THURSDAY, JULY 28, 1910.

PLANETOLOGY.

The Evolution of Worlds. By Prof. Percival Lowell. Pp. xiii+262. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1909.) Price 10*s.* 6*d.* net.

ONLY by the minutest study of that which is can finite man of a finite epoch hope to draw even the roughest sketch of the antecedent, or form the vaguest speculations as to the ultimate; the truth of the sketch and the soundness of the speculation increase or decrease in proportion to the knowledge acquired by the observer. Therefore we welcome a volume in which Prof. Lowell sets out a scheme of evolution which embodies a proper sequence of congruities and is based on the results of years of careful observation.

Planetology is defined as the astronomy

"which deals with the evolution of worlds. It treats of what is general and cosmic in that evolution, as geology treats of what is terrestrial and specific in the history of one member of the class, our own earth."

On these lines Prof. Lowell develops a scheme of evolution wherein the observational evidence wrested from what is, leads to the speculations as to what was and what will be.

The matter originally formed the subject of a university course of lectures, but a larger public demanded it, and hence the present volume.

There are seven chapters in which the probable life-histories of a planet and of a planetary system are vividly portrayed, and a perusal of the first, "The Birth of a Solar System," impresses very forcibly the idea how finite is man, how infinite matter and time. The inception of a new system is but the death-knell of its predecessor.

The problem of the birth was solved when Goodricke, the deaf mute of York, divined the cause of Algol's demoniacal winkings—a dark sun; on this is based the whole story. The descriptions of a number of Novæ support the statement that cataclysms are not unknown, and, by several lines of reasoning, the production of spiral nebulæ—the matrices of new worlds—is shown to be the result. The planetesimal hypothesis is probably now too well known to call for further elaboration here of Prof. Lowell's story of the birth, but before proceeding to the second chapter he draws a wonderfully awful picture of the conditions which would precede and attend the incursion of a second dark body, which, by its powerful perturbative action, would once more produce chaos from our present orderly system.

In the second chapter we are given descriptions of the existing proofs of this cataclysmic birth. The existence of myriads of meteors in interplanetary space, their common motions, and their likeness to terrestrial material, are cited as evidence of a common origin in one rotating mass. The mathematics for this—mathematics being "a precise reasoning applie usually to the discovery that a pet theory will not work," but more fruitful in this instance—are, with other more or less profound items, relegated to a series of notes at the end of the book. The physical evidence for this common origin reaches a climax with a statement of the varying densities of the planets; those torn off earlier by the tidal stress are less dense because they formed the upper layers of the parent dark body. Thus the hydrogen envelopes of Neptune and Uranus, demonstrated by Dr. Slipher's spectrograms, are evidences of primogeniture.

In the chapter on inner planets, many old "facts" are reorganised, on the evidence of the careful observations made at Flagstaff, and, as they have not yet appeared in their new forms in the ordinary text-books, their statement here is a useful addition to astronomical literature. Among others, the correction to the diameter of Mercury, so dramatically confirmed, independently, by Newcomb, is an example of the value of such careful attention to observing conditions and observations as has been paid at Flagstaff. Students of astronomy will also experience a feeling of relief that the rotation periods of Mercury and Venus now appear to be placed beyond question. The following description of Mercury is so characteristic of Prof. Lowell's graphic style as to be worth quoting:—

"Two antipodal hemispheres divide the planet, the one of which frizzles under eternal sun, the other freezes amid everlasting night."

The persistent observations at Flagstaff also dispelled the idea of a cloud-covered Venus, replacing it by a diaphanously-clad body on which the strong winds sweep up enough dust to account for the planet's high albedo. The radial streaks depicted on the accompanying drawing of the planet are supposed to be "runs" produced by winds which have consistent, and persistent, directions. An interesting suggestion is that the "earth-light" sometimes seen on Venus's dark limb is but a darkened vision of the ice which for countless æons has been hoarded up on that side of the planet which never sees the sun. "Monotony eternalised" is Prof. Lowell's apt description of the Mother of Loves.

It is with something like a shock that the reader finds but about a page and a half devoted to Mars; but the author opines that he has already treated adequately of the subject elsewhere. Phobos and Deimos are dealt with, however, and, according to Prof. Lowell's observations, they are larger than hitherto supposed; he gives 36 miles and 10 miles as their probable, respective, diameters. The dilatation of "Fear" and "Panic" by observations made at the Flagstaff Observatory may not appear to some conservative tenants of "facts" as a novelty.

Coming to the minor planets, evidence is cited to show that Olbers's theory of an exploded planet is untenable, and that this congeries of fragments represents what would have been a planet had not the giant Jove prevented the agglomeration. By plotting the major axes of their orbits in the form of a spectrum band, the wave-lengths scale being replaced by one of astronomical units, Prof. Lowell shows how commensurability of period with the period of Jupiter has determined the location of the asteroids. The

variability of magnitude exhibited by minor planets is accepted as evidence of dissymmetry, and this, in turn, is taken as evidence for the initial cataclysm as described. Torn by tidal stress, the dark sun was disrupted while still solid, the dissymmetry showing that the asteroids have never been in a fluid state.

Jupiter as a semi-sun is discussed at some length, its albedo of 0·75, as compared with Muller's 0·72 for clouds, being ascribed as possibly due to intrinsic light; the same explanation is offered for Saturn's albedo of 0·78. Jupiter's independence of the sun—its belts of cloud are apparently not affected by the rotation or revolution of the planet—serves as an illustration of the earlier condition of the earth, and other planets, before the advent of the sun-sustained period.

Of Saturn and Uranus but little is related, but the story of Neptune's discovery is told at some length. Rather more stress than usual is laid on Prof. Pierce's demonstration that Galle's discovery was a lucky accident. The problem solved by Leverrier and Adams was capable of three solutions, and it was but by chance that they attacked the right one.

"Congruities" is the keynote for the chapter on the formation of planets, and Prof. Lowell urges that incongruities, discovered since Laplace's time, have killed the nebular hypothesis. He then marshals the mutually-sustaining facts in support of the planetesimal hypothesis. By curves showing the masses of the planets relative to their solar distance, and others demonstrating the analogies of satellites and primaries in their departures from the common plane, he shows that the congruities, on this hypothesis, are perfect—to-day; future discoveries may necessitate further steps.

Having thus brought us to the formation of planets as discrete bodies, the author proceeds to outline the probable history of the finished sphere. On the one hand, we have the physical development, the cracks and cataclysms which formed our geographical features along lines necessarily different from those obtaining on Mars, or any other world; on the other is the chemical development, "as universal as the universe itself." Evidence that darkness was spread over the face of the earth is gleaned from many quarters, all showing that our planet was a sunless forcing-house; this was the self-sustained age. Then the earth cooled, the dense cloud covering condensed, admitting sunlight, and we arrived at the sun-sustained epoch which we still enjoy. Here the story of evolution is exceedingly interesting, especially that dealing with the Ice age. Probably the statements will be criticised by some geologists, but the author's substitute for what he terms their "astrocomico" suggestions is none the less attractively stated. The extraordinary ellipticity of the orbit, to account for the Glacial epoch, is rejected, and is replaced by one in which excessive evaporation and precipitation, producing polar ice-sheets of great thickness, play a great part. It is also shown that the glaciation was restricted to well-marked raised areas, such as Norway, Scotland, Labrador, Keewatin, &c., and was nothing more than a natural terrestrial phenomenon; observations of Mars show that, at the present time, the polar highlands retain their covering of snow for some time after the general melting of the cap has separated them from the main body of it.

In the last chapter the "Death of a World" is discussed, and the possible modes of extinction examined. It may be by collision with a dark sun, but, failing that, it is inevitable by the action of tidal friction and the diffusion of water and atmosphere. Collating the facts gleaned from the previous study of the several planets, it is shown that there is a more or less orderly sequence culminating in the present condition of our own satellite. *Sans* season, *sans* day and night, *sans* water and *sans* atmosphere, the worlds will await the quickening which can only come by the advent of a cataclysm such as is described in the earliest chapters.

The printing and illustration of the volume are beyond criticism, although the paper is rather heavy, and with its graphic language, its sustained interest, and clear story, the book is sure to appeal to the general reader who would learn more of the past, and of the probable future, of our earth and its fraternity.

WILLIAM E. ROLSTON.

NATURE-STUDY.

(1) *The Nature-Study Idea. An Interpretation of the New School-movement to put the Young into Relation and Sympathy with Nature.* By L. H. Bailey. Third edition, revised. Pp. ix+246. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1909.) Price 4*s.* 6*d.* net.

(2) *Man and Nature on Tidal Waters.* By Arthur H. Patterson. Pp. xvi+315. (London: Methuen and Co., 1909.) Price 6*s.*

(3) *Tommy's Adventures in Natureland. A Nature Story for Boys and Girls.* By Sir Digby Pigott, C.B. Pp. xvi+180. (London: Witherby and Co., 1909.) Price 2*s.* 6*d.* net.

(4) *Animal Romances.* By Graham Renshaw. Pp. vi+206. (London: Sherratt and Hughes, 1908.) Price 7*s.* 6*d.*

(1) PROF. L. H. BAILEY is well known as a botanist who believes in the practical and educational value of his science, and he has shown himself on many occasions able to give good reasons for the faith that is in him. In the present volume he discusses, in a lively and unconventional fashion, the true inwardness of "nature-study," which is not science, nor knowledge nor facts. "It is spirit. It is an attitude of mind. It concerns itself with the child's outlook on the world." "It would be better if it were called nature-sympathy." We do not think that professional educationists will quite agree with Prof. Bailey in associating all the pædagogical virtues with nature-study (for many of them may be expressed in the study of history, for instance), but most who have any sympathy at all with studying the world around us will agree with the sound educational sense which the book expresses. In a breezy and interesting fashion he discusses how nature-study may be taught, the school-garden, the rural-school problem, the teacher's outlook on nature, and about half a

hundred particular inquiries, some of which are very quaint, *e.g.* "Now that there are so many nature-books, how shall I choose the most useful one?" or, already, "Is nature-study on the wane?"

(2) Mr. Arthur H. Patterson has added a fourth volume to his series of east-coast books, and it is welcome, for the author writes with a light touch of the business of man and beast on the tidal waters of East Anglia. He describes at first hand much that is of interest regarding punt-gunning, decoying, snipe shooting, smelt fishing, shrimping, eel catching, and so on, and gives us delightful glimpses of the bird-life in particular. There is a great deal of fisherman's gossip in the book, but it is wholesome, open-air gossip, now and then cutting into the circle of the sciences.

(3) Sir Digby Pigott's nature-story for boys and girls is a sequel to "The Changeling," in which the author worked out, in a manner that pleased many, the idea of a child who was at one time a rook, at another a bee, at one time a fox, and at another a wild goose, and in due course a swift, a mole, and a short-eared owl. The author seeks to get young folks into close quarters with the real life of wild creatures, introducing them, through "Tommy's" adventures, to fur-seals and skuas, walruses and peregrines, and even to the dodo and "Archæopterix." We find the book a little too informative, but it is kept, on the whole, commendably simple, and we doubt not that it may be useful for those children who really enjoy getting at things in this curiously circuitous fashion. The notes seem to us to be an artistic mistake.

(4) Dr. Graham Renshaw's natural-history essays are well known and justly admired, but he has excelled himself in the sequel, which deserves its title of "Animal Romances." With the help of more than a score of peculiarly interesting and artistic photographs, he has succeeded in giving us living pictures of many wild animals in their natural setting—giraffes ("the dream creatures," "the aristocrats"!) Grevy's zebras ("the Horses of the Sun"), elephants ("the giants"), hippopotamus ("Behemoth"), and so on. He stays longest in Africa, but he takes us also to the Andes, to the Antarctic ice, to Tasmania, and elsewhere, and is always a lively guide. There is plenty of science in his nature-pictures, but there is poetry, too, and his book is literature of high quality.

TECHNICAL CHEMICAL ANALYSIS.

Technical Methods of Chemical Analysis. By Prof. George Lunge. English translation, edited by Dr. C. A. Keane. Vol. i., parts i. and ii. Pp. xxiv+996. (London: Gurney and Jackson, 1908.) Price 2*l.* 12*s.* 6*d.* net.

A BOOK which covers such a wide ground as Prof. Lunge's "Technical Methods of Chemical Analysis" is by no means easy to review. No one chemist, for example, is likely to be practically conversant with all the branches of analysis which are dealt with, and, recognising this, the author has, as is usually the case in similar works, obtained those who have specialised along certain lines to undertake the writing of such sections.

One of the difficulties to the reader of books like this is that to some extent it is a dictionary of methods, and it is sometimes a little bewildering to know which of many methods given for the analysis of one special substance is the best to employ. It is consequently not a book for the ordinary student, but one for the experienced worker, although even he will require to bring his critical faculty into play. The book is well written and is interesting to read, and those who study it will find it to contain quite an extraordinary amount of information which is by no means only analytical. The sections on clay and on clay wares, earthenware, and glazes are, for example, most interesting to read, even if one has no intention of carrying out the analysis. We like the arrangement of the section on potassium salts; first, all the methods employed are given in detail, and then the applications of these methods to special cases, such as analysis of Stassfurt salts, manures, beet ashes, and so on.

That the book is of the utmost value in the laboratory—in fact, almost indispensable—we can vouch, as since its publication it has been in constant use, and it is rarely that, within the scope of this volume, we have not obtained the information desired.

In conjunction with this volume an extremely useful little handbook of 260 pages, called "The Technical Chemist's Handbook," has also been issued. It is in limp cover, and of such a size that it can be carried in the pocket. Nearly 100 pages consist of tables, comprising, among others, factors for calculating gravimetric analysis, specific gravities, boiling points, tension of aqueous vapours, and weight of sheets of metals; there are, in fact, thirty-nine useful and valuable tables. The special part which follows deals with methods of analysis under various headings. To take an example at random, "III. Saltcake and Hydrochloric acid; A. Salt, B. Saltcake, C. Chimney-testing, D. Testing of the Gases in the Hargreaves Process, E. Hydrochloric acid." It should be mentioned that beside the thirty-nine tables referred to there are further tables in the special part, for example, the specific gravities of hydrochloric acid.

Dr. Lunge and Dr. Keane are to be congratulated on the issue of this volume, the one for writing it and the other for so ably editing the English edition. We hope that it will not be long before vols. ii. and iii. are ready.

BRITISH FOSSILS.

Palaeontographical Society. Vol. lxiii., 1909. (London: The Society, and Dulau and Co., Ltd.,

THE sixty-third volume of the Palæontographical Society's monographs contains instalments of works already in progress, and the council announces its desire, so far as possible, of completing these before commencing new monographs, for which they have received numerous proposals.

Prof. S. H. Reynolds continues his monograph of the British Pleistocene mammalia, here dealing with

the Canidæ, comprising the wolf, the fox, and the Arctic fox. This part is illustrated by six plates, and there are a number of text-figures and tables of comparative measurements which should prove useful, but nothing calls for special notice except the determination of the problematic *Lycaon anglicus*, Lyd., as a somewhat abnormal wolf, a conclusion which seems justified by the evidence now available.

For our knowledge of the Palæozoic fishes of the family Palæoniscidæ we are mainly indebted to the researches of Dr. R. H. Traquair, who continues his account of the British Carboniferous members of the family, describing the genera Acrolepis, Nematoptychius, and Cycloptychius; the last three of the seven plates illustrate the genus Rhadinichthys, which will, presumably, be described in the next part. The predaceous habits of the larger Palæoniscidæ are shown by a specimen of *Nematoptychius greenocki*, with the remains of a good-sized Acanthodes in the abdominal cavity, and another point of some interest to which Dr. Traquair directs attention is that in round-scaled Palæoniscidæ (Coccolepis, Cryphiolepis, &c.), the scales on the upturned portion of the tail always preserved their original angular form, as they do even in the modern Chondrosteans. The probable explanation is that the markedly heterocercal tail of these fishes was a powerful organ of propulsion, and that no sacrifice of strength could be made to gain increased flexibility; the Palæoniscidæ were strong swimmers with wide gill-openings, differing in their manner of life from the more sluggish Crossopterygians and Dipnoans, with their restricted branchial apertures, paddle-like paired fins, and diphycercal or hetero-diphycercal tail.

In the fifth part of his monograph of the fossil fishes of the English Chalk, Dr. A. Smith Woodward concludes the Teleostomes and commences the Chimæroids. Lophiostomus and Neorhombolepis are described as highly specialised Eugnathids, but of most importance is a very full description, accompanied by a restoration, of the Cœlacanthid *Macropoma mantelli*. Our knowledge of the Crossopterygian fishes of the order Actinistia is gradually becoming more complete; it is now some years since Dr. Smith Woodward made the interesting discovery that the pectoral fin was supported by a series of four hour-glass-shaped pterygials, exactly as in typical Teleosts, and in the present case he has elucidated many details of cranial structure.

Mr. Henry Woods gives another instalment of his elaborate monograph of the Cretaceous Lamellibranchs of England, describing the Solenidæ, Saxicavidæ, Pholadidæ, Teredinidæ, Anatinidæ, Pholadomyidæ, Pleuromyidæ, Poromyacidæ, and Cuspidariidæ. Several new species are included, and the preparation of the synonymy of some of the others must have been no light task.

The Palæontographical Society spares no expense in order to ensure that its monographs are properly illustrated, and the present volume contains twenty-nine plates, ten of which are assigned to Mr. Woods's memoir; the beautifully executed reproductions of English Cretaceous fishes, drawn by Mr. A. H. Searle to illustrate Dr. Smith Woodward's monograph, call for special mention. Indices to the Cretaceous Cephalopods and the Jurassic Belemnites, described many years ago, conclude the volume. C. T. R.

COMPARATIVE PHYSIOLOGY.

Handbuch der vergleichenden Physiologie. Edited by Hans Winterstein. Band ii., Physiologie des Stoffwechsel; Physiologie der Zeugang. 1st and 2nd fasciculi, pp. 1 to 320; 3rd fasciculus, pp. 321 to 482 of the first half of the 2nd volume; 4th fasciculus, pp. 1 to 160; 5th fasciculus, pp. 161 to 304 of the 2nd half of the 2nd volume; 6th fasciculus, pp. 483 to 658. (Jena: Gustav Fischer, 1910.) Price 5 marks per fasciculus.

THERE are being published in Germany just now a number of important works of a biological nature, in which eminent investigators are collaborating to produce a more or less exhaustive presentment of their special branches of knowledge. The fasciculi are published at short intervals as they are ready, and not necessarily in the sequence in which they will ultimately be bound together. The present work is the latest example of this method of publication, and the growing science of comparative physiology is receiving its due share of attention. The editor, Prof. Hans Winterstein, has an ambitious programme before him, and hopes to complete the work in four volumes. The list of selected collaborators contains the names of some of the best known of modern investigators; the majority of these are Germans, but the names of Fredericq, of Liége, Carlson, of Chicago, Tigerstedt, of Helsingfors, Bottazzi, of Naples, and Godlewski, of Cracow, also occur upon the title-page.

The fasciculi at present to hand will all ultimately be found in one or other of the two parts into which vol. ii. is to be divided. The first three fasciculi and the sixth are occupied with a single article from the pen of Prof. W. Biedermann, of Jena, and it deals with the digestion and assimilation of nutriment in the various classes of organisms; the article includes the consideration of plant as well as of animal life, so the term comparative is used in the widest sense. The article is left to be finished in future issues.

The fourth fasciculus is devoted to an interesting monograph by Prof. Léon Fredericq on the secretion of protective substances, in which we have an account of such materials from the nematocysts of protozoa up to the more elaborate means of defence found in the vertebrata; this includes an account of toxins, antitoxins, and the numerous other substances included in a general study of the vast subject of immunity. The monograph overlaps into and nearly fills the fifth fasciculus also, which concludes with the commencement of an article by Dr. R. Burian, an authority well qualified to deal with the subject allotted to him, namely, excretion.

The enterprise of our German brethren is to be admired in the conception of such a monumental work, and the preliminary fasciculi hold out the best promise for its future successful realisation.

W. D. H.

OUR BOOK SHELF.

Light and Sound: a Text-book for Colleges and Technical Schools. By W. S. Franklin and Barry Macnutt. Pp. viii+344. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1909.) Price 5*s.* net.

IN writing a text-book, an author generally chooses definitely between two methods of exposition: he either writes a small book, and confines his attention to the most elementary parts of the subject treated of; or else he writes a more pretentious work, in which most branches of the subject receive adequate attention.

The authors of the text-book now under review have followed a middle course. The fundamental principles of Sound and Light are discussed with great care, and numerous practical applications of these principles are described; for the explanation of complicated phenomena, the student is referred to more advanced text-books. The book opens with a very thoughtful exposition of the wave theory, illustrated by reference to water waves, sound waves, and waves in an elastic solid; and the subject of Light is developed wholly in accordance with the wave theory. Numerous optical instruments, including the standard forms of photographic lenses, are described and illustrated; and a clear but necessarily incomplete theory is given of the defects of lenses, and their compensation. Considerable attention is devoted to the subject of photometry and illumination; technical students should carefully study the chapter devoted to this part of the subject. The fundamental facts of polarisation are explained clearly and well.

In connection with sound, the simple phenomena, which are generally discussed in elementary text-books, are dealt with concisely. A very interesting chapter is devoted to the theory of music, and an account is given of Sabine's researches on the audibility of sound in rooms of various sizes; here, once more, technical students will find much to interest them. Altogether the book should prove very useful.

E. EDSER.

Kraft: das ist animalische, mechanische, soziale Energien und deren Bedeutung für die Machtentfaltung der Staaten. By Prof. Dr. E. Reyer. Zweite Auflage. Pp. xvi+471. (Leipzig: W. Engelmann, 1909.) Price 8 marks.

Soziale Mächte: als Ergänzung der Arbeit über "Kraft." Same author and publisher. Pp. 111. (1908.) Price 1.60 marks.

THE first edition of Dr. Reyer's "Kraft" was noticed at length in NATURE (vol. lxxviii., p. 660) shortly after publication, and to that notice we must refer the reader for details as to the scope of the work. The present, second, edition has been somewhat extended, but does not appear to have been rewritten to any considerable extent, and it retains all the faults of the earlier issue. The same lack of orderly arrangement distracts the reader, the same lack of references renders the work almost valueless to the serious student, and the same absence of "the scales and the names of the plotted quantities" continues to characterise the diagrams. The bibliography remains remarkable both for its inclusions and its omissions, and it still contains even the two remarkable entries to which attention was directed in the notice of the first edition —"Produktion and consum. of timbre in forein countries (blue book)," and "Statesman's yearbook, Statist. Abstracts (mit statistischen Tabellen)"—the latter entry apparently confusing the "Statesman's Yearbook" with the "Statistical Abstracts."

The title of the second volume named above is, at the present date, misleading. When first published—the title-page bears the date 1908, although the cover is dated 1909—the title may have been correct, for the volume is apparently a supplement to the *first* edition of "Kraft." It is not supplementary to the second edition, but a mere reprint of pp. 339–447. In these pages Dr. Reyer considers such matters as migration, wages and conditions of labour, the struggle for better conditions of life, personal energies and their contributions to civilisation.

Notes on the Electric Smelting of Iron and Steel. By Dr. W. F. Smeeth. Bulletin No. 5, Mysore Geological Department. Pp. vii+136; maps. (Bangalore: Government Press, 1909.) Price 2 rupees.

ELECTRIC steel melting and refining is now an established industry, but the electric smelting of pig-iron from the ore has recently entered on a new phase, namely, the commercially successful. The writer has had given to him, in confidence, figures of costs in connection with an electric furnace making charcoal pig-iron, with permission to mention the facts without the figures. It is clear that under conditions where the fuel is charcoal, and is becoming increasingly scarce and expensive, so far as can be judged from experience with a furnace of commercial size working for months, the smelting of high-grade ore into charcoal pig-iron is proving profitable. Only the balance sheet is a safe guide, but this test is about to be applied on quite a large scale.

The present bulletin embodies the technical portions of a report prepared by Dr. Smeeth at the request of the Government of the Maharajah of Mysore. A short description of the Stassano furnace is given, and details of several charges of steel made in the furnace in 1908 from pig-iron and scrap with the usual additions. Chapter iii. contains details of an attempt to make high-quality steel, carbon 0·2 to 0·3 per cent., in the Stassano furnace from very impure ore, a serious task. The author calculates that to produce steel from the ore, the electric furnace will require only about one-third of the amount of charcoal necessary for smelting with fuel furnaces, but (p. 45) "The sulphur is high (0·24 per cent.) and renders the steel quite unfit for use." Trial C showed a better analysis, but the mechanical test given by the steel was not good. In part ii. of the bulletin, materials and costs at Mysore are considered, and the opinion is expressed that the manufacture of steel castings, steel forgings, railway tyres, and even rails could be carried on successfully there, and at a profit. The author evidently has courage. A folding geological map of the Bababudan iron-ore area is enclosed in a pocket on the cover.

