the same ends in view as his Prussian department. He particularly mentioned the Commons Preservation Society, the Kyrle Society, the National Trust for the Preservation of Places of Historic Interest and Natural Beauty, and the Central Committee for the Survey and Study of British Vegetation. He suggested that the last-named organisation might add the preservation of British vegetation to its objects, and also that efforts in this direction might be helped by the British Association. He pointed out that love for and care of the characteristic natural scenery of the homeland was one aspect of true patriotism, and should act as a check on the purely materialistic development of modern civilisation. The lecture was illustrated by a beautiful series of lantern-slides showing types of protected scenery in Germany, and also of many British examples of a similar kind.

Discussion on the Cytology of Reproduction in the Higher Fungi.

This occupied most of Monday morning, August 5. Three papers were read, and were followed by a discussion.

In the first paper Miss Fraser and Miss Chambers described the development of the ascocarp in *Aspergillus* (*Eurotium*) *herbariorum*. The archicarp consists of a unicellular trichogyne, a unicellular ascogonium, and a septate stalk. An antheridium, divided into a stalk and antheridial cell, is present, and usually fuses with the trichogyne; both structures are cœnocytic. After normal fertilisation or its equivalent, the ascogonium becomes septate and produces ascogenous hyphæ. A sheath is developed, and finally asci are formed. In these, nuclear fusion takes place, and three divisions follow, giving rise to the nuclei of the eight spores.

The authors regarded the genus Aspergillus as primitive, and related its archicarp to that of other groups of Ascomycetes. They pointed out that the male organ closely resembles the antheridium of discomycetous forms; on the other hand, if the antheridial cell, instead of fusing with a neighbouring archicarp, were set free from its parent hypha, it would scarcely differ from the spermatium of the Pyrenomycetes. They held, with Wolfe, that a similar development had taken place among the Florideæ, and regarded the Ascomycetes as a monophyletic group.

Miss Welsford's paper dealt with fertilisation in *Ascobolus furfuraceus*. She confirmed Harper's statement that the archicarp, or scolecite, originates as a row of uninucleate cells. These subsequently become multinucleate, and one increases in size and gives rise to ascogenous hyphæ. Nuclei migrate into this cell and undergo fusion before passing into its branches. Miss Welsford regarded this process as a form of reduced fertilisation, and suggested two interpretations—either (1) the scolecite is a multicellular female organ and the fusions are those of female nuclei in pairs, or (2) the ascogenous cell only is female, the other cells of the scolecite being vegetative and representing a functionless trichogyne and stalk; in this case fertilisation probably consists of the union of a female and a vegetative nucleus.

In the third paper Miss Fraser gave an account of the cytology of *Humaria rutilans*. In this species sexual organs are not developed, but a reduced form of fertilisation obtains, the nuclei of the vegetative mycelium fusing in pairs. Asci are developed from hyphæ which contain fusion nuclei; these show sixteen chromosomes, the sporophytic number, in their mitoses. In each ascus three nuclear divisions take place; the first is heterotype, the chromosomes dividing *transversely*, and the second homotype. These bring about a reduction, related here, as in all other investigated organisms, to normal or reduced fertilisation. During the prophases of the heterotype division, a second nuclear fusion occurs; Miss Fraser suggested a mechanical explanation for this process, and showed that it was occasionally omitted. The sixteen chromosomes which are present throughout the meiotic phase represented the reduced number for two nuclei. The fusion in the ascus is compensated by a peculiar process of reduction taking place in the third division, and termed by Miss Fraser *brachymeiosis*. Sixteen chromosomes are formed from the spireme, and eight pass *without fission* to each daughter nucleus. The reduced number for one nucleus thus appears.

The author considered that this process probably occurred in connection with other asexual fusions also. She related her observations on *Humaria rutilans* to the facts described for Phyllactinia (Harper, 1905) and other Ascomycetes. In conclusion, she pointed out the close analogy between the two fusions in the life-history of Humaria, and suggested that the type of compensating reduction (whether meiotic or brachymeiotic) might be usefully employed to differentiate between sexual and asexual fusions.

The discussion was opened by Prof. Farmer, who agreed

that the spermatium of the Florideæ, and no doubt of the Ascomycetes, was closely related to a freed antheridium. He suggested the existence of a further analogy in connection with the events which follow fertilisation. In Ascomycetes a second nuclear fusion takes place in the ascus; in the Florideæ cell fusions occur, but the nuclei are indifferent or repelled. The cases described by Miss Fraser in which ascus nuclei continued their development without fusion might be regarded as intermediate. Prof. Farmer emphasised the dual aspect of nuclear fusion; the process was not primarily originated to associate paternal and maternal characters, but possessed a deep physiological significance.

Prof. Blackman also accepted the theory put forward as to the phylogeny of the male organ. He regarded the variety of female organs among Ascomycetes as difficult to reconcile with their monophyletic origin. The occurrence of both cœnocytic and uninucleate structures was a specially difficult point. With regard to the sexuality of the Ascomycetes, a fairly complete series now existed, including Pyronema (Harper, 1900) and other forms with normal fertilisation; Lachnea (Fraser, 1907) and *Humaria granulata* (Blackman and Fraser, 1906), where the nuclei of the ascogonium fuse in pairs; Ascobolus, where fusion is probably between a female and a vegetative nucleus; and *Humaria rutilans*, where sexual organs are lacking and the vegetative nuclei fuse. Prof. Farmer, in a recent paper, had grouped such various forms of reduction under the general term pseudapogamy, but Prof. Blackman felt that a more detailed classification was required. A further stage would be that in which no fusion took place, and one would then expect a corresponding difference in the divisions in the ascus.

Prof. Blackman accentuated the importance of *Humaria rutilans* as the first case in which the behaviour of the chromosomes in asexual fusions had been elucidated, and dealt with the difference between synaptic and non-synaptic reduction, associating the latter with the fusion of undifferentiated nuclei. In Humaria there is no physiological difference between the two fusions, but the first is obviously the relic of a normal fertilisation. He regarded the definition of a sexual fusion as dependent on the origin of the process, and not on the subsequent behaviour of the nucleus.

Prof. Hartog considered the attempt to differentiate between fusions of sexual and of vegetative nuclei in the ascogonium as puerile, since the pronuclei lose their distinctive sexual characteristics before fusion. He pointed out that brachymeiosis differs from other known types of division in that a sorting, but no splitting, of the chromosomes takes place, and referred to the unexplained fusions of three gametes in the Volvocineæ.

Dr. Darbishire spoke of the complex structure of the multicellular ascogonia of Lichens, and Prof. Buller suggested that a study of the phenomena of spore distribution might throw light on the phylogeny of the Ascomycetes.

Miss Fraser, in replying, dealt with various points raised during the discussion, and pointed out that the difficulty of relating cœnocytic with uninucleate forms was lessened by the occurrence of both states in the scolecite of Ascobolus.

Physiological Papers.

Prof. H. E. Armstrong read a paper by Dr. E. F. Armstrong and himself on "Enzymes, their Mode of Action and Function," which, it is understood, will shortly be published in the *Annals of Botany*. The authors pointed out that the distinctive feature of the chemical changes going on in the bodies of organisms was the fact that they are under the *control* of the action of the bodies called enzymes. Great progress had been made in our knowledge and activity of these bodies within recent years, one of the outstanding conclusions being that all chemical equations involving their action are to be written as reversible changes. It has for a long time been usual to think of ferment action as mainly concerned with destructive metabolic action, but it is probable that the constructive activity of enzymes is really far more important biologically. The authors illustrated the probable structural relations of enzymes to the organic substances upon which they act by reference to the structural formulæ of various sugars, showing that when a given enzyme can act upon several different substances it is because it can work upon a group of atoms common to all these, and in each case holding together the other groups. In the case of albuminoids a complex enzyme is required, but the conception of a skeleton which can only be packed with atoms in a particular way enables us to see that it is unnecessary to assume a mechanism so complex as the structure that has to be produced. It is probable that we should conceive of the constructive activity of enzymes in this way—that the enzyme is a skeleton on which the complicated organic body can be built up. Dr. E. F. Armstrong replied to some questions put by Prof. Reynolds Green and others.