A. MC.W.

Psychism. By M. Hume. Pp. 157. (London and Felling-on-Tyne: Walter Scott Publishing Co., Ltd., n.d.) Price 2*s.* 6*d.* net.

MRS. HUME begins with a curious and rather incoherent theory respecting the "Trinity of Man" (Matter, Intelligence, Force; or, in another aspect, Reason, Intuition, and Soul), but she becomes decidedly interesting when she proceeds to describe her own experiences. These have been visions, dreams, or other phenomena by which a warning of an impending event—*e.g.* the death of a friend at a distance—has been conveyed. The agency is believed by the author to be her own subconscious self, which possesses clairvoyant and other powers. The theory propounded closely approaches that of the leading investigators in these domains, but we would suggest that the terminology of Myers is preferable to that of T. J. Hudson, who, moreover, is an unsafe guide, being apt to rear a large structure of theory on a small or insecure foundation of fact. The book is well written and nicely got up.

J. A. H.

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.]*

Antarctic Pycnogons.

ONE of the most remarkable and unexpected zoological results of recent explorations in Antarctic seas has been the discovery of Pycnogonida (so-called "sea-spiders") having five instead of the usual four pairs of legs. Soon after the return of the *Discovery* expedition, Mr. T. V. Hodgson described *Pentanymphon antarcticum*, and a little later he had the good fortune to find, among the collections of the Scottish National Antarctic Expedition, the long-forgotten *Decolopoda australis* described by Eights more than seventy years ago. A second species of Decolopoda was added by Prof. E. L. Bouvier from the collections of the French Antarctic Expedition in the *Français*. The most surprising circumstance connected with this remarkable departure from what had been regarded as the normal structure of the Pycnogonida was that it appeared in two genera by no means closely related to each other, but, on the other hand, not dissimilar in general structure from other "normal" genera. Thus Pentanymphon is indistinguishable, except in possessing an extra pair of legs, from Nymphon, while Decolopoda is only a little more divergent from Colossendeis. From the point of view of phylogeny, two explanations of these conditions may be offered. Most authorities, for example, Prof. Bouvier and Prof. D'Arcy Thompson (in the "Cambridge Natural History"), adopt the view that the ten-legged condition is the primitive one, and has been retained by the most primitive members in two divergent branches of the group. The other explanation, first suggested by Prof. G. H. Carpenter and advocated by the present writer (*Science Progress*, April, 1909), is that the decapodous condition is a recent development, appearing independently in the two cases.

Prof. E. L. Bouvier has just announced (*C. R. Acad. Sci.*, July 4) a very important discovery which shows that the zoological possibilities of the Antarctic seas are far from being exhausted. Among the collections obtained by Dr. Charcot's recent expedition in the *Pourquoi Pas?* is a representative of a third genus of decapodous Pycnogons, and, strange to say, it appears to be quite unrelated (within the limits of the group) to the other two. *Pentapycnon charcoti* is a near relative of Pycnogonum, hitherto regarded as the most highly specialised of all Pycnogonida. Further, just as Pentanymphon is accompanied by species of Nymphon, and Decolopoda by Colossendeis, so Prof. Bouvier finds that Pycnogonum, hitherto unknown from Antarctic seas, is represented by a new species alongside of Pentapycnon at the South Shetlands.

Prof. Bouvier regards this discovery as quite in accordance with his views as to the evolution of the Pycnogonida. He believes that the group has evolved from a decapodous stage in which at least the chief divisions, represented by Pentanymphon, Decolopoda, and Pentapycnon, were already differentiated from one another, and he supposes that the suppression of the posterior legs has occurred independently at least three times with very little accompanying variation in other characters.

No doubt Prof. Bouvier will justify these views in greater detail when he comes to publish his final report on the Pycnogonida of the *Pourquoi Pas?* At first sight, however, the discovery of Pentapycnon would seem to weigh heavily on the side of Prof. Carpenter's hypothesis. While Pentanymphon is at least as primitive as Nymphon, and even Decolopoda can be admitted, without much difficulty, as a reasonably primitive form, no student of the Pycnogonida will question that Pycnogonum is one of the most highly specialised members of the group, and the only single character that Prof. Bouvier can find to place Pentapycnon on a lower level of specialisation is the presence of additional genital apertures, about which he speaks somewhat doubtfully. The fact that all three genera are found only in one restricted geographical area is also against the idea of their being survivors of a primitive group, for it can hardly be supposed that the Pycnogonida underwent practically the whole of their evolution in the Antarctic seas, and only became distributed over the rest of the globe when they had reached nearly the final stages of family, and even generic, differentiation. It seems much more probable (though the like has not yet been suggested for any other arthropods) that some mysterious influence of environment in these Antarctic regions has, so to speak, upset the stability of the octopodous condition and led to the independent appearance of an additional somite and pair of legs in several unrelated families.

It is to be hoped that the British expedition now on its way to the Antarctic may obtain material for throwing light on this problem. W. T. CALMAN.

A New Italian Orchid.

THE enclosed photograph represents, I believe, a species of Italian orchid which has not before been discovered. M. H. Correvon, who is, I suppose, the greatest living authority on the European orchids, considers it "seems to be out of the way of species known." When first I found it, I believed it to be *Serapias triloba*, but, having studied various authorities, I have since come to the conclusion that I was wrong. They all agree that the lip of triloba is crenulated, but in my specimen there is no sign of that Triloba is considered to be a hybrid between *Serapias lingua*

and *Orchis papilionacea*; although the ground was covered with the former, I could not find a vestige of the latter in the whole of that district.

Also, the authorities only give the Riviera as the habitat of triloba, whilst I found my plant in mid-Italy, near Florence. In my plant the sepals and petals are each very distinct and separate, not joined into a cap, as in all the other varieties of Serapias.

It may possibly be a cross between *S. lingua* and *O. laxifolia*, but, even so, it differs much from that pictured in Barla's book. It is a somewhat striking plant, as the flowers are very large in comparison to the rest, both the labellum sepals and petals being a very vivid shade of colour between pink and purple, the former a little darker.

W. HERBERT COX.

Centre of Gravity of Annual Statistics.

THE principle of taking the centre of gravity of annual rainfall is free from objection, but Mr. Cook's method (NATURE, March 31) is mathematically incorrect. Annual statistics should not be plotted on a straight line, but round a circular ring in accordance with the probable etymology of the term (*annus, anulus*).

For rainfall in India, results of some value may be obtained by Mr. Cook's method, because practically the

whole of the precipitation takes place during the summer months. Heavy falls at the beginning or end of the year would entirely throw the calculation out, as was shown by Mr. Watt in the issue of April 14. In countries such as England and Scotland, where the rain is fairly evenly distributed throughout the year, the centre of gravity, as determined by Mr. Cook, will nearly always lie between 6 and 7, although its true position may be anywhere from 0 to 12.

If the monthly rainfalls be plotted round a disc arranged like a clock-face, and then the moments be calculated about rectangular axes passing through the centre of the disc, a series of simple calculations gives the true position of the centre of gravity.

It is best defined by means of an angle, α, measured clockwise from XII, and a distance, a, expressed as a fraction of the radius. The latter is a measure of the unevenness of the distribution of the rainfall. If equally distributed throughout the year, $a=0$; if very unequally distributed, a approaches 1. If the angle α be divided by 30°, a figure is obtained corresponding to Mr. Cook's C.G. But as the true position of the monthly rainfall is at the middle and not the end of the month, 0·5 must be deducted from this figure to obtain D, the date in months corresponding to the true centre of gravity. Mr. Cook omitted to make this correction.

In the tables below this method has been applied to two stations in southern India, selected at random :—

Bangalore.

Month	Mean rainfall inches	Moment about horizontal axis	Moment about vertical axis	Moment by Cook's method
I	0·06	0·05	0·03	0·06
II	0·22	0·11	0·19	0·44
III	0·72	0	0·72	2·16
IV	1·19	−0·60	1·03	4·76
V	4·53	−3·92	2·26	22·65
VI	3·13	−3·13	0	18·78
VII	4·13	−3·58	−2·06	28·91
VIII	6·00	−3·00	−5·20	48·00
IX	7·11	0	−7·11	63·99
X	6·74	3·37	−5·84	67·74
XI	2·61	2.26	−1·30	28·71
XII	0·39	0·39	0	4·68
Year	36·83	−8·05	−17·28	290·88
a		0·513		
α		245°		
D		7·67 (August 20)		
"C.G."				7·90
"C.G." corrected				7·40

Kolar.

Month	Mean rainfall inches	Moment about horizontal axis	Moment about vertical axis	Moment by Cook's method
I	0·16	0·14	0·08	0·16
II	0·04	0·02	0·04	0·08
III	0·50	0	0·50	1·50
IV	1·32	−0·66	1·15	5·28
V	3·34	−2·90	1·67	16·70
VI	3·13	−3·13	0	18·78
VII	3·36	−2·91	−1·68	23·52
VIII	4·16	−2·08	−3·61	33·28
IX	5·10	0	−5·10	45·90
X	5·50	2·75	−4·77	55·00
XI	3·17	2·75	−1·58	34·87
XII	0·81	0·81	0	9·72
Year	30·59	−5·21	−13·30	244·79
a		0·467		
α		248°		
D		7·78 (August 23)		
"C.G."				8·00
"C.G." corrected				7·50

It will be seen that the results are not very different from those obtained by Mr. Cook's method, and the difference is constant, at any rate for these two stations (0·28, 0·27). But for English stations very different results would be obtained. The constants have also been calculated for the three imaginary cases suggested by Mr. Watt :—

	A in.	B in.	C in.
I	3	0	12
II	3	0	4
III	3	0	2
IV	3	6	0
V	3	6	0
VI	3	6	0
VII	3	6	0
VIII	3	6	0
IX	3	6	0
X	3	0	2
XI	3	0	4
XII	3	0	12
Year	36	36	36
"C.G."	6·5	6·5	6·5
D	—	6·0	0
a	0	0·644	0·830

It will be seen that D and a, together with the total rainfall for the year, entirely define the distribution, whereas the "C.G." calculated by Mr. Cook's method throws no light upon it.

This method of specific gravities can, of course, be used for other annual statistics, such as barometric pressures and temperatures. In the latter case, the figures for a would depend upon the zero of temperature selected, and would consequently be different for the Centigrade and Fahrenheit scales. It would perhaps be more satisfactory to take the mean annual temperature of the station as zero. The figures for D would not be affected by the choice of scale.

The applicability of the method is not confined to meteorology, but may be used for any phenomenon which varies with the time of the year, *e.g.* vital statistics or railway receipts.

A. MARSHALL.

Waverley Cottage, Naini Tal, India, June 14.

Present Meteoric Displays.

THE Perseid shower appears to have come into play rather earlier than usual this year, for I saw four meteors presumably directed from it on the nights of July 11 to 13. These meteors were of the usual streaking class, and formed a radiant at about 16°+50°, which agrees fairly well with the correct place of radiation at the end of the second week in July. This year I found meteors decidedly rare at the epoch named, but the skies were not very favourable, and twilight very strong.

By the time these lines appear in print the moon will only slightly interfere with observation, and a clear sky will show many meteors, for at the end of July the Aquarids, as well as Perseids, are generally plentiful; and there is no danger of confusing the members of the two streams, since their radiants are widely distant from each other. The Aquarids shoot slowly upwards in long flights from a radiant low in the southern sky, while the Perseids are directed in rapid courses from a radiant in the N.N.E.

On July 29–31 an observer may generally expect to see at least twenty meteors per hour, and especially after midnight, when the number visible usually exhibits a very marked increase, the radiants of both the Perseids and Aquarids taking up a more favourable position for the distribution of their meteors as the night advances.

It is to be hoped that all the brighter meteors and bolides will be individually recorded this year. The stars of Draco, Cassiopeia, Cepheus, Andromeda, Pegasus, Cygnus, and other constellations afford a ready guide for the accurate registry of meteor-flights, and such data will possess an enduring value as a means of furthering our knowledge.

W. F. DENNING.

Pwdre Ser.

THE following letter, which I received last winter, may possibly throw some light on the questions raised by Prof. Hûghes in his paper on "Pwdre Ser" in NATURE of June 23 :—

"*Allegheny, December* 4, 1909.

"DEAR PROFESSOR SCHLESINGER,—

"Referring to the falling meteor of which my husband made mention at your lecture last evening, the facts are

as follows. One evening some years since my father, Mr. Joel Powers, while walking on Lawrence St., Lowell, Massachusetts, saw a brilliant shooting star or meteor flash downward through the atmosphere, striking the earth quite near him. He found it upon investigation to be a jelly-like mass, and almost intolerably offensive in smell. I have often heard my father allude to this event, which greatly interested him, he being a close observer and an extensive reader.

"Respectfully yours,
"ELLEN M. ADAMS."

While I am of the opinion that the mass found by Mr. Powers had no connection with the meteor that he saw, it may be well to put this piece of evidence on record in view of Prof. Hughes's paper.

FRANK SCHLESINGER.

Allegheny Observatory, July 12.

THE ETHNOLOGY, BOTANY, GEOLOGY, AND METEOROLOGY OF GERMAN AFRICA.[1]

SOME time ago, reviewing a scientific treatise on German South-west Africa and the adjoining regions I ventured to make the remark in this journal that Germany deserved to be allowed to take under her control still more of the undeveloped portions of the earth's surface, provided she continued by the direct action of her Government to enrich the world's store of knowledge as she has been doing with her African and New Guinea researches during the last ten years. The present "Mitteilungen" support this exordium; they are of high scientific value.

There is, firstly, a separate volume by Dr. Weule on his ethnographical observations in the south-east parts of German East Africa. Here, for the modest sum of three shillings (three marks), one gets a splendidly illustrated work of first-rate importance on a section of Bantu Africa. "Ergänzungsheft Nr. 2" is a dissertation by Prof. Dr. Carl Uhlig on the cartography of the German portion of the Rift Valley region of equatorial East Africa, with an appendix on the orthography of place-names in Masailand, &c., by Dr. Bernhard Struck. Part i. of Band xxii. deals with the journeys in 1905–6 of Franz Seiner in the still very little explored country between the Kalahari Desert and the Upper Zambezi (especially the valleys of the Okavango, Kwando, and Omuramba rivers); part ii., with the glaciers of Kilimanjaro, the rainfall and meteorology of the Cameroons and of German South-west Africa; part iii., likewise with the exploration of the upper parts of Kilimanjaro, the rainfall of Togoland, and the geography of Ponape Island; and part iv., with the volcanoes recently active on the Cameroons Mountains, the rainfall and meteorology of the Cameroons and of the Logone River (Shari district), the Paresis Mountains of South-west Africa, and the meteorology of the German possessions in the Pacific. The space, however, which is attributed in this collection to the German oceanic territories is so small that no further allusion to them need be made (other than to praise very cordially the extremely interesting map of Ponape Island in the Carolines Protectorate), and we might proceed at once to discuss the valuable additions to our knowledge of Africa contained in these six sections of the scientific reports attached to the Deutschen Kolonialblatte.

Dr. Weule's work in East African anthropology has already been made known to English readers by Miss Alice Werner in a translation of his more "popular" account of his travels and in various papers in the Journal of the (British) African Society. It was remarked in one or other of these publications that Dr. Weule's work was a little impaired by his apparent unacquaintance with his subject before embarking on this expedition to East Africa. Had he studied more the numerous works in German and in English dealing with the native tribes of the southern portions of German East Africa and of British Nyasaland, he would have avoided a certain *naïveté* of discovering what had already been made known and a few blunders into which he had fallen through a lack of comparative knowledge; also that his orthography of native names was a little old-fashioned (in its German rendering) and divergent from the methods of spelling adopted long ago by German and British philologists and travellers.

These criticisms are less applicable to the volume under notice, "Wissenschaftliche ergebnisse meiner ethnographischen Forschungsreise in den sudösten Deutsch-Ostafrikas"; though the orthography still irritates and the many painstaking quotations of native speech in the dialects of Yao and Makua would have been the better for careful revision with German or British experts. (They tend to incorporate too much the Swahili words of some intervening interpreter.) But the greater part of this book is interesting and valuable to the ethnologist. The illustrations which accompany it are deserving of unstinted praise. Photographically (for the most part) and by clever draughtsmanship, Dr. Weule depicts the physical types of the Wa-mwera, A-makua, Wa-yao, Wa-makonde, Wa-matambwe, and Wa-ngoni peoples of the Ruvuma basin; their costumes, ornaments, and hideous self-inflicted deformities (such as the monstrous "pelele," or lip-disc, worn by nearly all the women in this region); their houses and methods of building; their graves, fetish-huts, granaries, cooking arrangements, doors, wooden locks and keys, pottery-making, metal-work, bark-cloth felting, basket- and mat-making, salt-straining; their weaving of cotton cloth and remarkable wood carving and calabash engraving. Indeed, he reveals a new chapter in negro art by his illustrations of their statues in wood, their clay dolls, their sculptured birds, Rhynchocyon insectivores, pigs, monkeys, and dogs; their most artistic carved snuff-boxes, amulets, powder-boxes, spoons, and stools. (As regards the last it is interesting to note the striking resemblance in shape and design to those of the south-eastern basin of the Congo.) One arises from this survey (and after reading the accompanying text) convinced that with due encouragement some section of the negro race is going to astonish the world yet in design and sculpture.

Then there are the extraordinarily ingenious traps, snares, and pitfalls, all most clearly and yet picturesquely illustrated. Elephants are sometimes killed by the falling of a heavily-weighted harpoon from a lofty tree-branch or scaffold which they release by the displacing of a cord; the larger antelopes similarly discharge arrows or assagais into their own bodies; the smaller quadrupeds dislodge in their passage a heavy beam which falls and crushes them. There are springes and nooses for the capture and strangling of beasts and birds, and cages for catching them alive; rat-traps and hyena-traps. All these display an ingenuity, a neat-handedness, and an unconscious knowledge of dynamics very remarkable in people still living ostensibly as semi-savages. One realises in studying Dr. Weule's work how it was that, although the fossil remains of *Homo primigenius*—and the negro stands higher as a subspecies of *Homo sapiens*—exhibit an osteology approximating slightly to the anthropoid apes, yet the brain capacity of any type of the genus Homo is almost of necessity an average

[1] Mitteilungen aus den Deutschen Schutzgebieten, &c. Ergänzungshefte Nr. 1, pp. x+150+Tafel 63; und 2, pp. iv+62. Heften i. bis iv., Band xxii. Edited by Dr. Freiherr von Danckelmann. (Berlin: Ernst Siegfried Mittler und Sohn, 1909.) Price 3 marks each.

minimum 1100 c.c.[1] to enable anything like a man to compass the degree of thought and reflection necessary to adroit use of implements and the contriving the death or capture of their prey.

Dr. Weule goes very fully into the boy and girl initiation ceremonies among the tribes above-mentioned. He seems to have omitted none of the details of these rites, all of which, whether excessively obscene, prophylactic, or rudely moral, are yet instinct with a certain feeling of natural religion: that is to say, they are performed not for their incidental lubricity but with the intention of making the girls good wives and mothers and the boys vigorous husbands and faithful members of the clan. Still, as regards the young women, native therapeutics[2] are entirely at fault, and the missionaries are quite right in believing and teaching that these "Unyago" ceremonies are in reality detrimental to health and morals.

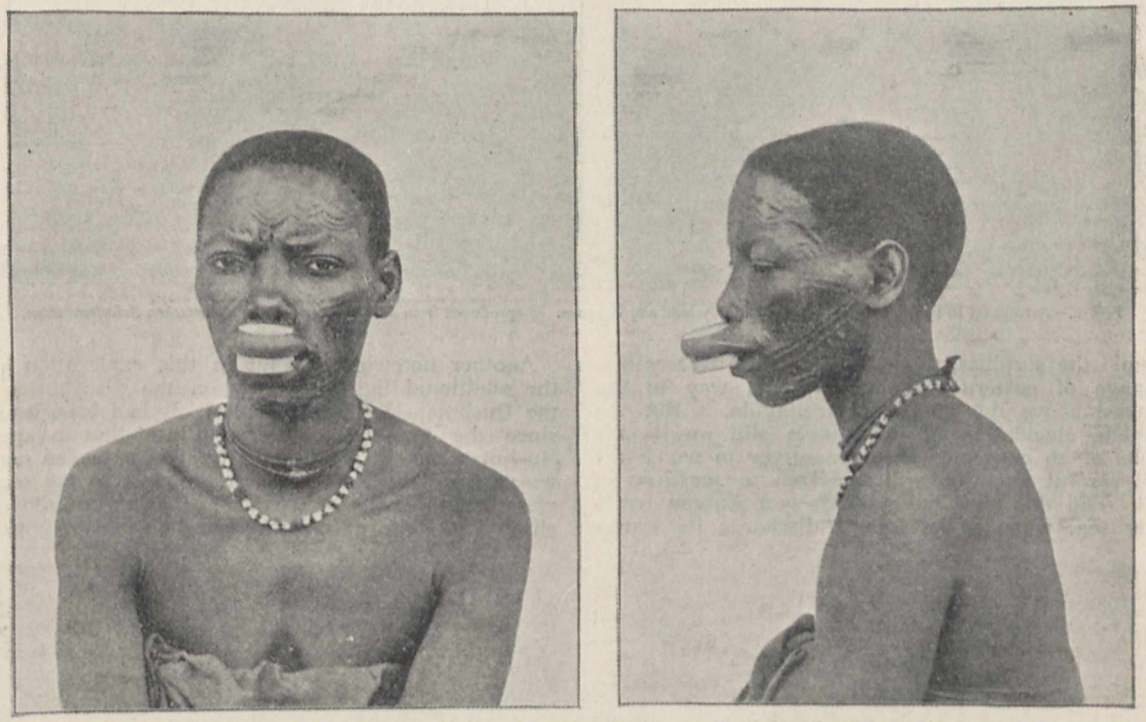


FIG. 1.—Young Makonde Women. Reproduced from *Mitteilungen aus den deutschen Schutzgebieten.*

The elaborate dances and their meanings, the strange dancing masks, the birth, marriage, death, and burial ceremonies are all described in detail, and a good deal of this information is absolutely new. Altogether Dr. Weule has made an important contribution to our knowledge of the still primitive Bantu tribes of the Ruvuma country, and incidentally has supplied some charming pictures of this great East African river; first studied by Livingstone in the vain hope that it might prove to be a water-route to Central Africa.

Prof. Uhlig's cartographical information on the German end of the Rift Valley is an important addition to our geographical knowledge of this somewhat desolate part of East Africa, a region, however, which is coming into such importance for the salts, phosphates, and sodas of its evaporating lakes that the British are building a branch railway to tap its products from the north. The human population is scanty, and consists mainly of Masai; and the Masai having long ago named all the leading features of the landscapes, Dr. Bernhard Struck (the well-known philologist) contributes an article on Masai place-names and on the correct orthography of African words. It is, indeed, a pity that all civilised nations cannot agree to adopt a uniform phonetic alphabet for such purposes. Of course, the basis for such a system is best found in the Lepsius standard alphabet, with certain slight changes. As Lepsius was a German, one would think that the Germans would agree with us in adopting his system. But no: there are two schools at present in the Fatherland: one that sticks to the old-fashioned German extravagance in consonants—the *dsch, tsch, ä* for *e,* doubled *s's, s* for *z* plan—still used by Dr. Weule; and the over-particular new German linguists and geographers who fatigue and dishearten the average student with their meticulousness in spelling, their accents, diacritical and elliptical marks, their circumflexes, dots, underlinings, and other cabalistic signs. Why cannot all the world agree to confine itself to such a phonetic alphabet as that adopted and used by the great German explorer in the service of the British Government—Henry Barth? In the humble opinion of the reviewer Barth's system is about perfect in accuracy and simplicity. It is, of course, founded on the alphabet devised by Lepsius.

Another important piece of African research is Herr Seiner's journey of exploration in that still little explored country bounded by the Upper Zambezi on the east, the Kunene River on the north-west, and the Kalahari desert on the south, the region separating the Bechuana peoples from the Herero stock (Amaherero, Ovambo, &c.), and the Herero from the Zambezian peoples (Ba-luyi, Basubia, Batonga, &c.). The hydrography of this region is still an unsolved problem. There is, first of all, the isolated basin of Lake Etosa in north-east Damaraland; then come the questions of the Ngami-Botletle-Makari-kari system, the real destination of the waters of the immense

1 The cranial capacity of the Neanderthal skull was about 1500 c.c.
2 Such as in the artificial hypertrophy of the *labia minora.*

river system of the Kubango (Okavango)-Kuito-Omurambo and Kwando. These rivers discharge the bulk of their waters into the remains of an ancient sea, of which the Haiñoma-Selinda-Mashi swamps, the network of the Tauche streams, Lage Ngami, the Botletle River, and the Makari-kari salt-pans are the vestiges; but by two separate overflows—the Mashi-Linyanti river-swamp and the Tamalakane outlet of the steppe flora of so much of irregularly watered tropical Africa, and the rich forest and swamp flora of West Africa. Seiner traces the approximate limits of each phytogeographical region: the southernmost boundary of the baobab tree, of the bulging-stemmed Hyphæne palm (*H. ventricosa*), of the high-timber forests of West African affinities, and the thin, low-growing woods of Copaifera and Burkea.

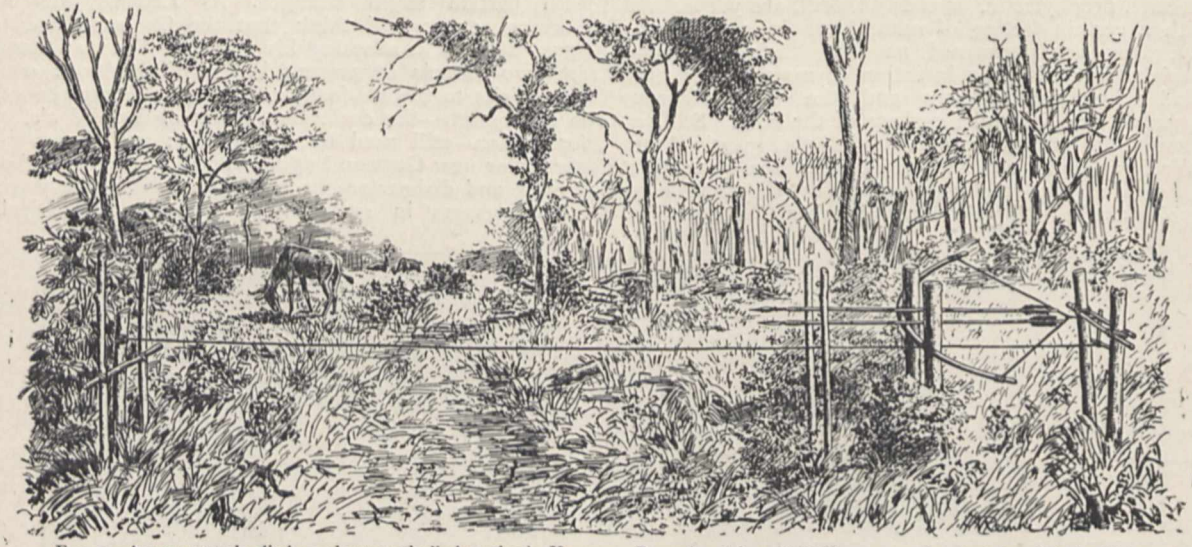


FIG. 2.—Arrows set to be discharged automatically by animals, Usagara. Reproduced from *Mitteilungen aus den deutschen Schutzgebieten.*

Ngami—the surplusage of the Okavango waters (the drainage of eastern Angola) finds its way to the Zambezi above the gorge of Kasungula. But the complete elucidation of this puzzle still awaits the results of an extremely accurate survey in which the most careful attention will be given to questions of level. Did this once huge South-west African fresh-water sea, when at its fullest, discharge its waters seawards through the Limpopo; or did it pierce the hills at Kasungula (some distance above the Victoria Falls) and thus united what is now the Upper Zambezi with the Gwai and the Kafue, and so create the Zambezi as we know it to-day? Herr Seiner's journey was singularly interesting because of his careful studies of plant-distribution. In this region meet the desert flora of the Kalahari and South-west Africa,

Another noteworthy point in this exploration was the additional light it threw on the distribution of the Bushman-Hottentot peoples. It had been known since the journeys of Serpa Pinto that a quasi-Bushman race of red-skinned hunters extended northwards from the Kalahari desert almost to the south-westernmost limits of the Congo basin; but the conclusions of Pinto were rather based on fancied physical resemblances than on language. Dr. Passarge—the German explorer who has made several journeys through the Okavango basin—added to our information, and now Seiner extends our knowledge of these people, speaking click languages, to the Kwando River and almost to the Upper Zambezi. The specimens of Bushman speech collected by Seiner and Passarge enable these travellers to divide the

FIG. 3.—The Kibo Crater of Kilimanjaro. View from the base at a distance of 3932 metres. Reproduced from *Mitteilungen aus den deutschen Schutzgebieten.*

northern Bushmen into two groups—that of the Kaukau of southern Damaraland and that of the Ngami, which would include the click-using peoples as far north as the Kwando River. Between the two groups there is very considerable linguistic difference, though there exist equally undeniable affinities. In Herr Seiner's photographs, however, only two examples of so-called Bushmen are recognisable as such, the remainder (though their language was "Bush") are obviously true negroes, and must be the result of hybrids ancient and modern with the true negro stock, as exemplified by the recent Bantu invaders (Bechuana and Zambezian) and the Berg-Damara. Seiner classifies the Zambezians as "Bantu," and the Bechuana as a class apart. There is no justification for this distinction. The Bechuana tribes are just as much "Bantu" in languages as the Zambezians, though some of them have obviously absorbed a good deal of Bushman blood during the last twelve or fifteen hundred years.

The descriptions and beautiful pictures of the Kilimanjaro glaciers (in parts ii. and iii. of Band xxii.) are of the highest interest; so also are the equally careful, illustrated reports on the "volcanelli" (if one may coin a word to describe the lesser craters which break out on the mass of a huge volcano) of the Cameroons. This article, by Dr. Otto Mann, describes the renewed activities of the Cameroons volcanic mass in 1909. H. H. JOHNSTON.

CORDITE.

THE recent discussion in Parliament on our supplies of cordite and our productive capacity for this type of smokeless powder has naturally directed public attention to these important questions. The production of a smokeless powder was ever the dream of the military strategist, and with the discovery of gun-cotton the conclusion was hastily arrived at that the ideal propellant was found, only to be rudely dissipated by numerous serious disasters. Gun-cotton for many years resisted all attempts to render its combustion sufficiently under control for it to be adopted as a propellant, yet to-day it is the basis of the smokeless powders of all nations. Its early failures were entirely due to the retention in the nitrated cotton of the physical characters of the parent cotton, for even after reduction to an extremely fine state of division during the process of manufacture, the fibrous nature of the cotton persisted. Success has only been attained by the destruction of this fibre, and the smokeless powders of all nations may be classed either as simple gelatinised gun-cottons in which soluble nitrocelluloses have been gelatinised by treatment with an ether-alcohol mixture, or as nitrocellulose-nitroglycerine colloids, in which the nitrocellulose employed may be of the soluble variety, as in ballistite, or the insoluble (true gun-cotton), as in the case of cordite.

The introduction of blasting gelatin by Nobel (1875), consisting of some 90 per cent. nitroglycerine with 10 per cent. of soluble nitrated cotton in a gelatinised form, was the first step towards the production of powders of the cordite type. The high percentage of nitroglycerine rendered blasting gelatin unsuitable for use in guns, but by incorporating the two constituents in equal quantities, Nobel gave to the world the first successful smokeless powder of this class, ballistite. Cordite was the outcome of the work of a committee presided over by the late Sir Frederick Abel, and was patented a year later than ballistite, in 1889. The essential difference between ballistite and cordite is that whilst the former contains soluble nitrocelluloses, cordite contains the insoluble or tri-nitrocellulose. This change in the character of the nitrocellulose employed entailed the introduction of acetone in the manufacture of cordite. Soluble nitrocotton and nitroglycerine can be thoroughly incorporated under proper conditions in the presence of water without the aid of any solvent, but the ingredients of cordite can only become perfectly incorporated in the presence of a mutual solvent. It is essential that the solvent shall be sufficiently volatile to permit of its removal at reasonably low temperatures from the finished powder, and acetone, which boils at 56° C., fulfils all the conditions best.

It is important to note that nitroglycerine is the only explosive containing an excess of oxygen, all nitrocelluloses being theoretically deficient in this element to give complete combustion of carbon to carbon dioxide and hydrogen to water. There are therefore admirable theoretical grounds for the incorporation of these two explosives with each other. The total change in physical characters of both nitroglycerine and nitrocellulose brought about entirely alters the character of their explosion; singly, both constituents are beyond control once combustion is started; gelatinised together, combustion is regularly progressive throughout the mass, an essential condition for a propellant.

The earlier form of cordite consisted of nitroglycerine, 68 per cent.; nitrocellulose, 37 per cent.; vaseline, 5 per cent. It was soon found that serious erosion took place in the guns, and Sir Andrew Noble showed this to be due to the rapid motion of the gaseous products at very high temperature. Since the temperature is a function of the nitroglycerine content, combustion to carbon dioxide taking place to greater extent with its accompanying higher calorific intensity, it followed that reduction of the nitroglycerine would lower the temperature of the products and lessen the erosion. This led to the introduction of modified (M.D.) cordite of the following composition:—Nitroglycerine, 30 per cent.; nitrocellulose, 65 per cent.; vaseline, 5 per cent.—practically a reversal of the former proportions of the chief ingredients. The introduction of the vaseline was made to overcome metallic fouling in the gun, arising from surfaces of metal in practically a clean condition rubbing against each other as the projectile moved outward. The vaseline decomposition products provided just the slight lubrication needed. It has performed another important office, little thought of on its introduction, in acting as a "stabiliser" in the cordite.

In the manufacture of cordite, the gun-cotton employed is thoroughly dried at a temperature of 40° C., and is then mixed by hand with the proper proportion of nitroglycerine, the mixture being finally passed through a sieve. The "paste" obtained is transferred to an incorporating machine of an exactly similar type to that employed in a machine bakery, except that temperature control is arranged for, and there worked into a thorough dough with the requisite quantity of acetone. The first kneading occupies about three and a half hours; then the vaseline is added and a further kneading for a similar period takes place. "Cordite dough," in which every trace of the fibrous character of the gun-cotton has disappeared, results, and this dough is then shaped into the finished threads, cords, or rods by pressure through suitable dies. As the thinner makes pass from the press they are wound on drums, thicker qualities being cut into suitable lengths as they pass out on an endless band. The acetone remaining must now be removed by drying in suitable rooms at a temperature of 110° F. The removal of solvent from the larger sizes of all smokeless powders offers considerable difficulty owing to their horny nature; the odour of acetone is readily detected in freshly ground cordite after long storage.

Naturally the detection of products which may indicate decomposition actually occurring or likely to occur is important, and for this purpose Abel's heat test, first introduced for gun-cotton about 1875, is employed for cordite. The test depends on the liberation of iodine from potassium iodide by the action of nitrogen peroxide, the principal decomposition gas. The ground explosive is heated to 180° F. in a tube, and the time noted for discoloration of the test paper to a certain standard tint. The question at once suggests itself, Does the test show decomposition products which were present in the explosive, or have they resulted from heating during the test, or both conditions acting together? Very divergent opinions are held as to the value of the Abel test as an indication of the stability or "life" of gelatinised explosives. Certainly a powder giving a bad test must be regarded with suspicion, but it is obviously not an easy matter to fix a time limit for a test which is subject to adverse criticism.

One of the most important considerations with any explosive is its stability. The question naturally arises, Is the molecular arrangement in such substances as nitrocellulose and nitroglycerine stable under ordinary conditions of temperature? Their explosive properties depend entirely on molecular rearrangement, which is practically instantaneous when detonation occurs. Certainly slow decomposition occurs in most nitro-compounds of the explosive class at temperatures not greatly above the normal with the production of oxides of nitrogen, and it has been shown that these oxides act catalytically on the explosive; in other words, their effect becomes cumulative and may lead to ignition. In order to avoid this catalytic action, "stabilisers" have been introduced in many explosives, substances capable of absorbing these nitrogen compounds. As already mentioned, the vaseline in cordite appears to perform this useful function.

THE SHEFFIELD MEETING OF THE BRITISH ASSOCIATION.

FOR the last few months the various committees dealing with the local arrangements for the meeting of the association have been hard at work and the general outlines are settled. The hardest task, perhaps, has fallen to the lot of the hospitality committee in finding accommodation for the large number of visitors expected, the city being notorious for its small hotel accommodation. A first list of hotels and lodgings is now ready, and members should lose no time in engaging rooms. To meet the expected demand, the committee has arranged for the two training colleges' hostels for women to receive members, the larger one for gentlemen, with a limited number of married people in an annexe, and the University Hostel for single ladies. The list may be obtained from the secretary of the hospitality committee, Mr. J. Wortley, George Street, Sheffield.

The reception-room will be at the Cutlers' Hall. Here, in addition to the various rooms and offices usually associated with the reception-room, will be a large luncheon-room, giving, close at hand, sufficient accommodation to prevent the pressure and overcrowding so prevalent in many previous meetings. The Cutlers' Hall is conveniently situated in the centre of the city, close to the tram termini, and the various section rooms are grouped round it, all within a radius of 400 yards, with the exception of that of physiology, which, for evident reasons, is better placed in the University. The president's address, and the popular lectures by Prof. Stirling (types of animal movement), Mr. Hogarth (new discoveries about the Hittites), and Mr. C. T. Heycock (the Saturday evening lecture to operatives), will be given in the Victoria Hall.

The first evening reception will be at the Town Hall, by the Lord Mayor and Countess Fitzwilliam. The Weston Park is to be the central scene of the second on Tuesday, September 6, at which about 4,000 guests are expected. The University lies along the east side of this park, and the Mappin Art Gallery is in it on the west. Advantage has been taken of this to have a combined reception by the University and the local committee. The Chancellor and the Duchess of Norfolk will receive one category of guests at the University, and the Earl and Countess Fitzwilliam another in the Art Gallery, but the two will really form a combined conversazione, with an evening garden-party in the park. One of the features of the latter will be a military tattoo with torches after dark. Afternoon garden-parties for the whole association will be given by the Lord Mayor at his seat at Wentworth, and by the local committee in the Botanical Gardens, whilst a number of smaller garden-parties will be given on other days. Arrangements have been made for visits to more than twenty works, covering the chief staple trades of the city. In the University also the various furnaces in the metallurgical department will be run on different days to illustrate that feature in the University curriculum.

Saturday, September 3, will be devoted to excursions to the Derwent Waterworks, to Chatsworth, Welbeck, and Clumber, where members will be entertained respectively by the Dukes of Devonshire, Portland, and Newcastle, also to Haddon, Roche Abbey, and Bolsover Castle. The neighbourhood is so rich in picturesque scenes that there will be ample scope for members to arrange private excursions, such as to the Peak Caverns, the limestone dales, Buxton, Matlock, Wingfield Manor, or even further afield, to York, Lincoln, or Newark Castle, and Southwell Minster.

A local handbook of 500 pages has been compiled under the editorship of Dr. Porter, with the assistance of a large number of local experts, containing a large amount of interesting matter, scientific, historic, and local. During the meeting the University will hold a congregation for the purpose of conferring honorary degrees on the president and other eminent scientific men attending the meeting.

Provisional Programmes of Sections.

Section A (Mathematical and Physical Science).—The address of the president (Prof. E. W. Hobson) will be delivered at 10 a.m. on Thursday, September 1. Two discussions are under arrangement. On Monday, September 5, there will be a joint discussion with Section G on the principles of mechanical flight, to be opened by Prof. G. H. Bryan; and on Tuesday, September 6, Dr. C. Chree will open one on atmospheric electricity. The section will meet with Sections G and B on Friday, September 2, to participate in the discussion on the report of the gaseous explosions committee, and in papers to follow dealing with combustion. Several papers have been already promised to the section, but the programme is still incomplete.

Section B (Chemistry).—The feature of the programme is the joint discussions with other sections. These are:—Friday, September 2, with Sections A and G: Subjects of general interest; in particular, combustion. Monday morning, September 5, with Sections I and K: Respiration; afternoon, with Section L: The neglect of science by commerce and industry. Reports will be presented by Prof. W. A. Bone, on combustion; Dr. J. V. Eyre, on solubility.

Papers on a fourth recalescence in steel, Prof. Arnold; the provident use of coal, Prof. H. E. Armstrong; influence of chemical composition and thermal treatment on the properties of steels, Prof. A. McWilliam; ferro-silicon, Dr. S. Monckton Copeman; corrosion of iron and steel, Dr. J. N. Friend; the crystalline structure of iron at high temperatures, Dr. Rosenhain; allotropy or transmutation? Prof. Howe; the molecular weight of radium emanation, Sir Wm. Ramsay and Mr. R. W. Gray. Papers from the Sheffield University Chemical Department: Formation of tolane derivatives from *o*- and *p*-chlorobenzylchloride, Dr. J. Kenner and E. Whitham; sulphonic derivatives of chloro- and nitrochlorotoluene, Dr. J. Kenner and Prof. W. P. Wynne; an instance illustrating the relative instabilities of the trimethylene ring as compared with the tetramethylene ring, Dr. J. F. Thorpe; three physical chemical papers dealing with viscosity and molecular association, W. E. S. Turner (in conjunction with C. L. Peddle and E. W. Merry).

AGRICULTURAL SUBSECTION OF SECTION B: Sugar beet growing, Sigmund Stein and G. L. Courthope, M.P.; nitrogen fixation, Prof. Bottomley and J. Golding; various: cost of a day's horse labour, A. D. Hall; cost of Danish dairy farming, Christopher Turnour; effect of town atmosphere on vegetation, Dr. Crowther; scientific problems in live stock breeding, K. J. J. Mackenzie. Joint meetings (1) with Economic and Statistical Section: The magnitude of error in agricultural experiments; scientific method in experimental work, Prof. H. E. Armstrong; experimental error in feeding trials, T. B. Wood and A. B. Bruce; experimental error in field trials, A. D. Hall and E. J. Russell; experimental error in milk analysis, S. H. Collins; experimental error in plant analysis, R. H. Berry; (2) with the Geological Section, *Soil Surveys (Agricultural)*: Survey of Kent, Surrey, and Sussex, A. D. Hall and E. J. Russell; survey of Norfolk, Mr. Newman; "Teart" land of Somerset, C. T. Gimingham; (3) with the Zoological Section: Part played by organisms other than bacteria in soil fertility, E. J. Russell and H. B. Hutchinson.

SECTION C (GEOLOGY).—Thursday, September 1, 10.0: The Joredale Series and its equivalents elsewhere, Cosmo Johns; the Palæozoic rocks of Cautley (Sedbergh), Dr. J. E. Marr and W. G. Fearnsides; the graptolitic zones of the Salopian rocks of the Cautley (Sedbergh) area, Miss O. R. Watney and Miss E. G. Welch; pleochroic halos, Prof. J. Joly. 11.30: Presidential address by Dr. A. P. Coleman; mountain temperatures and radium, Dr. C. H. Lees; outlines of the geology of northern Nigeria, F. D. Falconer; notes on the geology of the Gold Coast, W. Parkinson; the geological significance of the nickel-iron meteorites, Cosmo Johns. Friday, September 2, 10.0: Joint meeting with Section E (Geography): (1) Papers on local geography and geology, (*a*) the local geology, Cosmo Johns; (*b*) the local geography; (*c*) the marine bands in coal measures of south Yorkshire, H. Culpin; (*d*) the Maltby deep boring, W. H. Dyson. (2) Joint discussion on the economic products of Sheffield as affected by the structure of the district. Paper by Prof. McWilliam on the metallurgical industries in relation to the rocks of the district. (3) Regional surveys. Paper by T. Sheppard on the Humber during the human period. Monday, September 5, 10.0: Seismological report by Dr. J. Milne; thrust masses in the western districts of the Dolomites, by Mrs. W. M. Ogilvie-Gordon; on the geology of Cyrenaica, Prof. J. W. Gregory; on the geology of Natal, Dr. F. H. Hatch. 12.0: Joint discussion with subsection Agriculture on soil surveys. Tuesday, September 6, 10.0: Discussion on the concealed coalfield of Notts, Derbyshire, and Yorks. Papers by Prof. P. F. Kendall and Dr. Walcot Gibson; two papers by Ernest Dixon; (1) Kilauea and its lessons, (2) some volcanic phenomena in New Zealand, Dr. Tempest Anderson.

SECTION D (ZOOLOGY).—Address by the president, Prof. G. C. Bourne; mitokinetism and the electrocolloid hypothesis, Prof. Marcus Hartog; semination in *Calidris armarica*: a key to some problems regarding its migratory movements during the breeding season, Prof. C. J. Patten; some experiments and observations on the colours of insect larvæ, Prof. Garstang; a cytological study of artificial parthenogenesis, Dr. Edward Hindle; avian coccidiosis, Dr. H. B. Fantham; relation of regenerative and developmental processes, Dr. Jenkinson; first results from the Oxford anthropometrical laboratory, Dr. E. H. J. Schuster; development of the pectoral girdle in *Acanthias vulgaris*, Dr. H. W. Marett Tims; a paper dealing with some sex problems, Geoffrey Smith; Dr. Gadow will give the afternoon lecture on coral snakes and peacocks.

SECTION E (GEOGRAPHY).—Presidential address, Prof. A. J. Herbertson; cotton-growing within the British Empire, J. Howard Reed; the Uganda-Congo Boundary Survey, Major R. G. T. Bright; the river systems of Nigeria, Dr. J. W. Falconer; the alluvium of the Nile, Capt. Lyons; the homeward voyage of the *Nimrod*, Capt. J. K. Davis; Prince Charles Foreland, Dr. W. S. Bruce; the geology and metallurgical industries of the Sheffield district, joint meeting with Section C.

SECTION G (ENGINEERING).—Presidential address, Prof. W. E. Dalby: (1) the testing of lathe tool steels, (2) a new method of testing the cutting quality of files, Prof. Ripper; experiments on aëroplanes, W. A. Scoble; accelerometers, H. S. Wimperis; optical determination of stress, Prof. Coker; laws of electro-mechanics, Prof. S. P. Thompson; the electrification of the Brighton Railway, Philip Dawson; heat insulation, F. Bacon; report of the gaseous explosions committee; joint discussion on combustion with Section B (Chemistry); joint discussion on aërial flight with Section A (Mathematics and Physics).

SECTION I (PHYSIOLOGY).—Thursday, September 1: Presidential address, Prof. A. B. Macallum; the mechanism of reflex standing and walking, Prof. C. S. Sherrington. Friday, September 2: Discussion on prevention of caisson disease, to be opened by Dr. Leonard Hill. Monday, September 5: Joint discussion with Sections of Botany and Chemistry on biochemistry of respiration. Tuesday, September 6: Joint discussion with Section of Education on speech. There will be the usual reports of committees, and the following papers have been promised:—The relation of light perception to colour perception, Dr. Edridge Green; the combination of poisons with the contractile substance of cardiac muscle, Dr. H. M. Vernon; (1) the inorganic composition of the blood of vertebrates and invertebrates and its origin, (2) the inorganic composition of the blood serum of the laboratory frog in spring, (3) further observations on the localisation of potassium salts in animal and vegetable cells, Prof. A. B. Macallum.