Prof. Bottomley communicated some results of his experiments on the inoculation of nitrogen-fixing bacteria in plants other than the Leguminosæ, and stated that tomatoes had been made to produce a greatly increased crop by this means, the bacteria having been first cultivated in tomato-juice; in wheat the bacteria had been induced to establish themselves in the cortex of the root, though no nodules like those on the roots of Leguminosæ are formed. The economic possibilities of these results, if capable of further development, are sufficiently obvious. Prof. Farmer remarked that this was a case in which we ought to have concluded that if the organism could be cultivated outside the plant it could be got to live upon other plant-cells containing carbohydrates. It had been shown that rusts could be induced to live on different hosts by special training. It was known that wheat can go on for an unlimited number of years producing about thirteen bushels to the acre, but this would probably be much exceeded without manuring if the wheat plants, by the aid of these bacteria, were enabled to fix atmospheric nitrogen.

Mr. F. Darwin read a paper on the cotyledon of Sorghum as a sense organ. It was directed towards confirming the belief that the cotyledon is the seat of geotropic sensitiveness, evidence for which was given in a paper read before Section K at Dover (1899), and published in the *Annals of Botany*. The results given in the present paper were obtained partly by Czapek's "glass-boot" method and partly by an adaptation of Piccard's centrifugal method. The conclusions, though not perhaps finally convincing, are strongly in favour of the view that the cotyledon is the geosensitive region. The paper also contains observations on the traumatic and heliotropic curvatures of Sorghum.

Morphological Papers on Pteridophytes and Pteridosperms.

Prof. Bower read a paper on the embryology of Pteridophytes, embodying the result of his recent work on this subject. He pointed out that there are two types of pteridophytic embryo:—(1) the Lycopod type, which agreed with the Bryophytes in having a suspensor; and (2) the fern type, in which there is no suspensor. The main point he wished to bring out was that there is a definite polarity in the embryo defined at once by the first segmentation, the centre of the "epibasal segment" forming one pole coinciding with the stem apex. On the other hand, the polarity of the embryo with regard to the axis of the archegonium is quite variable, as is the number and time of origin of the first leaves and roots, and also of the haustoria and protocorms. In Isoetes there is no suspensor; the initiation of the polarity is changed, and is even variable within the species. The embryo of Isoetes is inverted as compared with an ordinary Lycopod embryo, but is otherwise in line with the other Lycopods. The initial polarity of *Botrychium obliquum*, according to Lyon's account, is also exactly inverted as compared with Ophioglossum. Goebel's position, that the organs of a plant are laid down in the most suitable positions according to circumstances, is not confirmed by the study of embryos. After the first segmentation the polarity is definitely fixed. There was an interesting discussion, in which Dr. Scott, Prof. Oliver, Prof. Weiss, and Mr. Worsdell joined, and which displayed a general agreement with the author's conclusions.

Mr. Gwynne-Vaughan contributed a striking paper on the real nature of the so-called tracheids of ferns. The author was led by some observations on fossil Osmundaceæ to investigate the pitting of the xylem

elements of modern ferns, and was led to the unexpected result that the "pits" are really quite open, placing the cavities of adjacent elements in free communication, while the pits themselves communicate with one another in the thickness of the wall, a "pit-closing membrane", being quite absent. In other words, the wall of the typical xylem element of a fern consists of corner columns joined by pairs of separate horizontal bars. In development the corner columns and bars are gradually lignified, while the pectic substance forming the rest of the primitive wall becomes granular and disappears. In *Pteris aquilina* the substance joining the two bars of each pair remains, though the pits themselves are open. The author exhibited preparations fully demonstrating the facts described in his paper.

Prof. F. W. Oliver read a paper on the structure and affinities of *Physostoma elegans* (Williamson), a pteridospermous seed from the Coal-measures, in which he gave a full description of the seed in question. Williamson afterwards called it *Lagenostoma physoides*, and it is certainly closely allied to the Lagenostomas. Nevertheless, it possesses certain curious and unique features which well warrant its separation, and lead to the conclusion that it represents one of the most primitive types of pteridospermous seed as yet discovered.

Mr. D. M. S. Watson described the cone of *Bothrodendron* (*Lepidodendron*) *mundum* as practically a Lepidostrobus with the radial extension of the sporophylls very much reduced, a state of things that would be expected from a consideration of the vegetative organs. It appeared that there had been a confusion with Miadesmia, the block containing the latter plant also having fragments of two other Lycopod cones, of which this is one. The idea of an immediate connection with Spencerites must be given up. In the course of the discussion Prof. Weiss remarked that we now know Bothrodendron more completely than any other fossil Lycopod.

Papers on Schizophyta.