SECTION K (BOTANY).—A joint discussion between the Botanical, Chemical, and Physiological Sections, on the biochemistry of respiration, Dr. F. F. Blackman and others to take part; a new method of estimating the opening of stomata, Dr. F. Darwin; the paths of translocation of sugars from green leaves, S. Mangham; (1) two synthetic genera of Filicales, (2) note on *Ophioglossum palmatum*, Prof. Bower; the pollen chambers of fossil and recent seeds, Prof. F. W. Oliver; the morphology of the ovules in Gnetum and

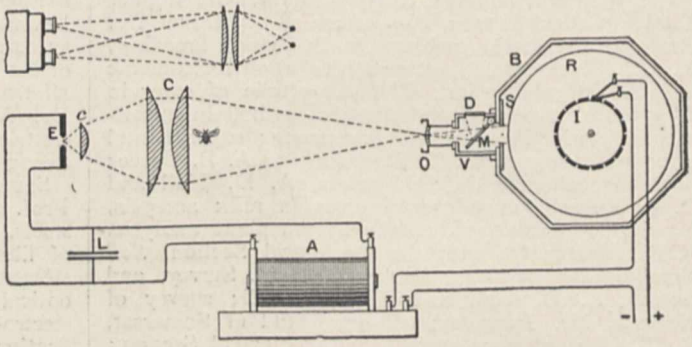
Welwitschia, Mrs. Thoday; further observations on the fossil flower, Dr. M. C. Stopes; chromosome reduction in the Hymenomycetes, Harold Wager; the sexuality of *Polystigma rubrum*, Prof. V. H. Blackman; telophases and prophases in Galtonia, Prof. Farmer and Miss Digby; a cytological paper, Dr. H. C. J. Fraser; the zoospores and trumpet-hyphæ of the Laminariaceæ, Dr. Lloyd Williams; plant distribution in the woods of north-east Kent, M. Wilson; the absorption of water by leguminous seeds, A. S. Horne. Papers are also expected by Prof. F. E. Weiss and others. The semi-popular lecture will be given this year by Prof. F. O. Bower; subject, sand dunes and golf links.

SECTION L (EDUCATIONAL SCIENCE).—The president for the meeting is Principal H. A. Miers, and his presidential address will be delivered on Thursday morning, September 1. It is intended to give up the whole of Friday, September 2, to the subject of educational research, and the meeting will be a joint one with the Anthropological Section. Prof. J. A. Green, of Sheffield, the secretary of a committee which has been investigating the mental and physical factors involved in education, will present a report on the present position of educational research at home and abroad. Dr. Gray will also present a report on behalf of a committee of the Anthropological Section on methods of observing and measuring mental characters. It is hoped that Prof. Münsterberg, of Harvard, will open the discussion, which promises to be an important one. Dr. Lucy H. Ernst, Prof. Lippmann, of Berlin, Dr. Kerr, the principal medical officer of the London County Council, and several members of his staff, Prof. C. S. Myers, Dr. T. P. Nunn, and Dr. Rivers, of Cambridge, amongst others, have signified their intention to take part, and reports will be presented, by the investigators, of serial observations on school children and others which have been conducted in London, Liverpool, Sheffield, Wolverhampton, and elsewhere. On Monday morning, September 5, Mr. J. G. Legge, Director of Education in Liverpool, will open a discussion on handwork and science in elementary schools. On Monday afternoon there will be a joint discussion with the Chemistry Section on the neglect of science in commerce and industry. Mr. R. Blair, the Education Officer of the London County Council, will open the discussion, and Prof. Bovey, Principal E. H. Griffiths, Sir William Tilden, and others have promised to take part. On Tuesday morning, September 6, the subject of open-air studies in schools of normal type will be taken up. There will be papers by Mr. J. E. Feasey, of Sheffield, Mr. G. G. Lewis, of Kentish Town, and Prof. Mark R. Wright, of Newcastle-on-Tyne, will read a paper on a training college under canvas. On Tuesday afternoon a joint meeting will be held with the Physiological Section for the discussion of voice production. Dr. A. A. Gray, Mr. H. H. Hulbert, Principal Burrell, of Isleworth, Prof. Wesley Mills, Mr. W. H. Griffiths, and others, will contribute papers.

THE ULTRA-RAPID KINEMATOGRAPH.

A RECENT number of *La Nature* (April 30) contains a very interesting account of the latest work of the Marey Institute. By means of the new instrument, the ultra-rapid kinematograph invented by M. Bull, sharp stereoscopic kinematograph views may be obtained of such extremely rapid movements as, for instance, the flight of a fly or the breaking of a soap bubble. With the ordinary kinematograph the photographic film moves discontinuously, being arrested at the moment of each exposure. While this is simple enough at moderate speeds, it would be quite impossible where the exposures are at the rate of 2000 a second, and the mean speed of the film 4000 cm. a second. These are the figures that are necessary for the study of insect flight, and these are attained in the new instrument. With such a speed the movement of the film must be continuous, and a sharp image is possible only if the exposure does not exceed 1/400,000 second, and for this the electric spark gives a light of sufficiently short duration.

The apparatus is shown diagrammatically in the figure. R is a wheel 34·5 centimetres in diameter, which may be turned at a high speed by means of an electric motor. It carries two long strips of photographic film to receive the stereoscopic images. On the same axis, but outside the octagonal light-proof case, is fastened an interrupter, I, of fifty-five strips of copper, which serve to make and break the primary circuit of an induction coil fifty-four times every turn, or 2000 times a second. The secondary of the induction coil is connected with a pair of spark-gaps, E, arranged in series, the electrodes being of magnesium to increase



the light. The arrangement of the two gaps and their relation to the optical system are shown in plan (but reversed, left for right) in the upper left-hand corner of the figure. A condenser, L, is connected to the wires leading to the spark-gaps. The optical system is made clear by the figure, but the lenses are made of quartz and Iceland spar instead of glass, so as to be transparent to the actinic rays of short wavelength for which glass is opaque. A mirror, M, throws the pair of images on a ground-glass screen, D, or, on being turned up out of the way, it leaves a clear passage for them to be formed on the films. In order to prevent the photographs from being spoilt by multiple exposure, two shutters of thin steel, actuated by springs, are released electromagnetically one after the other, the interval being the duration of one turn of the wheel.

The movements photographed are determined as to time by fine wire prolongations of the prongs of a tuning-fork of 50 ~ a second, which are photographed at each successive exposure, and as to distance by a divided glass scale, which equally appears in every picture. It is, of course, necessary to ensure that the fly or other insect shall traverse the field of view just at the time that exposure is made. There is no difficulty in causing the creature to fly in the right direction, as a window is sufficient to determine the line of flight. One method by which M. Bull releases the fly at the right moment is by holding it in electromagnetically-operated forceps, which are relaxed by the same current which starts the first shutter. This works well enough with ordinary flies, but hymenoptera and some other insects hesitate and only make

their flight after the exposure is completed. For such cases, M. Bull encloses them in a glass tube with a very light mica door, which is moved by the insect in its flight, and which, making a contact, sets the shutter mechanism in action.

In order to study the movements represented on the films, which in nature are far too rapid to be followed by the eye, it is merely necessary to pass them through an ordinary kinematograph, making some fifteen exposures a second instead of the 1500 or 2000 a second employed in taking the photograph, and then the movement, 100 or more times as slow, will be seen, and in many cases easily followed. Where a still greater slowing is required, M. Bull arranges to make the film appear stationary for a much larger proportion of the whole interval than is usual, and then only two or three views a second are sufficient to give an apparently continuous movement. C. V. BOYS.

THE TOTAL SOLAR ECLIPSE, MAY 9, 1910.

THE following two communications from Port Davey, dated May 7 and 9 respectively, complete the account of Mr. McClean's expedition to Tasmania. In spite of the trying weather conditions, a very complete installation of instruments was successfully erected, but, as previously reported, clouds prevented their use during the eclipse.

The photographs accompanying the report were taken by Mr. H. Winkelmann, and the three here reproduced have been selected to illustrate the setting up of some of the instruments.

Port Davey, May 7, 1910.

"The weather since April 27 was execrable until May 4, and was not good until the following afternoon. Continuous gales, heavy rains, and floods made progress absolutely impossible, and no trustworthy tests were made before May 4. The ground became a quagmire, and the instruments were covered with rust, in spite of paraffin and oil. Rain got into the concave grating slide-holder, and the cloth began to peel off. The cœlostat mirror was badly discoloured, in spite of coverings of Japara and Willesden canvas. The siderostat mirror was also permanently fogged and slightly spotted, and in the morning, on uncovering (when possible), was covered with moisture. In addition to this, the ground shook at every footstep, and everything vibrated. The barricades proved very useful in protecting the instruments from the wind, which was so strong that during the gusts it was impossible to walk against it. On several days no coverings could be taken off, and work was at a standstill. The *Wainui*, which came in on May 1, had to take refuge in Schooner Cove on the other side of the Bathurst Channel until the following day. Our boat, which had to go over to pick up Mr. Short, from Sydney, and his instruments, could not get back, and we had to cross behind Mundy Island and land 1 mile across country from our camp, leaving the boat in a cove until the next day.

"On May 4, however, there were a few intervals of sunshine during the afternoon, and on May 5 the afternoon was fairly bright after a drizzling morning, while May 5 was cloudless and with a gentle breeze from the east, and much progress was made. The instruments fed by the siderostat were in accurate position, and some trial photographs were taken with the concave grating spectrograph which on development proved to be good in every way.

"Mr. Short, who arrived on May 1, has decided to feed his five-foot camera from an auxiliary mirror from the siderostat, as, with the wind that is likely to occur, it would not be steady on the equatorial mount, and on this mount have been placed his telephoto and Worthington's camera, as the latter could not be run correctly with his clock.

"Considerable difficulty had been found in driving the siderostat after about 3.15 in the afternoon, and a device had been put up to help the mirror cell arm round after that time. Owing to bad weather, no complete examination had been possible until May 7, when the mirror and cell were removed, and it was found that one of the balance-arm bearings had not sufficient play to allow the rollers to continue in contact with the cell. Filing down was tried, but there was not sufficient material to do this fully, and so the bearing was reversed. This gave considerable improvement, but before the time at which eclipse would occur it was found that the rollers reached the end of their slot, and greater power was required to drive them up the slope. Having no tools for continuing this groove, arrangements were made for a weight to be attached upwards to the cell arm, and this was found to answer; but considerable dangers of irregular drive are present in this method. An attempt was made to work the slow motions from the concave grating spectrograph, but, owing to the distance, no good results were obtained, and Mr. Dowsett was therefore placed in charge of the siderostat to follow instructions from the spectrograph, where the large image on the slit gives a quick idea of any movement either in right ascension or declination.

FIG. 1.—Beginning the erection of the instruments on Hixson Point. Figures from left to right—J. Brooks, F. K. McClean, A. Young, S. Dowsett.

"Drills commenced on May 6 both separately and generally. The allocation of the instruments to the members of the party has been arranged as follows:—

Siderostat	S. G. Dowsett

Instruments fed by siderostat.

Concave grating spectrograph ...	F. K. McClean
De la Rue coronagraph	A. Wilson
Short 5-ft. ,, ...	J. Short

Instruments fed by cœlostat.

16-ft. coronagraph	... ...	J. Brooks
42-in. spectrograph ...	... ...	H. Winkelmann
Telephoto	... ...	H. Winkelmann
Steward (dismounted)	... ...	E. Jeffs

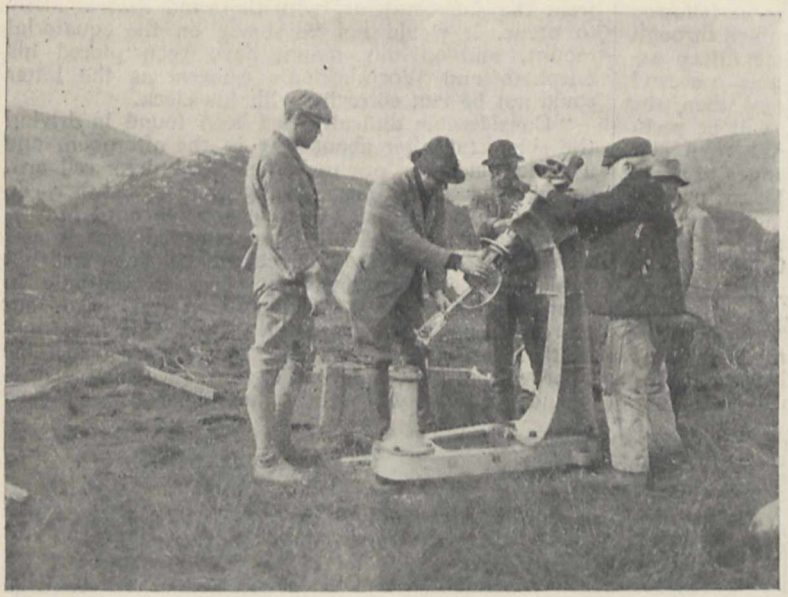


FIG. 2.—Setting up the 21-inch Siderostat.
Figures from left to right—A. Young, F. K. McClean, S. Dowsett, J. Brooks, J. Worthington.

Equatorial.

Short's equatorial mount carrying telephoto & Worthington camera and	J. Worthington
Time caller	A. Young

"Owing to the resilient nature of the ground, it was found advisable not to allow anyone to move about, and shutters were fitted to the 16-foot and De la Rue coronagraphs, which could be worked from the dark-slide ends. Winkelmann, who has two instruments in his charge, has only a step or two to make, and it is impossible to prevent him moving. In the following programme for the eclipse, the times mentioned are standard time (ten hours east), as given by Dr. A. M. W. Downing, F.R.S., and also local time at Pyramid Rock in the entrance to Port Davey, which is long. 145° 55′ E. and lat. 43° 22′ S. As the position of the observatory is long. 146° E. and lat. 43° 20′ S., the eclipse will start a little later, and finish a trifle earlier. The time was again checked on May 6 by Messrs. Brooks and Young, and the chronometer error found."

(Here follows a large table showing the exposures to be made in the various instruments. This is omitted here.)

"*Port Davey, May* 9, 1910.

"Rain commenced on the afternoon of May 8, and continued steadily all through May 9. No drills were possible. On the night of May 8 the dark slides were filled, and all were taken up to the observatory on the Monday afternoon, and, in spite of the rain, the instruments were made ready; but exposures were limited to one slide, which was opened at 5 seconds and closed at 200. There was a tremendous downpour during the eclipse, but it cleared a little afterwards. During totality there was a stretch of bright sky on the western horizon, and soon after sunset the clouds dispersed and a bright, starry night followed.

"Immediately after eclipse the barricades were pulled down and the ground prepared for the final packing."

Since the receipt of the above communications both Mr. McClean and Mr. Young have arrived home. They have both suffered from the effects of the hard work and inclement weather, and the former is still in the doctor's hands. While Mr. McClean has had considerable experience in roughing it, he describes his recent work in Tasmania as the most trying that he has yet had to contend with. Nevertheless, his keenness for eclipse work is by no means damped, for he is now looking forward to the eclipse of next year, which will be visible from islands in the Pacific Ocean, and is already commencing arrangements to observe it.

WILLIAM J. S. LOCKYER.

JOHN B. CARRUTHERS.

WE regret to have to record the death, at the early age of forty-one, of Mr. J. B. Carruthers, assistant director of agriculture in Trinidad. Mr. Carruthers only took up his new appointment last autumn, and with characteristic enthusiasm entered at once very energetically upon the task of making himself familiar with his fresh surroundings. The possibilities of rubber cultivation was the principal subject to occupy his attention, and to this end he visited most of the chief estates in Trinidad. Thence

FIG. 3.—Adjusting the Cœlostat.
J. Brooks on the left, F. K. McClean on the right.

he proceeded to Tobago—the dependency of the larger island—and here prosecuted his work under very adverse climatic conditions, with the result that on returning to Trinidad he was prostrated with a severe attack of malaria. After some four weeks' illness complications ensued, and he passed away on Sunday, July 17, from septic pneumonia following an operation.

John Bennett Carruthers, born in 1869, was the younger son of Mr. William Carruthers, F.R.S., until recently the keeper of the Botanical Department of the British Museum. He was educated at Dulwich College, the Royal School of Mines, and Griefswald University, Prussia. During this period appeared his first botanical contribution, "The Cystocarps of Some Species of Callophyllis and Rhodymenia" (Journal Linn. Soc., xxix., 77–86), and "The Canker of the Larch" (Journal Roy. Agr. Soc., 1891, Ser. iii., vol. ii.). A period as demonstrator in biology at the Royal Veterinary College, London, was followed by his appointment as professor of botany at Downton College, Wilts. Soon, however, he transferred his energies to the tropics, where his chief work was done.

In 1898 Carruthers went out under the joint auspices of the Ceylon Government and the Planters' Association to investigate a disease of cacao-trees. He proved successful, not only in ascertaining the cause of the disease, but in the frequently more difficult task of finding an effective remedy practicable under estate conditions. His successful work was recognised by his appointment in 1900 as mycologist to the Government of Ceylon and assistant director of the Royal Botanic Gardens.

In these days, when we regard a mycologist as necessary to any well-equipped agricultural department, it may come to many as a surprise that Carruthers's appointment, only ten years ago, was the first of its kind. He worked in Ceylon for five years, and in 1905 took up the directorship of the newly-formed Department of Agriculture for the Federated Malay States. Here he remained until he was invited to fill the Trinidad position, where it was expected that his special knowledge of cacao rubber and plant sanitation would prove of great value. These hopes have unfortunately been frustrated by his untimely death, but in the short space of time which intervened he initiated several important projects, and so recently as May contributed two papers to the Brussels International Congress on Tropical Agriculture and Colonial Development, whilst an account of rubber in Trinidad appears in the last issue of the *Trinidad Agricultural Bulletin*, of which he was joint editor.

Carruthers possessed the happy gift of "getting on well" with people, and officials and planters in many parts of the world, the members of the Royal Society of Edinburgh, the Linnean Society, the Association of Economic Biologists, the West India Committee, and a wide circle of friends unite in regretting his loss.

NOTES.

SIR E. RAY LANKESTER has been elected a foreign associate of the Paris Academy of Sciences in succession to the late Prof. Robert Koch.

THE following men of science have been elected foreign members of the Royal Society:—Dr. Svante Arrhenius, Dr. Jean Baptiste Édouard Bornet, Dr. Paul Ehrlich, Prof. Vito Volterra, and Dr. August Weismann.

A REUTER telegram from Wellington states that a new crater is in eruption near the dormant geyser of Waimangu (Rotorua), and is ejecting mud and pieces of rock. Its proximity to the volcano of Tarawera renders the outbreak significant.

MR. JOHN RAMSBOTTOM has been appointed an assistant in the Department of Botany, British Museum. Mr. Ramsbottom was lately exhibitioner of Emmanuel College, Cambridge, and Robert Platt biological research scholar, Victoria University, Manchester. He will devote himself to the fungi.

IN the course of a reply to a question asked in the House of Commons on Monday with reference to the Advisory Committee on Aërial Navigation, Mr. Asquith said that a further report of the committee will be laid before Parliament within a few days. Captain Murray Sueter, R.N., representing the Admiralty, and Mr. Mervyn O'Gorman, superintendent of the Balloon Factory, have been appointed additional members of the committee. The total approximate cost of the committee to the present date is 10,000*l*.

THE property in the centre of the Cheddar Cliffs, on which the quarry occurs that has caused much disfigurement to the gorge, has been purchased by the National Trust. Certain existing contracts, which expire in 1912, will be performed exclusively from the loose stone lying fallen in the quarry. No further blasting will take place. The National Trust hopes that by the purchase of this property the cliffs have been secured from all danger of further spoliation. The immediate and pressing danger to the finest part of the gorge arising from the vibration caused by blasting has now been stopped.

ACCORDING to a communication from Mr. J. T. Jenkins, published in the *Field* of July 23, there is reason to believe that the fur-seals on the Pribilov and other islands of the North Pacific are in imminent danger, if not of extermination, at all events of being so reduced in numbers as to be no longer of any commercial value. It will be remembered that the Anglo-American Commission of 1896 insisted upon the repression of pelagic sealing, and it was eventually agreed that, while this was to be absolutely prohibited to Americans, it would be permitted to British subjects only outside a sixty-mile limit from the Pribilovs. The Japanese were, however, no party to the arbitration by which this was arranged at Paris, and their vessels have for the last few years been actively engaged in pelagic sealing around the Pribilovs immediately outside the three-mile limit. In 1907 Canadians had fifteen vessels engaged in pelagic sealing, which took 5240 skins, while in 1908 there were eight vessels, which secured 4452 skins. On the other hand, the Japanese had thirty-six vessels in 1907 and thirty-eight in 1908, of which the respective takes were 9000 and 13,197. If the latter rate of killing be continued—especially when it is recalled that the great majority of seals killed in the open sea are females—it will not be many years before the herds will be practically annihilated. The case is one where international action is urgently demanded, and that at an early date.

AN article upon the character of King Edward VII. in the current number of the *Quarterly Review* gives much interesting information upon the early life and training of the late King. Queen Victoria and the Prince Consort appear to have considered the minutest details of the physical, intellectual, and moral training of their son, who was to become our King. The German blood and upbringing of the Prince Consort led him to attach great importance to thoroughness of educational training, while letters and notes "record the Queen's anxious solicitude that no boyish longing for excitement should interfere with the Prince's 'adherence to and perseverance in the plan both of studies and life' laid down by his father." Every hour

of the young Prince's time was mapped out by his governors and preceptors; and it is not surprising that under this high-pressure system, and without the stimulus of competition, the Royal pupil did not reach the lofty standard always before the mind of the Prince Consort. Every book was placed before the boy as a task, and the subjects in which he received instruction appear to have been presented in their driest form. Had more reasonable educational methods been adopted, and the Prince's individuality been considered instead of making it subservient to scholastic ideas, there would have been no occasion for the expressions of disappointment at his want of studious reflection. He was an acute observer, and could learn better from things than words. Even in his early days his teacher said of him that he was "learning almost unconsciously from objective teaching much which, I think, could never have been taught him subjectively"; and this capacity was his characteristic through life. While at Edinburgh as a lad of eighteen, he attended Lord Playfair's lectures on the composition and working of iron ores, and he never altogether forgot them. "They imparted to him a certain liking for practical science and its votaries which he never wholly lost." His interests were practical rather than academic, and his brilliant success as Prince of Wales and King was achieved not so much by his studies with tutors as in spite of them.

WE regret to announce the death of Mr. J. Ellard Gore, the well-known amateur astronomer, who did much to popularise astronomical science. While in the Public Works Department in the Punjab, he interested himself in scientific studies, and the result was the publication of "Southern Stellar Objects" (1877). From that date he was a voluminous writer on the descriptive side of astronomy, and his works have been welcomed on account of the general accuracy of his facts and the enthusiasm which his writings inspired. On double stars, variables, and planetary markings he was regarded as an authority. One of his noteworthy works was his share in the volume of astronomy which he wrote in the "Concise Knowledge" series in collaboration with Prof. Fowler and the late Miss Clerke. He was also well known for his translations of several of Flammarion's works.

THE processes of pottery-making as it appears in prehistoric interments in Europe is well illustrated by two contributions in *Man* for July, in which Mr. N. W. Thomas and Capt. A. J. N. Tremearne describe the methods in vogue in South and North Nigeria respectively. In neither district is the wheel used, the vessel being built up out of flattened ribbons of soft clay over the neck and shoulders of an old broken pot. Capt. Tremearne heard of, but did not witness, a still ruder method, in which the clay is shaped for the body of the pot in a hole in the ground, the upper portion being subsequently added in the way already described.

MUCH discussion has arisen regarding the date of the narrow cultivation terraces known in England as lynchets, and some authorities, like Dr. Mackintosh and others, have gone so far as to deny that they are artificial, asserting that they are merely natural raised beaches. Their contiguity to Neolithic and Bronze-age camps certainly lends much support to the view that they represent a form of prehistoric agriculture. Mr. W. A. Dutt, in *Man* for July, quotes an account of similar constructions in Abyssinia from Capt. Stigand's "To Abyssinia through an Unknown Land." The close analogies presented by these to the English examples are clearly in favour of the view that they are the work of a primitive race.

AN interesting phase of lacustrine culture is described in a monograph by Mr. S. A. Barnett, on the Klamath Lake and Modoc Indians of north-west California and southern Oregon, contributed to vol. v. of the Memoirs issued by the University of California. This specialised culture is largely based upon the use of the tule reed for hut-building, basketry, and other purposes. Their food is procured from the lakes on the shores of which they dwell, and for this purpose they use a peculiar duck arrow, fishing and bird nets, hooks of bone, and dug-out canoes. Stone implements, such as mullers, mortars and pestles, or mauls, are in common use. But many of these are relics of earlier Indian tribes, and their gradual disappearance before a culture based upon the use of metals is shown by the fact that they are now largely used as charms in medicine and gambling. A man, for instance, will take a large obsidian knife or spear-point, and, after reciting a charm, will place it under the mat on which a game is being played to ensure good luck. Fire is procured with a drill consisting of a piece of dry willow root twirled in a base block of cedar wood, for which purpose the canoe paddle is very commonly used.

UNDER the editorship of Messrs. W. M. Webb and E. S. Grew, *Knowledge* is much improved in general appearance, and, if we may judge from the July number, in the character of its contents. In one of the articles, the Rev. T. R. R. Stebbing urges that the gender of all generic names in zoology should be regarded as masculine, mainly on account of the difficulty of deciding as to the true gender of many of the terms now in use.

WE have been favoured with a copy of the report of the Danish Oceanographic Expedition during the winter of 1908–9, under Dr. J. Schmidt, published in *Geografisk Tidskrift* (20, B.H. vi., 1910, pp. 243–55). The area surveyed extends from Iceland through the North Sea on the one hand, and along the eastern border of the Atlantic on the other, into the Mediterranean as far east as Greece. The report is illustrated with bathymetric tables of temperature and salinity in different parts of the area, and likewise with a chart of the isotherms and "isohalines" on the two sides of Gibraltar. The dissimilarity between the distribution of isothermal and isohalic areas in the latter region is very striking and curious.

DETERMINATE evolution in the colour-pattern of "lady-beetles" forms the subject of an elaborately illustrated memoir by Mr. R. H. Johnson, published by the Carnegie Institution of Washington (Publication No. 122). Lady-birds, to give these beetles their ordinary name, were selected for the purpose of this investigation on account of their abundance, the facility with which they can be reared in confinement, their distribution, and the circumstance that they were recently, and perhaps still are, in an active state of evolution. Members of the leaf-eating epilachnine group were chosen for special study as being easier to rear than the aphid-eating forms. As regards the object of the colouring of the Coccinellidæ, the author accepts the view that it belongs to the warning, or aposematic, type. No single pattern can at present be recognised as forming the ancestral type, and it is evident that Eimer's laws of pattern-development are inapplicable to the present case. "Natural selection, if at all active, is principally conservative of the spotted pattern. In spite of this, determinate variation, largely actuated by the effect of the environment on the germ-plasm, and probably preponderance as well, have accomplished marked evolution of the pattern from this condition. Evolution proceeds by waves as well as by

even flow and by mutation in different characteristics at different times."

IN the *Scientific American* of July 2, Mr. W. L. Beasley describes, with large-size illustrations, the method employed in the American Museum of Natural History, New York, of mounting the skins of large mammals on specially prepared models, or "manikins," which in some cases are based on clay statuettes of living specimens. After being roughly modelled, the manikins are carefully finished by artists, and the skins fitted upon them, the method being illustrated in the case of an East African zebra, or bonte-quagga, and a hippopotamus. The article specially relates to the collection of large mammals obtained by the expedition to East Africa under Mr. Roosevelt. The director of the museum, Dr. Bumpus, has planned a comprehensive and striking exhibition of African mammals, to be, in due course, displayed in the buildings under his charge. The main part of this exhibit is destined to be shown in a series of new halls about to be added to the west wing of the museum, but some specimens will be used to fill gaps in the existing series. The cost of the additions to the building is to be defrayed by Mr. Samuel Thorne, who has already done much for the museum. Unless funds are forthcoming for the addition of a new north-west wing to our own Natural History Museum, that institution will be altogether beaten by New York in the show of big-game animals.

THE July number of the *Selborne Magazine*, with which *Nature Notes* is now incorporated, contains an abbreviated report of the lecture delivered by Mr. J. Buckland on June 17, at the annual meeting of the Selborne Society, on the traffic in feathers and the need for legislation in connection with the same. To the same issue Mr. Buckland communicates an illustrated article on illegal practices in the feather-trade, dealing especially with India. It is pointed out that, in 1903, the Indian Government prohibited the exportation of the skins and feathers of birds, except those of domesticated species and ostriches, together with natural-history specimens. This prohibition, according to the author, is, however, to a great extent evaded by feathers being shipped as cow-hair, horse-hair, or silk material. One such consignment of "cow-hair" was opened by the custom-house officers at the London Docks in 1908, and found to contain more than 6000 paraquet-skins; but as these were not contraband, they were, after some delay, handed over to the consignee. Further investigation proved that, during a previous period of eight weeks, no fewer than twenty-three cases of bird-skins had been landed in London under false declarations. The author sums up as follows:—"A vast number of the feathers which are used in the millinery trade in Great Britain are able to be brought into her ports only by means of false declarations, which are a direct evasion of the law, and which declarations are made deliberately for the purpose of deceiving ship captains and the customs authorities of the countries from which the feathers are shipped."

THE fourth part of Bulletin No. 82 of the Entomological Bureau of the U.S. Department of Agriculture is devoted to an account, by Mr. W. B. Parker, of the life-history and the means of controlling the hop flea-beetle (*Psylliodes punctulata*), which has of late years done much damage to hops in British Columbia. The species, which is widely distributed over the northern United States, and ranges into southern Canada, normally feeds on rhubarb, sugar-beet, and a few other plants, and was not known as a serious pest until a few years ago, when it began to devastate the hop-gardens in certain parts of British Columbia. When hop-cultivation commenced in the Chilliwack Valley in 1894, the beetle was noticed, but did little harm until 1903, when it appeared in force. From 1904 until 1908 the numbers of these insects gradually increased, attaining their maximum in the year last named. "As soon as the hops began pushing through the ground, the beetles were observed swarming around the vines, giving the soil in the immediate vicinity a black metallic appearance. These swarms of flea-beetles devoured the hop-shoots as fast as they appeared, and in places where the vines were a foot or more on the string the attack was so severe that in a few days the field looked as if it had been burned. The infestation resulted in a loss of about 75 per cent. of the crop."

THEORIES of life we have in plenty; it is somewhat a novelty to come across a pamphlet in which we have a theory of death propounded ("Das Altern und der physiologische Tod." By M. Mühlmann. Published by G. Fischer, Jena. Price 1.20 marks). The occurrence of physiological death is comparatively rare; most human beings die of accident, under which term disease is, of course, included; very few pass unscathed from such accidents, and die of simple old age, a gradual slowing down and final stoppage of life's machinery. But when it does occur, Dr. Mühlmann's theory is that it is due primarily to changes in the nerve cells, and that the run-down of the other organs is produced secondarily by changes in the ruling system of the body, the nervous system. Moreover, this degenerative change, which becomes evident to the microscope as a formation of pigmentary and lipoid granules, begins quite early in life; from one point of view, therefore, it is a form of growth which produces death, and considerable importance is laid by the author upon granules in cells as an essential protoplasmic constituent. The *brochure* contains many interesting data, such as the rate of growth of the different organs in various periods of life, and this, together with his views on the phenomena of regeneration, will amply repay careful perusal.

A NUMBER of the *Bulletin du Jardin Imperial Botanique*, St. Petersburg (vol. ix., part ii.), is devoted to a paper on lichens by Mr. A. N. Danilov, in which he adduces morphological evidence opposed to the theory of a mutually advantageous symbiotic union of alga and fungus. In the summary the author states that his results confirm the evidence of Peirce and Schneider with regard to the close investment of the algal gonidia with a net of hyphal threads, and the complete absorption of the contents of the gonidial cells.

ARISING out of a demand from members of the Manchester Microscopical Society for specimens illustrative of marine zoology, a quarterly publication, the *Micrologist*, has been initiated by Messrs. Flatters, Milborne, and McKechnie, of Manchester, which will contain directions for manipulations of such specimens, and thereby take the place of instructions that would otherwise be required. The specimens will be issued quarterly with the journal, and mounted preparations will also be available for purchase.

A NEW volume—the fifth—of the Circulars of the Royal Botanic Gardens, Ceylon, opens with a report on the tea plots at the Peradeniya experiment station, and subsequent numbers deal with "Rubber in the Early Days" and a visit to a rubber factory. In the last named, Dr. J. C. Willis gives an account of a visit to the large factory in Hanover. With regard to the tea experiments, the chief

point is the proved value of green manuring, for which purpose *Erythrina spp.* (Dadap) and *Crotalaria striata* were found to be most suitable.

THE exhibition at Shepherd's Bush has naturally created an interest in the methods and craft of "Japanese gardens." Judging from an illustrated article in the July number of *Irish Gardening*, a typical and most successful example of such a garden has been laid out at the Tully nurseries, Kildare, which to those interested would certainly repay a visit. It is explained that such gardens are purely pleasure resorts, and therefore the practice displayed therein is entirely distinct from the methods adopted in ordinary and agricultural gardens, in which the Japanese are fully alive to the value of intensive cultivation.

THE first three numbers of the current volume of the Bulletin of the American Geographical Society contain a detailed examination of trade routes in the economic geography of Bolivia, by Prof. Isaiah Bowman. The author deals at length with the resources and population of Bolivia in relation to the natural features of the country, and concludes that, in spite of the fact that 90 per cent. of Bolivia drains to the Atlantic and 10 per cent. is interior basin drainage with no outlet whatever to the Pacific, nevertheless, geographical position and the distribution of resources and climate are here equally powerful factors with topography. The Atlantic slope, and not the Pacific slope, is, and will long remain, the back door to Bolivia; for the section of the country in which the population is found looks to the Pacific, and the first essential of all the trade routes is a short line to the coast.

MR. W. JOERG examines the present state of our knowledge of the tectonic lines of the northern part of the Cordillera of North America in a paper published in the Bulletin of the American Geographical Society (p. 161). Basing his discussion chiefly on the summary contained in the final volume of Suess's "Antlitz der Erde," the author suggests the recognition of the Alaskides, as a separate province of major rank, as a subdivision of the Cordillera. This would give three divisions: the northern Cordillera or Alaskides, the central Cordillera, and the southern Cordillera or Lower California and the Mexican Highland. The boundary between the first and second would be the zone of coalescence, and between the second and third the depression along Salton Sink, the Gila, and the Rio Grande.

THE director-general of Indian observatories has issued a memorandum, dated June 9, on the meteorological conditions prevailing before the south-west monsoon of 1910 (June to early October). Dr. Walker has pointed out that the rainfall in India brought by this monsoon is apparently affected by previous conditions over a large part of the earth's surface, and that it is only when these are strongly favourable or otherwise that a definite forecast is justified. One of the many favourable signs is, as a rule, the prevalence of high barometric pressure in South America and of low pressure in the Indian Ocean prior to the period of the monsoon. At Buenos Aires pressure was in excess in March, April, and May last, but in the Indian Ocean conditions appeared to have been, on the whole, slightly unfavourable. From these and other factors specified in the memorandum the inferences drawn are that there appears to be no cause for expecting a large excess or defect in the total amount of monsoon rainfall. The rains are likely to be less steady than usual, especially those due to the Arabian Sea current. Rainfall due to the Bay current is likely to be, on the whole, more plentiful by comparison with the normal than that due to the Arabian Sea current.

AT the international meteorological conference at Innsbruck (September, 1905) Prof. Hellmann stated that the important question of the comparison of the barometers of the various meteorological institutes had engaged the attention of several conferences, but had not been solved in a satisfactory manner. Dr. Köppen also pointed out that so long as the differences between barometric standards are unknown, discontinuities arise when isobars are drawn for large areas. The conference finally arranged that the necessary work involved by such comparisons should be subdivided among the chief institutes, and the result of the part undertaken by the Prussian Meteorological Office is contained in one of the useful papers by Dr. Hellmann in the report of that institute for 1909. The comparisons of the standards at the central offices of the various German and some foreign systems show that at some stations (especially Potsdam and Zürich) the barometers agreed closely with the Berlin instrument, while others showed ± differences of appreciable amount, the greatest being 0·246 mm. (nearly 0·01 inch). The larger differences are thought to be due to the mercury having become unclean; at all events, the results have justified the expense and care bestowed upon the somewhat laborious work.

WE have received separate copies of several papers by Prof. S. Lussana, of the University of Siena, which have appeared recently in *Il Nuovo Cimento*. One of them deals with the coefficients of compressibility and of dilatation with temperature of certain pure metals and alloys. The coefficients were measured by means of a dilatometer containing the material enclosed in a metal case. The change of volume was measured by the change of resistance of a platinum wire in the capillary tube of the dilatometer as mercury was forced along the tube by the contraction of the material. The values obtained allow the difference between the specific heats at constant pressure and temperature, respectively, to be calculated. For pure metals the difference increases as the temperature rises, but for alloys it in general decreases. In nearly all cases it decreases with increase of pressure. The bearing of Prof. Lussana's work on the improvement which has been introduced into the law of Dulong and Petit by the substitution by Prof. Richarz of the specific heat at constant volume for that at constant pressure will be obvious to our readers.

IN an article on the renewal of sulphated storage cells, reproduced from the *Electrical World* in the *Electrical Review* for July 1, Mr. J. O. Hamilton describes a method of dealing with such cells which has proved very successful at the Kansas State College. If on test the efficiency of a cell sinks to 50 per cent. or lower, the plates are removed and washed thoroughly with distilled water. They are then placed in a cell containing a 2 to 5 per cent. solution of caustic soda in water, and the charging current sent through the cell in the usual way. If the sulphate on the positive plate does not disappear in the time of the ordinary charge, and the solution gives an acid reaction with litmus paper, more caustic soda must be added to the solution, and the charging continued until the plate has the usual chocolate appearance. The plates should then be removed from the soda solution, well washed, replaced in the sulphuric acid solution, and the charging continued until gassing begins. Many cells have had their efficiencies raised from 25 to 75 per cent. by six hours' charge, and Mr. Hamilton considers that any cell which will still hold together will well repay treatment by this method.

Terrestrial Magnetism and Atmospheric Electricity for June contains an article by Dr. L. A. Bauer and Mr. W. J. Peters in which the complete magnetic results of the first cruise of the *Carnegie* are given. After an extensive series of tests of the vessel at Long Island, it was found that a determination of any magnetic element could be made on it with an absolute accuracy not far behind that attained by experienced observers on land. This conclusion was confirmed by further observations made at Falmouth at the end of the trip across the Atlantic. The observations made at sea show that the present charts of the Atlantic require revision, as they show compass variations which are in many cases more than 1° in error, and in some cases more than 2°. These errors appear to have been introduced by the application of a correction for secular variation at points at which no determinations of that quantity had been made. A further paper by Mr. E. Kidson deals with the observations of electrical conductivity and of radio-activity of the atmosphere made during the cruise. The conductivity was determined by means of a Gerdien apparatus, and always proved low in the neighbourhood of land, and persistently higher for positive than for negative electricity. At night the conductivity appears to be nearly constant, and about double what it is during the day. It will be seen that these observations are likely to render some modifications of the current theories of atmospheric electricity necessary. The radio-activity was determined by the negatively charged exposed wire method, the decay of activity of the wire being observed by means of an electroscope. It appears to be due to radium emanation and to be derived from the land.

A "SHORT History of the Academy of Natural Sciences of Philadelphia" has been prepared by Dr. Edward J. Nolan, recording secretary and librarian, and published by the academy. This sketch of the academy's activities is to be regarded as preliminary merely to a detailed history to be issued in connection with the proposed celebration of the centenary of the academy in 1912. The academy accomplishes its work in four departments—the library, the museum, the publication office, and the department of instruction and lectures. The library, exclusively for reference, now contains about 60,000 volumes, almost entirely on the natural sciences; in many respects it is the most important collection of the kind in America. It is claimed for the academy's museum that it is one of the most important in existence. The vertebrate animals number about 130,000 specimens, 12,000 being mammals, 60,000 birds, 20,000 reptiles, and 40,000 fishes. The insects are estimated at nearly 400,000 specimens, and the shells at a million and one-half. There are in the cases 50,000 specimens of fossils, 30,000 minerals, 20,000 pieces of archæological material, and more than 600,000 preparations of dried plants. The remaining departments are equally extensive and enterprising. The academy has twice received appropriations from the State legislature, 4000*l.* in 1905 and 30,000*l.* in 1908.

A VALUABLE supplement to the meteorological observations undertaken by the University, Manchester, has been described by Messrs. Hayhurst and Pring under the title "Examination of the Atmosphere at Various Altitudes for Oxides of Nitrogen and Ozone," in the Journal of the Chemical Society. Previous estimates of the amount of ozone have ranged from 0·01 to 31·6 milligrams per cubic metre for the minimum quantity found, and from 0·03 to 158·0 for the maximum quantity, figures which appear to indicate a range of experimental error in the ratio of 3000 to 1. The very high values found by several observers are no doubt due to the catalytic action of oxides of nitrogen upon potassium iodide solutions exposed to air, whereby a mere trace of oxide may act as a "carrier" of oxygen to an indefinitely large quantity of iodide; the similar action of sunlight in promoting oxidation of the iodide is also important as a further source of error. In the experiments now described, air was blown through bulbs containing potassium iodide either at ground-level or attached to kites or balloons; the bulbs were protected from light, and the presence of ozone was inferred, not from the mere liberation of iodine, but from the production of alkali and iodate. When this criterion was employed, it was found that whilst oxides of nitrogen were present in variable proportions, the amount of ozone at ground-level and at altitudes up to 8000 feet was less than 0·003 mg. in 1 to 10 cubic metres, or less than 1 part by volume in 4,000,000,000 parts of air. At very high altitudes, up to ten miles, small amounts of ozone were detected, the quantity found averaging 0·04 milligram in 0·1 to 0·3 cubic metre of air, or 1 part in 3,000,000 to 9,000,000 by volume. These experiments are of value as showing that the presence and merits of ozone in the fresh air of sea and country are as much a matter of fiction as the substantial excess of oxygen which was discovered by over-zealous investigators prior to the researches of Cavendish; in fact, the only method of enjoying the effects of atmospheric ozone appears to be by ascending in a free balloon, which bursts and descends as a parachute after rising to a height of several miles.

COMMENTING on the Bournemouth Aviation Meeting, *Engineering* for July 22 remarks that perhaps the most interesting feature of the meeting from the technical point of view is the fact that all the best performances were done with aëroplanes fitted with the Gnome rotary engine. In fact, it seemed as if no machine which was not fitted with this engine had any chance of success. All engines of other types appeared to give trouble, and not to be able to furnish the desired power for any long time at a stretch. In some cases the trouble was hot bearings, especially big ends. In others the engine appeared simply not to be able to maintain its power, and, after flying a short distance, it could not sustain the machine in the air. The performances of the English engines were disappointing.

A NEW book by Dr. Berry Hart, of Edinburgh, entitled "Some Phases of Evolution and Heredity," will be issued very shortly by Messrs. Rebman, Ltd.

WE have received from Messrs. Friedlaender, 11 Karlstrasse, Berlin, a copy of the third part of a catalogue of entomological books and papers, this being devoted to Lepidoptera; also a catalogue of books on natural history, sports, travel, &c., offered by Mr. B. H. Blackwell, 50 Broad Street, Oxford.

MESSRS. SWAN SONNENSCHEIN AND CO., LTD., will issue shortly a companion volume to Dr. Theal's "History of South Africa," to be entitled "The Yellow and Dark Skinned People of Africa." This will contain a summary of all that is included in Dr. Theal's "History and Ethnography of South Africa" (3 vols.), and is especially intended for the use of ethnographical students.

THE latest addition to the series of "Savants du Jour," published by M. Gauthier-Villars, of Paris, deals with the life and work of Prof. Émile Picard, of the University of Paris. Prof. Picard was born in Paris on July 24, 1856, and his biography, as here written by M. Ernest Lebon, shows a growing regard from his school-days for algebra and mathematical analysis, which eventually led in 1897 to

his appointment to the chair in these subjects in the University of Paris. The list of Prof. Picard's works and papers on mathematical subjects occupies a very large part of the memoir, which also contains an appreciation of his work by Prof. Henri Poincaré, delivered in 1888 in presenting him with the grand prize of the Paris Academy of Sciences for Mathematical Science.

THE first issue of a new annual, entitled "The Green Book of London Society," has been received. Its subtitle describes the volume as a directory of the Court, of society, and of the political and official world, including celebrities in art, literature, science, and sport, with many other subjects of current interest. The editors of the compilation are Mr. Douglas Sladen, who, it will be remembered, compiled "Who's Who," and Mr. W. Wigmore. Under science are given lists of some men of distinguished eminence in the London scientific world, with the researches and discoveries which have made them famous; the most important scientific and engineering institutions; and some of the chief scientific periodicals. The book runs to 487 pages, and is published by Messrs. J. Whitaker and Sons, Ltd., at 5*s*. net.

THE sixth edition, revised, of Dr. Bernard Dyer's small handbook on "Fertilisers and Feeding Stuffs: their Properties and Uses," has just been published by Messrs. Crosby Lockwood and Son, price one shilling net. Short descriptions have been added of the two new fertilisers—nitrate of lime and calcium cyanamide—in which atmospheric nitrogen is fixed, but the practical disadvantages of their use are pointed out. Of the former Dr. Dyer remarks:—"It has a serious practical disadvantage in its deliquescent property, which makes it necessary to sow it immediately the air-tight packages in which it is sent out are opened, and it cannot be conveniently sown in moist weather." Calcium cyanamide is also unpleasant to sow. Dr. Dyer's book is a manual from which practical farmers can obtain many useful hints as to profitable procedure in fertilising the soil for different crops and feeding the stock. The text of the Act of 1906, referring to fertilisers and feeding stuffs, is printed in full, together with the regulations of the Board of Agriculture and Fisheries for the protection of farmers from the supply of adulterated materials.

OUR ASTRONOMICAL COLUMN.

ASTRONOMICAL OCCURRENCES IN AUGUST:—

Aug. 2. 11h. 18m. Moon in conjunction with Venus. (Venus 4° 8′ S.).
8. 9h. 11m. Minimum of Algol (*β* Persei).
9. 6h. 26m. Moon in conjunction with Jupiter 2° 34′ S.
10. 12h. 46m. Venus and Neptune in conjunction. Venus 0° 27′ N.
11—13. Maximum of August Perseid display. Radiant 44°+57°.
14. Venus. Illuminated portion of disc=0·889.
16. Saturn. Major axis of outer ring=43·21″. Minor axis=13·51″.
25. 5h. 46m. Moon in conjunction with Saturn. Saturn 1° 18′ S.
27. 14h. 11m. to 14h. 54m. Moon occults *τ* Tauri. (Mag. 4·3).
28. 10h. 53m. Minimum of Algol (*β* Persei).
30. 11h. Mercury at greatest elongation, E. 27°.

SUBJECTIVE PHENOMENA ON MARS.—In No. 4427 of the *Astronomische Nachrichten* M. Antoniadi returns to the discussion of the objective reality of the dark band seen circling the Martian snowcap. He previously directed attention to the fact that this band was not visible on photographs of the planet, and suggested that its appearance during visual observations was simply an effect of contrast. This argument was weakened by the possibility of photographic "spreading" in the sensitive film being sufficient to account for the obliteration of the dark band. But M. Antoniadi now points out that on the photographs taken with yellow screens during the last opposition, the caps are no more intense than the "continental" areas, and from this he suggests that "spreading" is negligible. Yet the dark band is not to be found on these photographs, and therefore, if the premises are true, it appears that its visibility in visual observations is only a subjective phenomenon.

THE GENESIS OF VARIOUS LUNAR FEATURES.—In the *Comptes rendus*, No. 2 (July 11), M. Puiseux discusses the probable origins of the circles and of the angular outlines of lunar crevasses shown in the polar regions of the moon on the concluding sheets of the great photographic atlas of the moon published by the Paris Observatory. He points out that many of the circles appear in chains, of two or more, parallel or perpendicular to the meridian. Where two of these circles intersect, the point of junction is marked by a small crater or a considerable elevation, and M. Puiseux believes that this is evidence against Faye's theory that the *bourrelets* were formed by repeated periodic overflowings which filled in the circle. Such differences of level as are now revealed would be incompatible with this theory. On the same plate (lxvi.) is seen a number of circles aligned on, or across, a meridian, and joined by a high, narrow ridge, and M. Puiseux considers that these are evidence against the meteoric bombardment theory.

Near the northern pole the geometrical contours of circles are exceptional, and angular features predominate. The ridges here are found to be in echelon, and M. Puiseux considers that the sharp angles were formed where previous ejecta prevented the eruptions from following the general line of weakness to which, however, the subsequent eruptions returned, thus producing the echelon form.

HALLEY'S COMET.—A preliminary account of the observations made by an expedition which journeyed to the Pic du Midi to observe Halley's comet is given in No. 2 of the *Comptes rendus* (July 11) by MM. G. Millochau and H. Godard.

Arrangements were made to photograph, regularly, the comet and its spectrum, but they were sadly interfered with by bad weather. No spectrograms were secured, but several good photographs were taken with a Zeiss "astroplanar" lens having a large field. The photograph secured on May 29 showed a bright condensation, detached from the nucleus, which at 2° from the head became broader, and was prolonged some 8° into the tail. The photograph of May 31 shows a secondary nucleus at a distance of 17″ from the primary.