Mr. David Ellis read a paper on the phylogenetic connections of the recent addition to the thread-bacteria, *Spirophyllum ferrugineum*, Ellis, in which he showed that the new species links the iron-bacteria with the genus Spiromonas, and suggested that the definition of Migula's order Chlamydobacteriaceæ should be modified so as to include both of these genera.

Mr. B. H. Bentley read a paper on cell-division in Merismopedia, in which he described a process like karyokinesis in the cells of this genus. The paper was somewhat adversely criticised by Mr. Wager.

Ecological Papers.

Prof. Yapp communicated a paper by Prof. H. H. W. Pearson (Cape Town) describing a botanical excursion to the Welwitschia desert. The conditions obtaining in this desert (German South-West Africa) are remarkably severe—the annual rainfall varies from zero to 3 cm., the illumination is very intense, and surface deposits of saltpetre and other salts are frequent. This severity of conditions, which must affect the germination of seedlings, results in an extreme paucity of vegetation. One may sometimes walk for miles without seeing a single flowering plant, while as regards species, in the British territory of Walfisch Bay, the total phanerogamic flora, excluding that of the Khusib river-bed, probably does not number more than twelve species. Welwitschia itself has a range extending from 14° to 23° S. latitude. It seems to prefer more or less sheltered and sloping valleys at an elevation of about 100 feet above sea-level. The author gave some interesting observations respecting the pollination of Welwitschia, adducing evidence to show that it is largely effected through the agency of a parasitic hemipterous insect (Odontopus), which is apparently never absent from the plant.

By comparing the Welwitschia plants of known age at Kew with the youngest seen in Damaraland, Prof. Pearson estimates that the latter cannot be less than forty to fifty years old. From this it follows that the conditions necessary for the successful germination of the seeds of Welwitschia occur but rarely. As there are not wanting indications that the rainfall of this area was once considerably in excess of the present one, it is to be feared that the effective reproduction of Welwitschia is now more rare than formerly, and that, with the continuance of the climatic conditions at present prevailing in western Damaraland, the species is doomed to become extinct in its native region.

Prof. R. H. Yapp gave a paper on the hairiness of certain marsh plants. A considerable number of plants found in damp or marshy habitats possess a more or less dense covering of hairs. Many of these plants, however, show seasonal differences in respect of hairiness. Thus the leaves formed in spring on low-growing shoots are usually small and glabrous, while the later leaves, especially those on the erect flowering shoots, are larger, and increasingly hairy. *Spiraea Ulmaria* was referred to in some detail. In spring this species successively forms glabrous, partly hairy and densely hairy leaves. The partly hairy leaves show a regular distribution of the tomentum on their lower surfaces, the leaves decreasing in hairiness from above downwards, while the margins are generally more hairy than the central parts of the lamina. This distribution of hairs is suggestive, in view of the fact that if *Spiraea ulmaria*, var. *denudata*, an entirely hairless variety, be grown in an exposed situation, its leaves suffer more than those of the hairy form, and that the withering due to exposure first begins in those parts of the leaf which, in the hairy variety, are the first to be covered with the tomentum.

Other Papers.

Mr. R. P. Gregory read a paper on the inheritance of certain characters in *Primula sinensis*, in which he dealt with experiments on the inheritance of long and short styles, leaf form, colour of stems and petioles, and, lastly, of flower colour. While some of these characters obey simple Mendelian rules, the colour inheritance presents very complex problems which are by no means completely elucidated. Two distinct classes of whites in flower colour were separated. Sutton's "Snowdrift," with pure green stems, is a true albino, but in all the other races of white-flowered plants a character occurs which inhibits the development in the flower of a colour potentially present in the plant. The results of crossing these "dominant whites" with coloured flowers are complex. Various partial explanations of the observed results were suggested by the author.

Local Papers.—A paper on Charnwood Forest, illustrated by particularly beautiful lantern-slides, was read by Mr. W. Bell, the local secretary, in which the scenery and vegetation of the forest were treated descriptively and historically, and by a comparison of old lists of species with those found at the present day the effect of drainage and cultivation on the native flora was brought out.

Mr. A. R. Horwood read a paper on the disappearance of certain cryptogamic plants from Charnwood Forest within historic times. In this paper the great impoverishment of the lichen flora was particularly noticed, and was attributed largely to the effect of smoke, a similar phenomenon to that observed in the region affected by the Lancashire and Yorkshire smoke-cloud.

Semi-popular Lecture.—Prof. Weiss delivered the semi-popular lecture on "Some Advances in our Knowledge of the Pollination of Flowers." The lecturer dealt with the newer work on this subject, and discussed its bearing upon the older views of the mechanisms of pollination.

Excursions.

By invitation of Mr. C. C. Hurst, an excursion (in conjunction with Section D) took place to Burbage to examine the results of his experiments on Mendelian heredity in rabbits, sweet-peas, &c., and also to witness a demonstration of the inheritance of eye-colour in man, for which about 100 school children from the families studied by Mr. Hurst were assembled. Most unfortunately, rain to some extent interfered with the success of these extremely interesting demonstrations, but Mr. Hurst very kindly repeated them in Section D at a later period of the meeting. The allelomorphic pair of characters in eye-colour studied by Mr. Hurst are the presence or absence of brown pigment on the front of the iris. Eyes with the former

character are called *duplex*, with the latter *simplex*. "Duplex" is dominant to "simplex."

A successful excursion to Charnwood Forest, under the guidance of Mr. Bell, took place on the Saturday (August 3), and an excellent idea of the vegetation of the uncultivated portions of the forest was gained by the members of the section.

ECONOMIC GEOLOGY IN THE UNITED STATES.

STRIKING evidence of the work which the United States Geological Survey is carrying on for the direct advancement of mining interests throughout the country is afforded by a batch of eight Bulletins recently received. These Bulletins cover 1562 pages, and are copiously illustrated with plates and coloured geological maps. The most valuable of the series is Bulletin No. 315, dealing with contributions to economic geology in 1906, the object of which is to secure prompt publication of the economic results of investigations made by the survey. This Bulletin deals with the metals, structural materials, and other non-metals. A separate bulletin will be issued later dealing with survey work on coal, lignite, and peat. In investigations of ores during the year, reports are given by Mr. W. Lindgren on an interesting group of thin veins carrying wolfram in Boulder County, Colorado, which now constitute one of the most important sources of tungsten in the country; by Mr. H. S. Gale, on some new deposits of the uranium and vanadium-bearing mineral carnotite, which occur in the upturned Dakota sandstones east of the coal basins in Rio Blanco County, Colorado, deposits of importance as a further possible source of radium; and by Mr. G. F. Kay, on the deposits of silicate of nickel near Riddles, in Oregon. Much work was done in connection with iron ores, and reports are given on the red ores of the Birmingham district, Alabama, by Mr. E. F. Burchard; on the brown iron ores of the Russellville district, Alabama, by the same author; and on the grey iron ores of Talladega County, Alabama, by Mr. P. S. Smith. Mr. A. C. Spencer describes the magnetite deposits of Pennsylvania, and Mr. S. H. Ball the important iron-ore district at Hartville, Wyoming, and the titaniferous iron ore of Iron Mountain, Wyoming. An interesting investigation was made on glass-sands by Mr. Burchard. He gives the results of chemical and physical tests, not only of glass-sands now in use, but also of sands from undeveloped deposits which seem available for use as glass-making material. Prof. A. H. Purdue deals with the recently discovered phosphate fields of Arkansas, and Messrs. F. B. Weeks and W. F. Ferrier describe a new and important phosphate district at Montpelier, Idaho, in the western United States. The discovery has opened up a new industry in the West.

The progress of investigations of the mineral resources of Alaska in 1906 is dealt with in a separate report (Bulletin No. 314). An increase of nearly 50 per cent. in the value of the gold output of 1906 over that of the previous year is the best evidence of the advancement of the mining industry in Alaska. Copper mining has undergone a rapid expansion, and other mineral deposits, such as coal, marble, tin, and gypsum, have also received considerable attention. The progress has consisted in the development of the older districts rather than in discoveries of new mineral fields.

The Juneau gold belt, Alaska, forms the subject of a separate report by Mr. A. C. Spencer (Bulletin No. 287). This belt comprises the mainland strip of south-eastern Alaska from Berners Bay on the north-west to Windham Bay on the south-east, together with Douglas Island. The ores met with are mainly gold, though silver is usually present in small amounts. At the mines of the Treadwell group in Douglas Island, the methods of mining employed represent the highest possible attainment in the successful working of low-grade ores. For the last few years the average value of the material passing through the mills has been only about 8*s*. per ton.