A long summary of the numerous observations made at different places during the passage of the comet is published in the July number of the *Bulletin de la Société astronomique de France*, and is illustrated by a number of drawings and photographs.

THE GNOMON IN ANCIENT ASTRONOMY.—All who are interested in the early days of astronomical observation will find an article by M. Jules Sagaret, published in No. 17 of the *Revue scientifique*, full of interest. M. Sagaret discusses at length the *rôle* played by the gnomon in the observations made by the ancient Chinese, Babylonians, Egyptians, &c., for the determination of time and season, especially of the solstices, and shows that in a vertical bamboo rod the Chinese of about the second century B.C. found a, comparatively, very effective astronomical instrument.

THE LEEDS ASTRONOMICAL SOCIETY.—The Journal and Transactions of the Leeds Astronomical Society for 1909 (No. 17) shows that this society is endeavouring to popularise the study of astronomy with its wonted vigour. In addition to numerous interesting papers read by members at the meetings of the society, there are a number of reprints of popular articles contributed to various publications. Among these are articles on current phenomena contributed by Messrs. Whitmell, Scriven Bolton, and Ellison Hawks, and a series of articles by Mr. Elgie which appeared in *T.P.'s Weekly* over the pseudonym "F.R.A.S."

RECENT WORK OF GEOLOGICAL SURVEYS.[1]

IV.—THE UNITED STATES.

THE United States Geological Survey frequently assists research by publications in which definite subjects are dealt with from a comprehensive point of view. The Bibliography of North American Geology for 1906 and 1907 was issued in 1909. A bibliography of Archæan and Algonkian geology, divided up under the various States, is given in Bulletin 300 (pp. 940, 1909), in which Messrs.

FIG. 1.—Alluvial flat of Rock Creek Valley, Laramie Basin, looking towards the Pre-Cambrian hills.

Van Hise and Leith review the pre-Cambrian geology of North America. As the title shows, Canada is included, and the summaries given of published work make this volume welcome in every library of scientific reference. Bulletin 364 (1909) is by Messrs. Darton and Siebenthal on the Laramie basin in south-eastern Wyoming. The name Casper formation is proposed (p. 13) for Carboniferous limestones and sandstones resting on pre-Cambrian rocks on both sides of the Laramie Range. The Laramie beds, over which much discussion has arisen, may be represented by the highest sandstones and shales of the Cretaceous Montana series, and an unconformity, now widely recognised, occurs between this series and the Cainozoic beds (pp. 35 and 43). The Laramie question, it may be observed, has been recently discussed by Mr. Whitman Cross (Proc. Washington Acad. Sci., vol. xi., 1909, p. 27), who proposes the name Shoshone Group for the beds elsewhere styled Laramie, but lying above the unconformity. The coloured geological map in the memoir, and the illustrations, show well the character of the broad valley of the Laramie, with its floor 7000 feet or more above the sea, and gneissic hills rising some 3000 feet higher on the east and west (Fig. 1). Interesting contrasts are afforded in a great variety of strata, especially where Oligocene sands form level ground in hollows of the Archæan rocks of the Laramie range.

Mr. D. F. MacDonald, in Bulletin 384, carries us up to the old rocks of the Canadian border in the extreme north of Idaho, where a large series of strata exist that are presumably of pre-Cambrian age. Mr. J. S. Diller (Bulletin 353) describes the Taylorsville region at the north end of the Sierra Nevada in California, and to the south-east of the great cone of Shasta. Compression of the Jurassic and older sediments occurred here in early Cretaceous times; the present Sierra region began to rise, and the Great Basin slipped away from it along faults (p. 108). Though the sea, as happened in so many other areas, returned during the Upper Cretaceous epoch, it did not dominate the new mountains; soon after, it became excluded altogether. Elevation continued in the Eocene, and gold-bearing gravels streamed down until the end of the Pliocene, when great warping took place, accompanied by faulting. Hence (p. 110) interesting changes in the drainage-lines occurred, and old valley-floors are traceable that undulate up and down, with bulges rising 1000 feet high across the former courses of the streams. In describing the volcanic rocks, which are of various ages, from Silurian to Pliocene, the author uses the terms meta-rhyolite and meta-andesite for types much altered from their original condition (p. 81). The famous Lassen Peak volcano lies a little outside the area now described.

Mr. W. T. Lee (Bulletin 352) has explored a part of western Arizona, where the Colorado River emerges from the Grand Canyon and runs southward, forming the State boundary. Fine examples of consolidated, and probably Quaternary, conglomerates and gravels, weathered out into huge bluffs, are given in the plates. The author describes the erosion of valleys that went on in Cainozoic time (p. 58), accompanied by faulting; then followed the great uplift of the plateau, and renewed excavation by the streams, the Colorado being now driven to carve out the Grand Canyon. The gravel deposits in the broad Detrital-Sacramento valley to the south are 2000 feet thick, and are believed to have been deposited after the erosion of the canyon. The obstacle that checked the southward flow of the river down this valley may have been a barrier of comparatively modern basalt, and the formation of a nearly flat cone of deposition above it allowed the river to wander westward and to start new excavation along its present course (p. 65). During this next epoch the alluvial conglomerates were eroded into their present fantastic outlines (Fig. 2). The history of the southern valleys, here somewhat modestly presented, must clearly be taken into consideration when we review that of the more famous plateau-region to the north. The coloured geological map, inserted, according to the present useful practice, in the memoir, enables one to follow the arguments, as well as the travels, of the author. It will be noted that the excavation of the Grand Canyon is here transferred from Cainozoic to early Quaternary times.

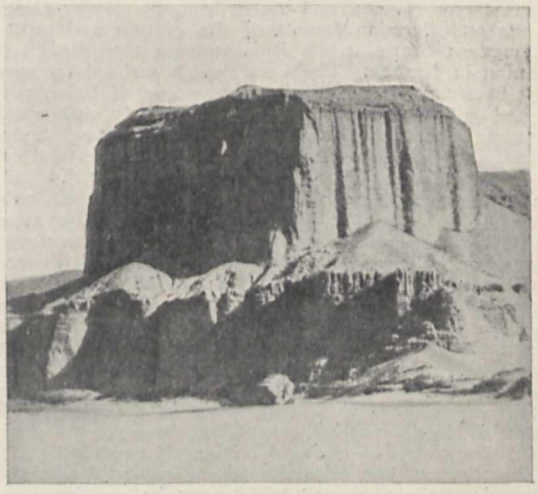


FIG. 2.—Bluff of eroded Quaternary Conglomerate, mouth of the Virgin River, Arizona.

Mr. Lee also describes the "Manzano Group" of marine red sediments in the Rio Grande Valley of New Mexico (Bulletin 389, 1909). Mr. G. H. Girty deals with the palæontology of these strata, which are now ascribed to the Upper Carboniferous (p. 38). Red beds were deposited in the Rocky Mountain region from Lower Carboniferous to Jurassic times. There seems here a suggestion of the continuity of the bright colour conditions that influence tropical and semi-tropical strata at the present day. The

[1] Continued from vol. lxxxiii., p. 234, April 21.

fauna includes numerous new species, and a new molluscan genus, Manzanella, allied to Nucula, is established (p. 75). The stratigraphical simplicity introduced by this systematic piece of work may be realised from the previous reference of the beds to Permian, Triassic, and Jurassic series (p. 11).

Mr. L. M. Prindle's account of part of the Yukon-Tanana region in Alaska, extending nearly to the Arctic Circle (Bulletin 375, 1909), is interesting for comparison with Canadian work, and has also an economic value. The lignites of the "Kenai formation" are placed, with other "Arctic Miocene" deposits, in the Eocene (p. 26). Our old friend *Corylus MacQuarrii* appears in the flora, which may, of course, prove ultimately to be Oligocene.

Professional Paper 61 (1909), by Mr. W. W. Atwood, describes the glacial history of the Uinta and Wasatch Mountains, which lie to the east of the now desiccated area of the Great Salt Lake of Utah. Here "it is certain that there were at least two ice epochs separated by a long interglacial interval" (p. 92). Lake Bonneville sediments rest upon the earlier drift, and are overlain by the later drift, and support is given to Gilbert's conclusion that "the inter-Bonneville epoch of low water was of greater duration than the time that has elapsed since the final desiccation." The correlation of glacial advance with lake-extension is interesting in connection with the association by Messrs. Davis and Huntington of pluvial flood-gravels in Central Asia with the growth of ice upon the highlands. Mr. Lee, in his Arizona bulletin, referred to above, seeks to connect epochs of erosion in the Colorado basin with those of high water in Lake Bonneville, so that we may now realise a good deal of "the face of the earth" as it appeared soon after Pliocene times, from the Wyoming border down to the Gulf of California.

Mr. G. H. Girty's memoir on the fauna of the Caney shale of Oklahoma, in which cephalopods are prominent (Bulletin 377, 1909), will interest students of Carboniferous zoning. Professional Paper 58 (1908), a quarto of 652 pages, is by the same author, on the Guadalupian fauna of New Mexico. The Guadalupe mountains are formed of marine limestones and sandstones, the Capitan Limestone in the upper part yielding a scarp reminding one of Tyrol. A large Fusulina, *F. elongata*, is abundant in the higher beds. The fauna as a whole furnishes a localised type (p. 28), and differs from the Upper Carboniferous and Permian faunas of the eastern and most of the western States, while it is younger than beds styled Permian in Kansas. The Guadalupian series is compared most nearly with the Fusulina Limestone of Palermo (pp. 35 and 50), and it is urged that the beds may possibly be younger than the European Permian, although truly of Palæozoic age. New genera of lithistid sponges and calcisponges are described. Attention is especially directed to the bryozoan species grouped under Domopora, as indicating Mesozoic affinities, and throughout the memoir discussions arise which must be considered by workers on Permo-Carboniferous horizons. In Professional Paper 59 (1909) Mr. W. H. Dall describes the Miocene of Astoria and Coos Bay, Oregon, including some Oligocene forms from the Aturia beds. Reprints of rare papers on Cainozoic strata of the Pacific coast are usefully given as appendices. Mr. True (p. 143) contributes an account of the Miocene sea-lion, *Pontolis magnus*, which has interesting alliances with *Eumetopias jubata*, still living in the district. The plates of fossils are of exceptional beauty, and include whorl-like groups of a singularly large Crepidula.

The Survey has also issued numerous bulletins on economic geology, among which may be mentioned those on the granites of Massachusetts, New Hampshire, and Rhode Island (No. 354); on the Great Falls Coal Field of Montana (No. 356), where the Carboniferous strata contain gypsum and the Lower Cretaceous sandstones contain valuable seams of coal; on the Book Cliffs Coal Field of Colorado and Utah (No. 371), where the coal is in the higher beds of the Upper Cretaceous; on the iron ores of southern Utah (No. 338), where igneous intrusions have introduced iron salts into limestone, and where the petrographic observations of the geological surveyor (p. 86) have a special bearing on future exploration; and on magnesite in California (No. 355), from which it appears that this mineral is in special demand for refractory bricks and for the production of carbon dioxide, the residue being more valuable than lime. Bulletins 328, 335, 337, and 345 deal with mineral resources in Alaska. In the first of these (p. 151) the famous beach-placers of Nome are described, which were practically exhausted, with great profit, in two years. In No. 335 the level Bering Glacier, a companion of the Malaspina, and also in part forest-clad, is described and illustrated (p. 46). No. 337, by Mr. Prindle, should be read in connection with No. 375, by the same author, noticed above. Professional Paper 62 (1908), by Messrs. Ransome and Calkins, describes the ore deposits of the Cœur d'Alène district, Idaho. The post-Glacial gravels (p. 77) are in this case referred to the epoch of the dwindling and recession of the ice, which was here localised in cirques and valleys. Lead, silver, zinc, copper, and gold are worked, and the district produces more lead than any other in the United States. The labour-wars in the district, waged with dynamite and rifles, show that the difficulties have not been all due to geological structure. The rich lead-silver ores, ranging through 4000 feet of contorted Algonkian rock, are believed to represent emanations from a great batholite (p. 137), which is represented by its uppermost intrusions (monzonite) at various points.

The papers on water-supply issued by the United States Survey are well known by their brown covers, and usually contain matter of geological as well as of economic importance. Two of them have been recently noticed in NATURE (vol. lxxxii., p. 379). No. 223 (1909), by Mr. F. G. Clapp, on the underground waters of S. Maine, includes a coloured geological map and useful illustrations of joint-structures in granite, diorite, and slate. In No. 221 (1909) Mr. C. A. Fisher describes the Great Falls region of Montana, where the Missouri is still fresh and vigorous, and liable to considerable additions when the snow melts off the mountains to the west. The destruction of forests by fire on these high slopes has further increased the risks of flooding. The copious water-supply is now being utilised for a system of irrigation-canals in the somewhat arid plains to eastward. In No. 220 (1908) Mr. G. A. Waring records a piece of pioneer work in southern Oregon, where no good topographical map previously existed. The country reminds us of N.W. Europe in Triassic days, with its large shallow lakes, liable to dry up at times, and at others to extend their boundaries, so as to find outlets and swell the diminished streams. Goose Lake has thus been known to flow over southward into Pit River. It receives, in all probability, a considerable supply from subterranean sources (p. 42). The problem of the region, of course, lies in the alkali-lands, where sodium chloride, sulphate, and carbonate may be brought to the surface during irrigation, the carbonate being much the most injurious. Sodium carbonate not only blackens the surface of stems and roots just below the surface, whence its name "black alkali," but also deflocculates the soil. References are, of course, made to the bulletins issued by the U.S. Department of Agriculture, and this memoir shows a promising correlation between the work of the Geological Survey and of the Bureau of Soils.

No. 225 (1909), by Mr. W. C. Mendenhall, continues the history of the Salton Sea, from its disastrous formation by the drawing in of the Colorado River in 1905 (see NATURE, vol. lxxv., p. 501) to the closing of the gap by the energy of the Southern Pacific Railroad early in 1907. If the work holds, it is estimated (p. 40) that the great lake will have disappeared by evaporation in 1925, to the detriment of the users of ground-waters in the valley to the north-west. This valley, and the Colorado Desert generally, were once occupied by the head of the Gulf of California. The surface of the Salton Sea had fallen to 200 feet below sea-level early in 1907. A remarkable water-line, 40 feet above sea-level, is traceable round the bluffs, and is attributed (p. 18) to an important predecessor of the Salton Sea, formed before the Colorado took up its present course across its delta (Fig. 3). In this rainless region it is estimated that such indications, often accompanied by deposits of calcium carbonate, have lasted through a thousand years. The same author describes, in Paper 222 (1908), the conditions of the San Joaquin Valley, California, and urges the importance of small farming

with individual hard work, as carried out by the Italian immigrants, in opposition to the characteristically American "desire to get rich overnight, to control large holdings, and to avoid personal labour." The warning is also true in regard to English agriculturists in South Africa, and may in time become applicable even to the enormous prairie-lands of Canada.

The Geological Survey of New Jersey, in its annual report for 1908 (1909), records its continued cooperation with the Survey of the United States. In a paper on the building-stones of New Jersey, the rocks are excellently illustrated by coloured photographs of polished surfaces, as well as by views of the buildings constructed from them.

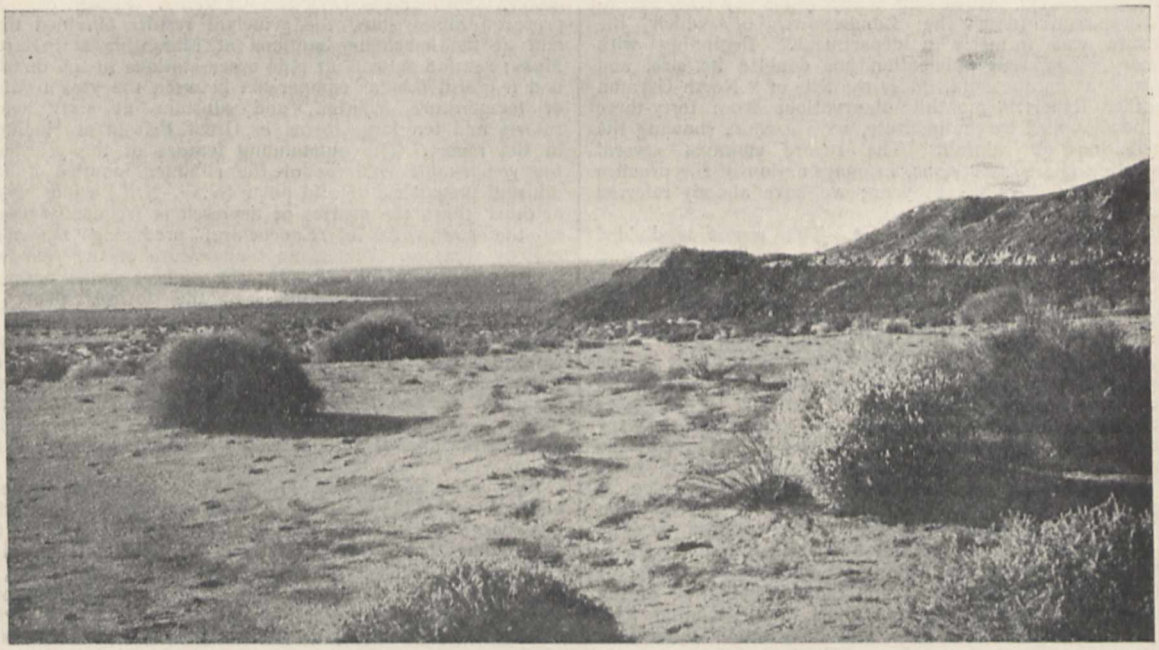


FIG. 3.—Old water-line above west side of the present Salton Sea, California.

The annual report of the Iowa Geological Survey for 1908 has been received in 1910, and is mainly occupied (pp. 21–687) by a comprehensive series of papers on the coal-deposits of the State. The peat bogs and their flora are described in the concluding papers.

G. A. J. C.

REPORTS OF METEOROLOGICAL OBSERVATORIES.

THE Meteorological Service of Canada (1906).—This report extends to nearly 650 quarto pages; the geographical position, and height above sea where known, of the numerous stations in operation in that year are given, also hourly observations at Victoria, Winnipeg, Toronto, and Montreal. From a monthly chronicle of weather conditions it would appear that, generally speaking, temperature was above and rainfall below the normal. Temperatures exceeding 100° and below −50° were, as usual, recorded at many stations, the highest being 107°, at Point Clark, Ontario, and the lowest −65·5°, at Dawson City, Yukon. The absence of maps, the impracticability of comparing data contained in various tables, and the frequent practice of separating rainfall and depth of snow, render it somewhat difficult to obtain a general idea of the characteristics of the year over such a vast area beyond that given by the chronicle referred to. For this purpose the excellent summaries in the *Monthly Weather Review*, although based chiefly on telegraphic reports, are more convenient. The weather predictions were very successful; the general total percentage of fulfilment (including partial verifications) varied from 81·3 in November to 92·4 in July, the average being 86·3 per cent.

Toronto Observatory (1907).—The results of the meteorological and seismological observations for the year are interesting and valuable. In the annual summary the results are compared with the means for the last sixty-eight years. The mean temperature of 1907, 44·2°, was practically normal; mean of maxima, 51·6°, of minima, 36·7°. The absolute maximum was 88·8°, in July (highest on record, 99·2°); absolute minimum, −10·0°, in January (lowest on record, −26·5°). The highest solar radiation was 112·3° (June); lowest night radiation, −13·9° (January). The annual rainfall was 25·56 inches (normal, 26·88 inches); depth of snowfall, 52 inches (normal, 66 inches). Rain fell on 100 days and snow on forty-seven days. Bright sunshine was recorded on 1921 hours, being 43 per cent. of the possible amount.

Bombay and Alibag Observatories (1909).—The equipment of these institutions is very complete; the routine operations, which include terrestrial magnetism, meteorology, seismology, and astronomical observations, so far as these relate to time-keeping and signalling, are carried out with great minuteness and regularity. The annual rainfall was 71·22 inches, being 3·94 inches below the normal (1873–96); the mean temperature was 78·9°, 0·5° below the average. Milne's seismograph registered fifty-three earthquakes; great disturbances occurred on April 11, June 3, July 8, and October 21. The table representing the magnetic character of each day shows there were 149 calm days, 182 days of small, and 34 days of larger disturbance. The mean declination was 1° 0′ 16″ E.

Helwan Observatory (1909).—The magnetic observations made during the year have been published in pamphlet form by the Egyptian Survey Department. The tables include mean monthly values of the various elements, and hourly deviations from the mean. The mean annual results were:—westerly declination, 2° 49·2′; dip, 40° 40·4′; horizontal force, 0·30031 (C.G.S. unit); vertical force, 0·25804. A list is given of the maximum and minimum values of the elements during fifteen of the principal disturbances with a daily range of more than 100 γ in the horizontal intensity (γ=0·00001 C.G.S. unit). The greatest disturbance was recorded on September 25 (to which we have already referred as regards Kew Observatory). At Helwan the range of horizontal intensity was >585 γ (the curve extending below the limit of the photographic sheet), vertical intensity 237 γ, declination 38′. The range of horizontal intensity in most of the cases quoted was from three to four times that of the vertical intensity.

Royal Prussian Meteorological Institute (1909).—The increasing work during the year was much hampered by the loss of Dr. Sprung and Dr. Kremser, and by the consequent changes in the re-organisation of the staff. The institute has now established observations of earth temperature at some of its principal stations, and the results will be published weekly for the benefit of agriculturists. The rain stations (exclusive of ordinary meteorological stations) now number 2637, and the thunderstorm stations 1482. The Potsdam Observatory has greatly increased its activity in respect of atmospheric electricity and other useful researches. Dr. Hellmann points out that a considerable improvement has been introduced in the "Statistical Correspondence" issued for many years by the Statistical Bureau (now the Landesamt), of which the institute was formerly a department. Beginning with January, 1909, that publication has doubled its size, and includes, as an appendix, under the title of "North German Weather Report," monthly observations from forty-three stations supplied by the institute, with a chart showing the distribution of rainfall. The report contains several interesting short discussions, in continuation of the practice introduced in the previous year; we have already referred to one or two of them.

The Deutsche Seewarte (1909).—This report is divided into two parts:—(*a*) general part, containing interesting particulars relating to the staff, the agencies for the supply of instruments, &c., the observers on land and at sea, together with other details; (*b*) reports of the chiefs of the different departments. By looking through these an idea is gained of the great variety and importance of the work performed under the superintendence of the Seewarte. They include (1) oceanography and maritime meteorology; in addition to such work as sailing directions and ordinary meteorological charts, daily synoptic weather charts of the North Atlantic and adjacent coasts have for many years been issued in conjunction with the Danish Meteorological Institute, and these furnish invaluable data for studying the sequence of weather conditions over western Europe. (2) Verification of nautical, meteorological, and magnetic instruments, both at the Seewarte and at the agencies, of which there are twenty-two, and the determination of the deviation of compasses in iron ships. (3) Weather telegraphy; in addition to a very wide distribution of weather telegrams and storm warnings, this branch superintends the agricultural weather service between May and September, and conducts experiments from time to time on the possibility of making profitable use of wireless telegrams from ships in the Atlantic. (4) Other branches deal with the testing of chronometers and watches, the collection of materials referring to coasts and harbours for the benefit of navigators, the collection and publication of observations at distant stations, &c. The investigation of the upper air by means of kites is carried out daily when weather permits, and the results telegraphed at once to various services; in the summer half-year the ascents are made at 6h. a.m., and in other months at 8h. a.m.; the altitude attained generally reaches or exceeds 2000 metres.

The Sonnblick Observatory (1909).—The results of meteorological observations made at the summit of the Sonnblick, 10,187 feet above sea-level, show that the mean temperature for the year was 18·0°; the highest monthly mean was 33·6°, in August (the only month with mean above freezing point); absolute maximum, 48·2°. The month with lowest mean temperature was February, −3·1°; absolute minimum, −23·4°. The total annual precipitation amounted to 61·65 inches, on 233 days; most of this fell as snow; rain only occurred on eighteen days, and hail on three days. Fog was prevalent on 271 days, the least being in January. As in previous years, the report includes observations and interesting details relating to some other mountain observatories and to upper-air research.