The zinc and lead deposits of the Upper Mississippi Valley are described in great detail in a report by Mr. H. Foster Bain (Bulletin No. 294). The presence of ore deposits in this region was well recognised as early as 1687, but the early work was restricted to lead mining, the zinc ores being disregarded. The rise in the price of zinc ore in 1899 attracted attention to the district, and since 1903 its development has been rapid. The author gives an account of the present condition of the district and a statement of ideas relating to the formation of ores. The geology of the district is simple. The region is one of unmetamorphosed, little disturbed, sedimentary rocks of Palæozoic age, and there are no igneous rocks nor recent ones near it. The ore-bearing rock is a massive dolomite. The ores, consisting of blende, smithsonite with galena and marcasite, occur in crevices, in honeycomb masses, in pitches and flats, and as disseminations. The ore bodies are doubtless due to concentration or reconcentration through the action of underground waters.

A geological reconnaissance in south-western Nevada and eastern California is described by Mr. Sydney H. Ball (Bulletin No. 308). Ore deposits in the area described appear to be confined to the Palæozoic rocks, the post-Jurassic granitoid rocks, and the older Tertiary rocks.

The economic geology of the Independence quadrangle, Kansas, is described by Mr. F. C. Schrader and Mr. Erasmus Haworth (Bulletin No. 296), who present the substance of what is known concerning the distribution, occurrence, and development of petroleum and natural gas in the quadrangle, and note briefly the more important industries growing out of these natural resources. Mr. F. C. Clapp describes the economic geology of the Amity quadrangle, Eastern Washington County, Pennsylvania (Bulletin No. 300). The main interest in this area, which is situated near the centre of the north end of the Pittsburg coalfield, lies in the facts that it has been the seat of extensive petroleum and natural gas development, and that it is almost entirely underlain by at least one valuable seam of bituminous coal.

In the last report to be noticed Mr. E. C. Sullivan discusses the interaction between minerals and water solutions, with special reference to geological phenomena (Bulletin No. 312). Although not directly the result of geological field work, it has an important bearing on such work in that it is a chemical investigation of some of the problems most frequently met with in the study of the origin of ore deposits. Some of the changes that take place at ordinary temperature when water solutions are brought into contact with rock-forming minerals have been investigated. The result has been to make it apparent that chemical reaction between natural silicates and salt solutions is a very general phenomenon, taking place to a decided extent immediately upon contact, and that the outcome is mainly an exchange of bases in chemically equivalent quantities between solid and solution. The metal of the dissolved salt is precipitated, and an equivalent quantity of silicate is decomposed, and its bases enter the solution. Salt solutions as decomposing agents are much more active than pure water, and are comparable with acids in this respect.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

TWO courses, open free to teachers in London schools, have been arranged at Bedford College for Women (University of London) for the Michaelmas term; they are:—(1) "The Organisation of Nature-study Courses in London Schools," lecturer, Miss M. R. N. Holmer, Saturdays, 10.30, beginning October 5; (2) "Geology for Teachers of Physical Geography," lecturer, Dr. C. A. Raisin, Wednesdays, 6 p.m., beginning October 9.

IN connection with the garden produce, poultry, and honey competitions of the Kent County Council and of the National Potato Society at the South-Eastern Agricultural College, Wye, Kent, on Wednesday, October 2, a conference will be held, when an address will be given by the principal, Mr. M. J. R. Dunstan, to be followed by discussion.

SIX lectures, open to the public without payment or ticket, on the "History of Statistics and the Nature and Aims of Modern Statistical Methods," will be given at

University College by Mr. G. U. Yule on Wednesdays at 5.30, commencing Wednesday, October 9. A course of ten lectures will be delivered on Saturday mornings, beginning on Saturday, October 12, by Mr. F. L. Grant, on "Recent Developments in the Teaching of Arithmetic." This course is open, without fee, to all teachers in London schools. Teachers wishing to attend should apply for forms to the executive officer, London County Council Education Offices, Victoria Embankment, W.C. Forms should be returned by Monday next, September 30.