Norwegian Meteorological Institute (1909).—The observations and results are published in two volumes:—(1) Meteorological Year-book: The principal tables include hourly readings for Christiania, daily observations for twelve stations, monthly and yearly summaries for sixty stations. (2) Rainfall (and Snow): Daily observations are given for 200 stations, monthly and yearly results for 476 stations, and normal values for the years 1876–1905. The volumes have appeared in the same form for many years, and contain valuable and trustworthy data for an area extending as far north as latitude 71° in the Arctic Ocean. The yearly rainfall varies considerably, according to locality; the isohyets for 1909 range from 1000–2000 mm. and upwards along the Atlantic coast, with closed areas of 3000 mm., while near the Swedish borders the lines vary from 400–800 mm. and upwards. The methods of measuring both rain and snow are explained, with illustrations of the gauges.

The Southport Meteorological Observatory (1909).—Every effort is made to render this report as interesting and complete as the important position of the establishment on the eastern shore of the Irish Sea warrants. Fifteen carefully prepared tables show the principal results obtained there and at the subsidiary stations at Marshside and Barton Moss; rainfall returns at nine other stations in the district, and a useful tabular comparison between the year's values of temperature, rainfall, and sunshine at sixty health resorts and ten large towns in Great Britain are included in the report. The outstanding feature of the year was the remarkable coldness of the summer months, due to unusual prevalence of cold polar (N.W.–N.E.) winds, while at other times the centres of depressions frequently passed to the southward of Lancashire, producing miserable, gloomy weather. The mean temperature of the year was 47·4°, 0·8° below the average; the highest shade temperature was 78·4°, on May 21, the lowest 18·0°, on December 21. The greatest daily range was 33·6°, on May 20, and the least 2·0°, on February 4. The annual rainfall amounted to 35·72 inches, 2·82 inches above the thirty-five years' average. In December precipitation amounted to 5·94 inches, which Mr. Baxendell states was unprecedented, being nearly 3 inches above the mean; but for this the annual amount would barely have equalled the normal.

Falmouth Observatory (1909).—The important meteorological and magnetical work performed by this institution has been carried out with great assiduity during the year. The observations are supplied to the Meteorological Office (from which it receives an annual grant of 250*l*.), to the National Physical Laboratory, and other organisations. An event of special interest during the year was the visit of the magnetic survey ship *Carnegie*; the scientific staff of the vessel was furnished with valuable data in connection with the proposed magnetic survey of the Atlantic and Pacific Oceans. The results of the "climatological" observations (taken for the Royal Meteorological Society) show that the mean maximum temperatures were 46·4° in February, 69·6° in August; absolute maximum 80·0°, in August (the highest in that month for twenty-eight years). Mean minimum, 36·8° in March, 55·3° in August; absolute minimum, 26·4°, in February. The annual rainfall was 37·6 inches, nearly 4½ inches below the normal. Some interesting details are given of the great magnetic storm of September 25, which disorganised the telegraphic system of this country and parts of the Continent. The mean value of magnetic declination for the year was 17° 48·4′ W.

Observatory Department of the National Physical Laboratory (1909).—This report shows that the useful work of the observatory to which it refers continues to expand; this is especially noticeable in the verification of instruments (exclusive of watches and chronometers), the total number being 41,318, nearly 11,000 more than in the previous year, and including 25,861 clinical thermometers. The meteorological observations call for no special remark; the automatic records are tabulated for each hour, and are published in detail by the Meteorological Office, as one of its principal observatories. The chief magnetic disturbances took place on January 3, 30–31; March 19, 28–29; May 14, 18; September 25, 30; and October 19; the most remarkable was that of September 25 (see NATURE, September 30, 1909). As in previous years, a table is given of the magnetic elements at a number of observatories, and reports of the results at Falmouth and Valencia. The largest seismic disturbances occurred on January 23 (earthquake in Persia), July 30 (earthquake in Mexico), and October 20–21. An account of the work at the affiliated observatory at Eskdalemuir, Dumfries, N.B., is included in the report; we note that some useful researches on

atmospheric electricity and on solar radiation are being carried out there.

In our issue of June 23 we referred to the important changes that were being carried out in connection with the control of the two observatories at Richmond and Eskdalemuir.

SCIENCE AT THE JAPAN-BRITISH EXHIBITION.

THE arrangement of the British Science Section at the Japan-British Exhibition differs considerably from that of the Franco-British Exhibition. At the latter exhibition a separate annexe was set aside for science which made it comparatively easy to arrange the exhibits uniformly; but although the building was close to the entrance, the majority of the public passed it by and went straight through to the grounds. The fact is, the average man is rather afraid of anything called scientific, and unless he is brought to examine such an exhibit unawares is very apt to fight shy of it. Yet it was noticeable that those who did go into the building, even if they had no scientific knowledge, found a great deal to interest them, and frequently stayed a considerable time.

This year the Science Section is housed in the upper galleries leading from the Uxbridge Road entrance into the grounds. Consequently, all who go to the exhibition by that entrance, and the majority do, must pass through the Science Section. The exhibits are more broken up than in the Franco-British Exhibition; but this is rather an advantage than otherwise, as it takes away the museum appearance of the exhibit. Another advantage to the public is that there are two special attendants, who are able to explain the exhibits to the public in an intelligent manner. It has also been decided that certain members of the Science Committee shall give short lectures on special subjects in a portion originally intended for a band-stand, which has been curtained off; whether they will attract and keep an audience remains to be seen.

Science is so diversified, and its scope so enormous, that it is not possible to give in the space of a short article a comprehensive account of the exhibit which has been collected. Of course, it must be understood that the exhibit is not comprehensive in the sense that it covers the whole range of scientific research; but what it does do is to give to those unacquainted with scientific work an idea as to what is actually done by those engaged in scientific study. The Agricultural Section will be of interest to almost everyone; the South-eastern Agricultural College at Wye exhibits some most interesting specimens and preparations showing the various insects, mites, and eel-worms which are injurious to crops and stocks, and in some cases even harmful to man. The largest section is that dealing with the enemies of fruit trees and bushes, because the damage done to these is enormous, and has received a great deal of attention. There are, for example, specimens of the various aphides, green and black fly. The insect pests of the hop are also fully illustrated, one of the aphides being the most important, or rather, from the grower's point of view, the most disastrous. It was very prevalent in 1909, and is calculated to have cost the hop-growers in England 120,000*l.* in combating the attacks of this insect.

Astronomy is well represented, the section comprising a large number of old astronomical, nautical, and horological instruments. Examples are shown of the peculiar wooden Davis quadrant employed by the navigators in the time of Elizabeth for the determination of latitude. The Royal Astronomical Society shows, among other things, a reflecting telescope made by Sir William Herschel; also a sextant, formerly the property of Captain Cook. The transparencies of photographs of the southern heavens made by Mr. Franklin-Adams seem to attract considerable attention, and are indeed worthy of it. The Solar Physics Observatory exhibits a large number of photographs of stellar spectra taken with different instruments. There are also photographs of ancient British stone monuments which Sir Norman Lockyer has investigated and shown their astronomical connection.

The history of fire-making, illustrating the gradual evolution of the match, is very interesting, and is probably one of the most complete exhibits of its kind which has ever been shown. The exhibit includes fire drills, tinder, pistol tinder-box, and a brass fire piston. In order to operate this latter a little tinder was placed in a small cavity at the end of the piston; the piston was then rapidly compressed, and the sudden compression of the air caused sufficient heat to ignite the tinder. Optical, electrical, and chemical methods are also illustrated, and one of the first friction matches, made by John Walker, of Stockton-on-Tees, is shown.

One of the largest sections is oceanography; this section is mainly designed to show the progress of oceanography within the past forty years. Before the *Challenger* expedition in 1870, very little was known as to the depths of the ocean, and there was practically nothing known about the ocean beds. Specimens of the method of sounding are shown, also recording thermometers for ascertaining the temperature of the ocean at any depth. The series of hydrographical charts shown are intended to illustrate the process of construction of a chart from a sheet of blank paper until it is printed and is ready to be issued to the fleet. There is a very complete exhibit of compasses, which comprises specimens used in H.M. ships from 1765 to the present day. In the days when very little iron was used in the construction of ships, the errors of induced and permanent magnetism were very slight, but with the construction of iron vessels alterations had to be made in the construction of the compasses, and specimens of these compasses are shown.

Biology is very well represented; there is an interesting series of photographs illustrating the origin of the domestic breeds of horses. An exhibit of particular interest is one of the parasites which cause grouse disease, also a series of charts illustrating the method of systematic research into the conditions of life in the sea, which is the only true method for any attempt to improve the fishing industry. There are also interesting specimens illustrative of the parental care of fish. One fish carries its own eggs in its mouth, while another has an abdominal pouch like that of a kangaroo, in which the young seek refuge; but there is so much to see and so many things one would like to mention that we must pass forward with the words go and see, as there is very much more of interest.

The chemistry exhibit ranges from artificial silk to sections of ships' propellers, showing the erosion produced on different alloys. There is the handsome exhibit of nickel produced by the Mond process, oils from all over the world collected by Sir Boverton Redwood; an original example of mauve, electrochemical preparations, pharmaceutical products, and preparations of dye products from the University of Leeds.

The Physics Section is very representative, and includes apparatus in connection with mechanics, heat, optics, electrical measuring instruments, and telegraphy and telephony. The electric micrometer of Dr. P. E. Shaw is shown, which, by means of a train of levers, an electrical contact, and a telephone, enables movements of 100,000,000th inch to be detected. A seismograph is shown, and in connection with it records of earthquakes taken in London and the Isle of Wight. Much attention has of late been devoted to rubber testing and its mechanical properties; in this connection the hysteresis rubber-testing machine of Prof. Schwartz is shown. Under heat, there is a model of the calorimeter used by Joule in his work on the mechanical equivalent of heat, and near by it the most recent example of the Boys calorimeter for testing the calorific value of gases. Electrical instruments make an exceedingly fine display, amongst which may be mentioned Dr. Drysdale's potentiometer for measuring alternating and direct currents, the Duddell twisted strip ammeter, and a number of X-ray apparatus.

In the Geological Section there are some specimens of volcanic rocks from Antarctica, obtained during the recent South Polar Expedition of Sir Ernest Shackleton. The rocks were collected on Ross Island by Dr. Priestley, and consist principally of lavas belonging to the type known as kenyte. The important subject of geological surveying and mapping is exhibited historically, one of William Smith's maps of nearly a century ago being exhibited by Mr. F. W. Rudler.

Under arithmetic and mathematics, models of surfaces and of crystals are shown; also the calculating machine of the late Charles Babbage, electrical machine for solving equations, and electromagnetic device for solving equations.

It has only been possible to direct attention briefly and imperfectly to the scope of the science exhibit, but this will perhaps serve to give an idea to those interested in science and cause them to visit and examine it in detail. In conclusion, mention should be made of the anthropological exhibit, an interesting feature being that a small space has been set aside for the actual taking of measurements, so that certain particulars of those attending the exhibition can be taken and data added to the large collection already obtained. F. M. P.

THE PROGRESS OF CANCER RESEARCH.

THE annual meeting of the general committee of the Imperial Cancer Research Fund was held at the Royal College of Surgeons on July 20, Mr. A. J. Balfour being in the chair. Sir William Church presented the annual report, and gave an able exposition of its most salient features.

The Duke of Bedford, who has been a strong financial supporter of the fund from its foundation, was elected president. Mr. A. J. Balfour moved a vote of thanks to the members of the various committees, and to Dr. Bashford and his staff. Mr. Balfour's remarks were mainly directed to the layman, and have received such wide publicity in the daily papers that we need not quote them in full, well as they will bear quoting. Mr. Balfour emphasised the progress made since he presided in July, 1903, and directed attention to the caution characterising the statements emanating from the laboratory, urging the need for patience upon the public, the members of which are not always able to comprehend that the slow progress made by scientific methods is the only progress that can legitimately be expected. Mr. Balfour emphasised the fact that heredity has been shown to be not of main importance, meaning thereby, we infer, that the congenital germ-theory of cancer has been discarded for good, in view of the facts elicited by the Imperial Cancer Research Fund on the association of cancer with peculiar irritants in human races practising peculiar customs, and in some animals.

Emphasis may be laid upon this point; in India, draught-cattle are liable to cancer at the root of the left horn, not of the right horn; cancer of the skin of the abdomen is only frequent in the Kashmiris who wear the "Kangri," or charcoal fire-basket; cancer of the floor of the mouth is only frequent in women who chew betel-nut. Surely these peculiar incidences of cancer are not due to a different distribution of congenital germs in the right than in the left horn of cattle, or in the abdominal skin of Kashmiris other than that in other races, any more than is betel-nut cancer due to a peculiar accumulation of congenital germs in the mouths of those women who chew betel-nut. All these forms of cancer could almost certainly be greatly diminished if the parts attacked were not irritated.

Advance in knowledge must yield information regarding other more obscure forms of cancer. Another point emphasised by Mr. Balfour was his belief in the reasonableness of expecting that the cure and prevention of the dissemination of transplanted cancer, as announced in the report, foreshadows similar achievements for original cancer, although perhaps so much may not be attained in his lifetime.

The other business was purely formal.

The report itself states that King George has consented to become Patron of the Imperial Cancer Research Fund in succession to His late Majesty King Edward VII., who was so largely responsible for its inception, as well as for inciting the modern crusade against cancer, and who in July, 1901, when opening the congress on tuberculosis, stated:—"There is still one other terrible disease which has, up till now, baffled the scientific and medical men of the world, and that is cancer. God grant that before long you may be able to find a cure or to check its course, and I think that to him who makes the discovery a statue should be erected in all the capitals of the world."

The appeal which the investigations of the Imperial Cancer Research Fund make to students throughout the world is exemplified by the number of foreign voluntary workers attracted to its laboratories. They have flocked to them from Germany, Italy, Belgium, Norway, Austria-Hungary, Roumania, the United States, Holland, and Japan, and many now hold independent appointments abroad. Thus the British national investigations on cancer may be said to have fulfilled their immediate purpose in that the English school of cancer research commands world-wide confidence, which we hope will be confirmed and extended by the director's necessarily technical report, from which we give below extracts of a few important passages. The report makes no pretence to appeal to the man in the street who wishes to know if the cause, the cure, or the means of preventing cancer have been discovered. Nevertheless, to all with "inside" knowledge, the progress made by the indirect method of attack—by the intelligent sapping and mining of hitherto unassailable citadels—must appear full of encouragement for the future.

Cancer in Vertebrates.

Much additional information has been obtained on the occurrence of cancer in lower vertebrates. It is gratifying to record that the systematic investigation of cancer in the animal kingdom has found numerous adherents both at home and abroad. Particular attention has been devoted to the incidence of the disease in cattle and in mice. While in mice the phenomena are presented in miniature even in their most advanced stages, in cattle they are demonstrated on a magnified scale as compared with man, although the universal minuteness of the early stages is independent of the size of the animal. In the course of the past six months, ninety cases of malignant new growths in cattle were obtained from a single abattoir. The histological types comprise the majority of the forms met with in man.

Breeding Experiments bearing on Heredity and Contagion.

The advantages of using short-lived animals for studying the possible influence of heredity were pointed out in 1903. The breeding experiments which have been in progress for five years have yielded a material of nearly 2000 animals of known age and ancestry. Of these, 700 females attained the age of six months or more. In them, seventy-five cases of cancer of the mamma have appeared spontaneously. This material is very complete as regards diagnosis of the disease, age, pedigree, and other important data, and it is now sufficiently large to permit of the most exact analysis of the influence of ancestral constitution on the liability of mice to spontaneous cancer of the breast. Analysed so as to bring out the liability to cancer according as the young were born before or after it appeared in the mother, the figures show a higher incidence in those born before the mother developed the disease. Since the conditions necessary for contagion were present, the opposite result would have been obtained had any analogy existed between cancer and the recognised infective diseases.

Constancy and Variability of Tumour Cells.

Tumours growing in a living animal can be protected from all outside influences, and, when propagated in large numbers of young mice of the same strain, the conditions are as constant as it is possible to provide. In these circumstances, it would not be surprising, on the one hand, if tumours showed little or no departure from the features they exhibited at the outset of propagation; on the other hand, it would not have been surprising if tumours widely different in character had tended all to approximate to a common type, in response to the unvarying nature of their environment. What has actually come out is both interesting and instructive, in that it shows that the tumour cells possess a relative constancy in their general biological properties, but, at the same time, exhibit an inherent tendency to vary in spite of the constancy of the environment, and therefore apparently for reasons independent of it. Each tumour preserves its individual features, and if there be variation, then the variations likewise are individual. The constancy may be very perfect, so that strains of the same tumour propagated separately for three and four years remain indistinguishable in all their properties. On the other hand, the variations arising may be

so great and of such constancy that strains propagated separately from the same mother-material would not be suspected to have any relation to one another if submitted to one ignorant of their life-history.

In former years we have pointed out that an increase in the rate of growth, or in the percentage of successful inoculations, does not necessarily imply a fundamental biological alteration finding expression in an accelerated rate of proliferation of the tumour cells, but may be explained by the selection of particular cells adapted to the conditions of growth, and, consequently, the survival and proliferation of a larger number of such cells. That is to say, these two phenomena may be explained by an increase in the dose of the cells able to grow. The evidence for the acquirement of new properties by tumour cells is very much stronger when one observes the occurrence of morphological alterations which become of relative constancy, such as the disappearance—or latency—of their typical characteristics in the case of squamous-celled carcinoma, the disappearance of acinous structure in the case of glandular carcinoma, the derivation from cubical epithelium of epithelial cells which, if their previous history had not been known, could not have been distinguished from those of a spindle-celled sarcoma. In other cases, the change is made manifest by the alterations taking place in the supporting connective tissue and blood-vessels, so that tumours which at one time exhibited dilated blood-vessels lose this character. Biological alterations occur without evident morphological expression, *e.g.* some tumours at the commencement of propagation, after an initial exuberant growth, disappear in a large proportion of cases, whereas after the propagation is prolonged, a large percentage of the implantations grow progressively. The opposite phenomenon may also be observed, and tumour strains which grew progressively at the outset of propagation may later be found very liable to disappearance. A tumour which grows well only by the implantation of intact grafts, *i.e.* if the tissue structure is preserved, can be adapted to transplantation as a cell emulsion, and again brought back to its original condition.

Of the twenty-nine tumours of the mamma that have been propagated in the laboratory for more than two years, as many as sixteen have shown departures from the features they exhibited at the outset, these departures affecting the degree and nature of the histological differentiation, the percentage of successful inoculations, the rate of growth of the resulting tumours, the relative proportions of progressively growing tumours and of tumours which undergo spontaneous absorption after transitory growth, the susceptibility of the tumour to method of transplantation, to dose, to race, to age, and to the influence of induced immunity.

Thirteen tumours have shown a relative constancy of their structural and biological characters.

Of the sixteen variable tumours, nine have varied from the primary condition in both respects. Two have shown biological variations without histological change, and five have altered in microscopical characters without noticeable modification of their biological behaviour. On the whole, therefore, histological character is less constant than biological behaviour.

The relative constancy, but still more the variability which the tumour cells exhibit during propagation, throws indirect light of the most suggestive kind upon the nature and the manner of the development of cancer. The variability in a constant environment, during propagation, allows one to infer that corresponding variations may take place while the cells are under the influence of the particular environment provided by the animal in which the tumour developed spontaneously. The environment of the cell will depend on the individuality of the animal, and, with the progress of life, distinctions between one animal and another may become more and more marked. This inference accords with what has been said above on the ease with which auto-transplantation is effected and the difficulty with which transplantation can be effected to another individual, and therefore also with the fact that all cancerous mice do not exhibit an equally suitable soil for tumours in general.

These spontaneous variations of the parenchyma cells of tumours during propagation suggest that we have here a repetition, in a minor degree, of the cellular processes responsible for the primary transformation of non-cancerous into cancerous tissue; just as cellular changes occurring during propagation may transform within a brief space of time an acinous growth into a solid one, or a slow-growing tumour into one rapidly proliferating, so in the tissues prior to the development of a malignant new growth the responsive proliferation of cells may pass into the progressive, independent proliferation of cancer.

Experimental Sarcoma.

In this connection it may also be well to refer again to the production of sarcoma under experimental conditions from what have been the non-malignant connective tissues of carcinoma. Not the least significant aspect of the origin of sarcoma by the transformation of the stroma of transplantable carcinomata is the rarity of its occurrence. Two only of our strains have exhibited it, and the conclusion seems warranted that in these cases the parenchyma is possessed of peculiar properties. In one of our strains the change occurred only in a small number of animals, and the whole process, from the first indications of sarcomatous changes in the stroma to the substitution of the carcinomatous elements by pure sarcoma, took place slowly, and was only completed after several successive transplantations. In the other strain, the transformation was much more frequent, took place more rapidly, and the disappearance of the carcinomatous element may be complete in one transference. In spite of these differences, the parallelism between the histological pictures in the two strains is extremely close, and leaves no doubt of the essential similarity of the processes involved. The stimulus exerted by the carcinoma cells on the stroma must be different in these two strains from that exemplified by the other transplantable tumours, otherwise every transplantable carcinoma should end in sarcoma, as it has, indeed, been asserted they might do. A fairly long duration of the stimulus exerted by the carcinoma cells without cessation of their proliferation seems to be necessary, and the first steps of the process are always localised in an extremely minute area of what are often large tumours. The parallel to the circumscribed origin of squamous epitheliomata arising in areas subjected to chronic irritation in man (chimney-sweeps' cancer, paraffin cancer, Kangri cancer) does not require to be insisted on further, since it has been emphasised in previous years.

Immunisation.

It is now possible, under given experimental conditions, to prevent a secondary transplantation, *i.e.* artificial metastasis, taking place for certain tumour-strains. This result has been obtained by inserting between the primary and secondary transplantations an inoculation of a very rapidly growing tumour showing only transitory growth, as the following sample experiment shows. Of twelve mice, already bearing progressively growing tumours and treated in the manner described, the secondary inoculation was successful in three only, and then the tumours were very much smaller than in the control consisting of thirteen mice, of which ten developed new progressively growing tumours on secondary inoculation. A similar result can be obtained by the implantation of tumours growing much more slowly and liable to spontaneous absorption, as well as by an inoculation of normal mouse-tissue. By similar methods the growth of the primary transplanted tumour may be greatly hindered, can be brought to a standstill and the animal cured, in circumstances under which the disease would certainly have progressed, and where the possibility of the occurrence of spontaneous cure can almost certainly be excluded. Thus the control of *transplanted* cancer has been brought within the region of probability.

These achievements must not be confounded with successful vaccination against spontaneous cancer arising, or against infectious disease. Animals perfectly protected against the repeated inoculation of cancer may develop tumours of their own—an observation often confirmed. Still more emphatically do we warn against applying to the human subject the methods which, after long perseverance, have enabled us to arrest the growth, and even to cure, animals of transplanted tumours that were well

established, and also to render animals resistant to a secondary inoculation, *i.e.* to dissemination and metastasis formation.

The immunity reactions to transplanted cancer are throughout clearer and more easily studied than are those of spontaneous cancer. The problems presented by spontaneous tumours are more delicate and elusive. The methods effectual in normal animals against primary inoculation with transplantable tumour, which, as mentioned above, also arrest the growth of growing transplanted tumours and prevent successful re-inoculation in suitable circumstances, have been without action on the continued growth of the twenty-five spontaneous tumours on which they have been tested, have failed to prevent recurrence or dissemination, and have not yet prevented a successful re-inoculation of the spontaneously affected animal with its own tumour. The investigations must go on until a higher degree of resistance can be obtained in this way, or it may be that an entirely different method must be sought. The expectation of ultimate success seems a fair inference from the results obtained with transplanted tumours which reproduce all the phenomena of growth and dissemination of spontaneous tumours, and from the rare but undoubted cases in which temporary arrest of growth or total disappearance have occurred in spontaneous tumours.

The prospect is made the more hopeful by the discovery of a method whereby an animal can be immunised by means of one of its own tissues against a primary inoculation of a tumour transplanted from another animal. This, again, is a very different matter from immunising an animal against its own tumour. Nevertheless, it illustrates how much that was previously unsuspected is being revealed, as step by step advances are made into yet unexplored regions. Inquiries into the effects which the several tissues of the body may have, either singly or in combination, in inducing protection are being made.

Chronic Irritation and Cancer.