At the autumnal meeting of the Association of Chambers of Commerce, held at Liverpool last week, the following resolution was carried:—"That it is of the highest importance that the education of boys be continued after leaving school; that employers be urged to use their influence in inducing boys to attend evening classes and to give facilities for such attendance; that in every locality there should be schools provided for secondary and commercial education and for teaching the scientific and artistic principles underlying local industries to boys and domestic economy to girls." The association also carried unanimously a resolution urging the Government to bring in at an early date, as foreshadowed in the King's Speech in 1905, a measure for the conversion of the Board of Trade into a Ministry of Commerce on modern and representative lines.

The "Scholarships and Training of Teachers' Handbook" for 1907–8, just issued by the London County Council, gives particulars of the Council's scholarships and other scholarships open to London children, together with regulations for the admission of pupil teachers, bursars and student teachers, and for admission to training colleges, and a list of London secondary schools. The county scholarships of the Council provide a complete scheme under which a boy or girl may proceed by various stages from the public elementary school to the highest grades of education, whether at a university, technical college, or other institution providing advanced training for a professional career. The scholarships consist of junior county scholarships (ages of candidates, eleven to twelve), intermediate county scholarships (ages fifteen to seventeen), and senior county scholarships and exhibitions (ages, nineteen to twenty-two years). The first class (awarded to all candidates—about 2000—who reach scholarship standard) provides free education at public secondary schools approved by the Council, and a maintenance grant of 6*l*. a year; the second (not less than 100 scholarships), free education at approved secondary schools or technical colleges up to a fee of 25*l*. a year, and a maintenance grant of 25*l*. or 30*l*. a year; and the third class (fifty scholarships) provides a maintenance grant of 60*l*. a year for three years, and tuition and examination fees up to 30*l*. a year. In awarding these senior scholarships, regard is paid to the past successes of the candidates, the financial need, and the recommendations of the teachers under whom the candidates have worked. All candidates for scholarships may be required to present themselves for medical examination, and no award is confirmed if a candidate is found physically unfit to take advantage of a scholarship. In addition to the junior, intermediate, and senior scholarships, the Council awards a number of technical, industrial, and other scholarships, particulars of which are given in the handbook. All the scholarships are confined to candidates resident in the administrative county of London whose parents have incomes not exceeding 160*l*. a year in the case of the junior scholarships, and 400*l*. a year in those of the intermediate and senior scholarships.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, September 16.—M. A. Gaudry in the chair.—Observations on the electrical action of the sun and moon: Albert **Nodon.** This work was carried out at the observatory on the Pic du Midi, at an altitude of 2877 metres. The results generally confirm those obtained at lower altitudes; the sun induces a positive electric charge varying from 1 to 6 volts per minute, according to the state of the atmosphere. The solar charge is absorbed by passing through a cloud or layer of moist air. The full moon produced a positive electric induction analogous to that of the sun.—A new flying apparatus called the gyroplane: Louis **Breguet,** Jacques **Breguet,** and Charles **Richet.** The lifting force is supplied by rotating planes, driven by a 40 horse-power motor. The apparatus sustained its own weight, together with that of a man (540 kilograms in all), for one minute at a height of 0·6 metre above the ground, and descended slowly as the velocity of the plane was reduced.—A method for the rapid estimation of carbon and hydrogen in organic substances: Pierre **Breteau** and Henri **Leroux.** The vapours driven off by heating the boat containing the substance in a current of oxygen are burnt by an electrically heated spiral of platinum wire, a diagram of the arrangement being given. It is claimed that the time required for a combustion is only from fifteen to forty minutes, according to the nature of the organic substance. No test analyses are given.—The conservation of the arterial pressure in man after the application of high-frequency currents in the form of autoconduction: J. **Bergonié,** André **Broca,** and G. **Ferrié.** The apparatus used gave a frequency in the solenoid of between 400,000 and 410,000, with effective intensities of between 15 and 20 amperes, or from seven to ten times greater than those described up to the present. The conditions for the most advantageous use of the apparatus are given, together with details of experiments on ten subjects. The net result is that high-frequency currents are without action on the arterial pressure.—Remarks on the preceding communication: M. **d'Arsonval.** A discussion of the possible sources of the discrepancies between the results given by the authors of the preceding paper and those of earlier observers.—The agents of coagulation of the milk contained in the juices of *Broussonetia papyrifera*: C. **Gerber.**—The light-receiving terminations in the compound eyes of the Muscidæ: Pierre **Vigier.**

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