A practical result arises out of the association of various forms of irritation with the development of cancer in sites where more obscure influences can be excluded, especially from what has been ascertained on the incidence of cancer in native races practising peculiar customs, and on the incidence of cancer in some animals. Experiment has emphasised this relation, and has thrown light upon the mechanism which makes the irritation effective, leading to similar consequences, although the irritants themselves have nothing in common. Recent legislation is thereby justified in the interest of workers employed in circumstances exposing particular parts of the body to chronic irritation of peculiar kinds. In 1903–4 the feasibility of obtaining more accurate information of the incidence of cancer in different occupations was before the Statistical Sub-committee. The progress made since renders such an investigation still more urgent to-day. It must not be supposed, however, that cancer has been proved to be always the result of irritation. The *mediate* influence of irritation has only been defined more closely than ever before.

MANGANESE MINING IN INDIA.[1]

THE many uses of manganese in the arts were known long before the metal had itself been recognised. It has been used since prehistoric times as a colouring material, and by primitive Indian smiths as a flux and as an alloy for hardening iron and bronze; and its power as an oxidiser now renders it one of the most important of disinfectants, and a valuable chemical reagent. The metal has an interesting, but uncertain, history; the origin of the name is doubtful, but it appears to have been first used in the sixteenth century as a variant of magnesium, from which it had not been separated; and even after its recognition as a distinct metal by Gahn in 1774, Bergmann still called it magnesium, though the name manganese, derived from magnésie by the reversal of two letters, had already been used.

Manganese is one of the most widely distributed of the metals. According to Mr. F. W. Clark it forms one-thousandth of the earth's crust, and is the fifteenth of the elements in quantitative importance. Mr. Fermor, accepting the number of mineral species as 1000, reports that no fewer than 130 to 140 of them contain manganese as an essential constituent. The manganese minerals are especially conspicuous, as they are mostly found in decomposed rocks upon the earth's surface; and as manganese salts are easily dissolved, the metal is a common constituent in the ash and latex of plants, and is found in the blood and tissues of many animals. According to Penrose, the proportion of manganese to iron in the human body is said to be as 1 to 20.

The increased use of manganese as an alloy has led to a more active search for its ores, with the result that the once important manganese mines of the south of England have been closed owing to the discovery of much larger supplies abroad. The manganese mines of India, according to native traditions, supplied ores to the Phœnicians, and the local smiths faced their anvils and hammers with manganese steel, which they knew as kheri. It was not, however, until 1892 that India began to produce manganese ores for export, with the small contribution of 685 tons. The ores are abundant in India, especially in the Central Provinces and in the States of Hyderabad and Mysore, and as the deposits are on the surface, and can be worked by shallow quarries, the Indian output increased rapidly until, for the years 1890–1906, it was second only to that of Russia. In 1906, and possibly some later years, India has taken the front place as a producer of manganese ores. The other countries in order of yield are Brazil, Spain, Turkey, Chile, France, Greece, the United States, and Japan, while large quantities of manganiferous iron ores are raised in the United States, Germany, and Greece.

The manganese ores of India have frequent but short references in geological literature, but little was known certainly about them until after the discovery of their economic importance. They have now been carefully investigated by Mr. L. Leigh Fermor, of the Geological Survey of India, and he has issued the result of his studies in a monograph that forms a most important addition to the geology and mineralogy of manganese. The Indian mines have added several new species of manganese minerals, amongst which the most important are hollandite, the crystalline form of psilomelane, and two new species characterised by their striking pleochroism—juddite, a manganese pyroxene, and blanfordite, the corresponding amphibole. Mr. Fermor also introduces new names for two manganese garnets, grandite, an abbreviation for grossular-andradite, and spandite, for spessart-andradite. Commercially, the most important of the Indian species are braunite and pyrolusite, which together produce 90 per cent. of the output.

Mr. Fermor's memoir includes a detailed account of the manganiferous minerals. The chemical composition of the various species is re-considered, and the complexity of many of them is shown by the elaborate general formulæ, by which alone they can be adequately represented.

The Indian manganese ores are mainly found in the pre-Cambrian rocks, though some interesting deposits of secondary economic importance occur in the laterites. The chief ores are associated with a varied series of igneous rocks, which Mr. Fermor groups as the kodurite series. They range from acid to ultra-basic varieties, all characterised by being rich in manganese and manganiferous minerals. Mr. Fermor describes in detail the petrography of this interesting rock series. The kodurites are apparently intrusive—though the evidence for this fact is described as incomplete—into two series of Archean gneisses. The first series consists of calcareous gneisses and the second of the metamorphic gneisses, which have been described by Mr. J. T. Walker as the kondalite series.

As usual with manganese deposits, the Indian mines are still shallow, and the deposits are probably very limited in depth; for they have been formed by chemical processes that only take place near the surface. They are generally due to the replacement of rocks by solutions containing manganese. Mr. Fermor reports that many of the deposits

[1] Memoirs of the Geological Survey of India. Vol. xxxvii. The Manganese-Ore Deposits of India. By L. Leigh Fermor. Part i., Introduction and Mineralogy. Pp. xcvii+231. Part ii., Geology. Pp. 232–405. Part iii., Economics and Mining. Pp. 406–610. (Calcutta: Geological Survey, 1909.) Price 3 rupees each.

are not more than 50 feet deep, and none has yet been proved to continue below 300 to 500 feet. The future of manganese mining is limited by some of the same factors as iron mining, owing to the limited range of the ordinary oxide ores. The mines are still open quarries, from which the ore can be very cheaply produced. Mr. Fermor's monograph concludes with a comparatively elementary statement regarding the methods of mining and the economics of the industry. More precise information as to labour costs and efficiency would have been of interest. The rates of pay are from 2½ to 7 annas a day for men, 1½ to 4 annas for women, and from 1 to 3 annas for children; the efficiency must be very low if it may be judged by dividing the annual output of the different mines by the number of people recorded as engaged in them. The native miners appear to insist on more holidays than Welsh colliers, without having the same excuse.

Owing to the present great activity in Indian manganese mining, the known deposits there cannot last very long. Mr. Fermor in 1907 estimated that the supplies would be worked out in from thirty to fifty years. Now, in spite of some additional discoveries of ore, he is disposed to reduce even that short limit; and he earnestly warns India that it is adopting a wasteful policy in the reckless export of manganese, which will have to be purchased from other countries for the manufacture of ferro-manganese when India works its enormous supplies of iron ores. Owing to the possibility, however, of the discovery of fresh deposits and of the invention of new processes that may supplant manganese, it is not proposed to impose legal restrictions on the export of the ore. J. W. G.

THE STRUCTURE OF CRETACEOUS PLANTS.

HITHERTO our knowledge of the structure, as distinguished from the mere external appearance, of Mesozoic plants has been for the most part limited to the older floras, in which only the earlier types, such as ferns, cycadophytes and conifers, are represented. From the Upper Cretaceous, the epoch when the now dominant angiosperms first overspread the world, little structural material has been available until lately, if we except the petrified wood of palms, which has long been known and is of the utmost interest.

At the present time new facts of great value are coming in from two principal sources—from the researches of Drs. Hollick and Jeffrey on the lignites of the eastern United States, and from the work of the authors below cited on the petrifications from northern Japan.

The specimens described in the present paper, which must be regarded as only a first instalment of the work, were among those collected by Miss Stopes on her recent expedition, undertaken with the assistance of a grant from the Royal Society, and helped in every possible way by the Government and universities of Japan. Eighteen types are described—not a large number, but quite enough to make a good beginning. The number of species with structure preserved is not very large, even in the best known fossil floras. We think, however, that the authors in their comparison somewhat underestimate the richness of the English Carboniferous flora in admitting only about seventy structural species; 100 would be nearer the mark.

The flora investigated is a mixed one, the eighteen species including one fungus, three ferns, eight gymnosperms, and six angiosperms; such proportions are quite unusual, the angiosperms commonly being dominant if they appear at all.

Only a few of the most important forms can be referred to here. Among the ferns, *Schizaeopteris mesozoica* bears the characteristic sporangia of Schizæaceæ, Aneimia being the nearest genus. Of the gymnosperms, *Niponophyllum cordaitiforme* may be either a leaf or a leaflet; if the former, it may be a belated member of the ancient Cordaiteæ; if the latter, it may be akin to the Bennettiteæ.

Yezonia vulgaris, with a cypress-like habit, has a very peculiar structure, the small adpressed leaves containing numerous vascular bundles. If, as there is reason to suspect, the cone *Yezostrobus Oliveri* was its fruit, the plant appears to represent a type intermediate in certain respects between Cycadophyta and Coniferæ.

Cunninghamiostrobus yubariensis shows a clear affinity with the recent Cunninghamia, while *Cryptomeriopsis antiqua*, so far as vegetative characters can decide, comes near the familiar Cryptomeria of modern Japan.

Among the fossils referred to angiosperms, *Saururopsis niponensis* shows an anatomical structure similar in some ways to that of Saururus, an ally of the peppers. Some readers may perhaps ask if it is quite certain that this plant is an angiosperm, and may even think of a possible comparison with Ophioglossaceæ. In the meantime, the authors' suggestion is at any rate tenable. It is interesting that the commonest angiosperm in these rocks, *Sabiocaulis Sakuraii*, appears to show the nearest affinity with the native climbing plant *Sabia japonica*.

The most sensational discovery, however, is that of a three-celled ovary of the type of Liliaceæ, for this is the first case in which any angiospermous fructification has been found fossil with its structure preserved. A perianth or bract is adherent to the lower portion of the ovary, making it partly inferior. It is curious, if somewhat disappointing, to find that this ancient flower appears to have been already so advanced as to give no clue to its ancestry.

In many cases diagrammatic text-figures are used very advantageously to supplement the photographs (sometimes a little obscure) which form the bulk of the illustrations.

The authors' concluding remarks suitably sum up the results so far attained:—"These new fossil plants, then, seem to be an interesting community, consisting of a mixture of old and new types, of higher and lower plants mixed in nicely balanced proportions: a community, which in some respects, at any rate, one could have hardly imagined from the fossil remains hitherto available from the Epoch."

[1] "Studies on the Structure and Affinities of Cretaceous Plants." By Dr. Marie C. Stopes and Prof. K. Fujii. Phil. Trans. Royal Society, Series B. vol. cci. Pp. 90; plates 9. (Royal Society, 1910.)

ARCHÆOLOGICAL AND ANTHROPOLOGICAL INVESTIGATIONS IN ARKANSAS AND LOUISIANA.[1]

MR. CLARENCE B. MOORE in 1908–9 investigated the mounds and cemeteries of the valley of the Ouachita, a river that rises in central western Arkansas and flows south-easterly into the State of Louisiana; its lower course is the Black River, which joins the Red River, a tributary of the Mississippi. The more striking remains are earthenware vessels of very varied forms and different colours. The most common form of decoration consists of the original surface of the vessel being left in scroll bands and round or oval discs, the interspaces being generally filled up with parallel lines or cross-hatching. The accompanying figure illustrates a superb bottle, 8½ inches in height, which has a coating of red pigment of superior quality, through which is incised a beautiful combination of discs and running scrolls in a field of parallel lines which emphasise the design; possibly the incised lines were accentuated with white pigment, but no trace of this remains. The technique of some of the vessels from Glendora is superior to anything of the kind hitherto met with outside the Lower Mississippi region.

The excavations were confined almost entirely to land that was, or had been, under cultivation. When the aborigines selected dwelling sites along rivers subject to overflow, they naturally chose high ground; and later, when Europeans selected land to clear for cultivation, they were similarly influenced, especially as much of this land had been enriched by aboriginal deposits. It is needless to say that the report is illustrated in that sumptuous manner which characterises Mr. Moore's publications.

The value of the memoir is enhanced by a very careful study, by Dr. Aleš Hrdlička, of the skeletal remains discovered by Mr. Moore. This constitutes a welcome contribution to the craniology and osteology of the American Indian, and we hope it will be followed by similar studies by the same anatomist. Dr. Hrdlička, in an attempt to determine the amount of prognathism, made use of the

[1] "Antiquities of the Ouachita Valley." By Clarence B. Moore (Journal of the Academy of Natural Sciences of Philadelphia, 2nd series, vol. xiv. part i., 1909).

basi-facial angle, a measurement which was independently arrived at by Dr. Rivet (*L'Anthropologie*, xx., 1909, pp. 35, 175). The majority of the crania exhibit one of the two main forms of artificial deformation, *i.e.* occipital flattening, or cradle-board compression, and fronto-occipital flattening ("flat-head" deformation). Each variety predominates in, but is not limited to, a certain type of people, thus indicating an exchange of customs.

The predominating type is that of the brachycephals, who range in stature from moderate to well developed, with good, though not pronounced, muscular development. They were probably the people among whom prevailed, and who communicated to their neighbours, the intentional fronto-occipital deformation. The other type, less well represented, indicates Indians of stature and strength similar to those of the people just mentioned, but with oblong, mesocephalic to dolichocephalic skulls. They were, in all probability, remnants of a relatively large local strain of dolichocephals mixed with the more numerous round-headed people. The physical characters of these people approach, on the one hand, those of the more northerly tribes of Missouri, Illinois, and parts of Tennessee and Kentucky, and, on the other, those of the more westerly and south-westerly tribes, represented in northern Texas

Bottle from Glendora, Ouachita Valley, La.

and especially by the oblong-headed type among the Pueblo Indians. The prevalent occipital flattening of the skull would point likewise to a connection with the south-west and the north-east. In addition, a few crania from these two States resemble very closely the subtype of the eastern Algonquians.

A. C. HADDON.

THE TABULATION OF VITAL STATISTICS.

ATTENTION has so often been directed in these columns to the desirability of the adoption of more scientific methods in our Government departments that it gives us pleasure to notice the paper which was read by Dr. T. H. C. Stevenson before the Royal Statistical Society on June 21. Dr. Stevenson was appointed last year Superintendent of Statistics in the General Register Office for England and Wales, and his paper on suggested lines of advance in English vital statistics is, in effect, an outline of all the changes which it is proposed shortly to introduce in the mode of compilation of the vital statistics issued from that office, and of the mode in which it is proposed to compile certain tables in the census reports, more especially those relating to the new data to be obtained in 1911 (see NATURE for April 7, p. 152).

That a civil servant should, with the approval of his official superiors, submit for criticism to a scientific society, before their final adoption, a statement of changes which it is proposed to introduce is, we believe, a course wholly without precedent, and deserves the warmest commendation. Taken in conjunction with the acceptance by the Registrar General, Mr. Bernard Mallet, of many of the suggestions made by the Statistical Society for the improvement of the census, the course augurs well for the thoroughly scientific spirit in which his office will be conducted.

The matter of Dr. Stevenson's paper is too detailed for abstraction in these columns, but it may be noted that it is intended in future to tabulate vital statistics by administrative instead of by registration districts, and that the data as to number of children which will be obtained at the next census will be tabulated, not only for different occupations of father, as suggested in the article in this journal to which reference is made above, but also by the number of rooms occupied or the number of servants employed, so as more clearly to distinguish the different social strata. It is also proposed to introduce the card-system for vital statistics and for census work, and to use mechanical methods for sorting and counting the cards. The frankness with which Dr. Stevenson points out difficulties and asks for suggestions is one of the most pleasing features of a paper on which he can be unreservedly congratulated.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

ENTRANCE scholarships have been awarded at Bedford College for Women (University of London), as follows:—Pfeiffer scholarship in science (value 50*l.* a year for three years) to Miss W. R. Smyth, of the North London Collegiate School; Henry Tate scholarship in science (value 50*l.* a year for three years) to Miss F. M. Lunniss, of the Cambridge and County School.

WITH the view of securing uniformity in the statistics concerning higher education, the Carnegie Foundation for the Advancement of Teaching has issued, as Bulletin No. 3, a series of standard forms for financial reports of colleges, universities, and technical schools. The forms as they are published are the result of a prolonged inquiry concerning the practice of universities and colleges in the United States in the rendering of public financial statements of their receipts and expenditures. The object of the forms is to make it easy for students of education and others to answer the questions, What is the total income of a given institution for the year? What is its annual expenditure? What are the assets at the end of the year? The forms may be commended to the attention of officials who are responsible for preparing balance sheets and other statistics in connection with universities and colleges in this country.

MR. SIDNEY BALL, fellow and senior tutor of St. John's College, Oxford, and Prof. I. Gollancz, professor of English at King's College, London, have been elected the first fellows of the English foundation of the A.K. travelling scholarships. It may be remembered that these fellowships, each of the value of 660*l.*, were recently founded in this country by Mr. Albert Kahn, of Paris, to enable the fellows to travel round the world. The object of the founder is that persons selected from the first rank of those engaged, in whatever way, in the education of the nation may become better qualified to teach and to take part in the instruction and education of their fellow-countrymen. The trustees are the Lord Chancellor, the Lord Chief Justice, the Speaker, Lord Avebury (nominated by the founder), and the principal of the University of London (Dr. Miers), the last-mentioned being honorary secretary to the trustees. The affairs of the trust are administered at the University of London.

THE current issue of the *Reading University College Review* contains several articles of interest. An editorial

discusses the American faith in universities. The institution and development of universities, each of which is wholly dependent upon a particular State, is, the writer maintains, the most conspicuous activity that has of late been shown in America. The American recognises more and more that university life, under favourable conditions, can give a training in comradeship and personal character which is one of the best preparations for efficient citizenship. He wants, too, the best knowledge—useful and technical—because without it he knows he cannot have the right kind of citizens. Prof. H. N. Dickson contributes an essay on higher education and commerce, and points out that those universities and colleges which are able to provide instruction of the higher kind in commercial subjects are steadily increasing in number. An address delivered by Prof. A. L. Bowley last May on progress and leisure is also included.

IN reply to a question asked in the House of Commons, Mr. Lloyd George has informed Mr. Duncan Miller that he is not prepared to propose any additional grants to the Scottish universities during the current financial year beyond the sum of 21,000*l.* included in the Supplementary Estimate issued on July 13, but as regards the future he has expressed willingness to sanction, subject to certain conditions, a further addition to the existing grants, provided that suitable schemes of expenditure can be submitted by the authorities of the several institutions concerned. For the current financial year the total grants in aid to Scottish universities and their allocation will be :—

	Grant under Universities (Scotland) Act, 1899	Grant under Education and Local Taxation Account (Scotland) Act, 1892*	Grant from Votes, Class 4, Sub-head I.	Supplementary Estimate	Total
	£	£	£	£	£
St. Andrews	6,300	4,500	—	4,000†	14,800
Dundee University College	—	—	1,000	—	1,000
Glasgow	12,180	8,700	—	6,250	27,130
Aberdeen	8,400	6,000	—	4,500	18.900
Edinburgh	15,120	10,800	—	6,250	32,170
	£42,000	£30,000	£1,000	£21,000	£94,000

* Payable from the Local Taxation (Scotland) Account.
† Includes £1,000 for Dundee University College.

FOLLOWING an order of the House of Commons, the Board of Education has issued a return by each county council in England and Wales, except London, of the rates levied for elementary education, and of the rate levied for higher education. So far as higher education is concerned, it is interesting to notice that Glamorganshire is most highly rated for this purpose, the rate being 3¼*d.* in the pound, and bringing in 43,030*l.* Eleven counties levy a rate of 2*d.* or more, but less than 3*d.* They are, in order :—

	Rate d.	Amount raised £
Yorks : West Riding	2·97	92,948
Cardigan	2·88	2,647
Monmouth	2·73	13,074
Denbigh	2·46	6,096
Merioneth	2·31	2,049
Herts	2·13	14,853
Cheshire	2·12	30,746
Westmorland	2·10	3,771
Flint	2·10	3,636
Pembroke	2·10	2,813
Salop	2·00	11,131

A number of counties levy a smaller rate than a halfpenny in the pound; these are Devon, Dorset, Hereford, Lincolnshire (three divisions), Notts, East Suffolk, West Suffolk, East Sussex, and the North Riding of Yorkshire. The Holland division of Lincolnshire raises nothing for higher education; the Kesteven division raises 10*l.* only, Hereford 35*l.*, East Suffolk 58*l.*, and Dorset 100*l.* Two counties only raise more than 50,000*l.*, namely, the West Riding, 92,948*l.*, and Lancashire, 65,082*l.*

A SCHOOL of aviation is to be established near London in memory of the late Mr. C. S. Rolls. A sub-committee of the Aërial League has had the scheme under consideration, and its cost for the first year is likely to be 2500*l.* The primary aim of the school will be to provide training in aëroplane manufacture and flight, and to obtain a class of men grounded in the subject from beginning to end, including such laboratory and theoretical work as funds and the gifts of apparatus may permit. The laboratory will be open for the use of students from technical institutions already providing elementary classes in the theory of flight, and also for public demonstrations in order to spread an interest in aëronautical science. Men who have undergone courses of training in engineering schools, and competent engineers and mechanics, will be eligible as students. The practical work of students will be directed to securing machines offering greater stability and trustworthiness, lower power and fuel consumption, diminished capital cost and expense of maintenance, and a higher factor of safety than the apparatus now used. In order that an early start may be made, two machines are to be bought at once, and the students will build all further machines, and also those of selected inventors whose ideas are judged to be worthy of construction and practical trial. The funds will be administered by an independent committee of management, including practical men of science. Mr. Patrick Y. Alexander has offered to equip the proposed laboratory with the necessary practical apparatus. The new institution will probably be called the Rolls Memorial School.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, July 18.—M. Émile Picard in the chair.—P. **Villard** and H. **Abraham** : The existence of two explosive potentials; a reply to a recent note of M. Amaduzzi. The authors state that their original intention was to bring forward a theory of the silent and continuous discharge, characterised by luminescence at the anode, based in accordance with the modern hypotheses as to the passage of electricity in gases.—L. **Maquenne** and E. **Demoussy** : The toxic qualities of certain salts towards green leaves. The salts of ammonium are shown to be specially dangerous in this respect, while calcium chloride and sea salt have very little effect.—A. **Laveran** and A. **Pettit** : The forms of endogenous multiplication of *Haemogregarina sebai.* Observation in this organism shows for a given species a great variety in the multiplication cysts, both in dimensions and number of merozoites, such that it is necessary to beware of assuming the existence of different species too readily.—Joannes **Chatin** : The variations of structure of the sclerotic among vertebrates.—Ch. **Platrier** : A problem of rational mechanics and its application to the theory of propulsive helices.—Ernest **Esclangon** : The passage of the earth through the tail of Halley's comet.—M. **Schulhof** : Some remarks on the inequalities of the longitude of the moon.—Jules **Drach** : The logical problem of the integration of differential equations.—Serge **Bernstein** : The equations of the calculus of variations.—Sigismond **Janiszewski** : The geometry of cantor lines.—L. **Zoretti** : The notion of a line.—Jean **Chazy** : A differential equation of the third order which has its critical points fixed.—René **Garnier** : A class of differential equations the general integrals of which have their critical points fixed.—Witold **Jarkowski** : Some theorems on "sustainers."—A. **Tanakadate** : A photographic study of the current of air produced by the movement of a helix.—E. **Mathias** and H. Kamerlingh **Onnes** : The rectilinear diameter of oxygen. Experiments in the case of oxygen give an affirmative answer to the question whether the deformation of the surface when the critical temperature is lowered leaves intact its rectilinear form.—A. **Perot** and J. **Bosler** : The theory of the luminescence of the mercury arc *in vacuo.*—A. **Tian** : The action of ultra-violet rays on gelatine. These rays destroy jellies, causing their liquefaction or solution, thus forming a contrast to the action of the same rays in coagulating albumen.—G. A. **Hemsalech** : The relative periods of calcium rays in the spark of self-induction. Experiments of this character provide useful indications in the analysis of bodies containing unknown impurities.—

H. **Buisson** and Ch. **Fabry**: The electric arc in an atmosphere of feeble pressure.—M. **Rouch**: Observations of atmospheric electricity made on Petermann Island during the stay of the Charcot expedition.—William **Duane**: A photographic method of registering α particles.—M. **Barre**: Sulphate of thorium. The author finds that sulphate of thorium in aqueous solution shows a specific resistance and a freezing point entirely in agreement with the laws of Bouty and Raoult. Measurements also of conductivity and freezing point of solutions containing 1 per cent. of potassium sulphate show the existence of a double salt.—F. **Bodroux**: The action of some ether salts of monobasic fatty acids on the mono-sodium derivative of benzyl cyanide.—Marcel **Guichard**: The absorption of iodine by solid bodies. The fixation of iodine by the surface of a solid is a specific property, and the author gives a list of a number of substances showing this behaviour.—M. **Gard**: Binary hybrids of the first generation in the genus Cistus and Mendelian characters.—B. **Sauton**: Influence of iron on the formation of the spores of *Aspergillus niger*.—Pierre **Marty**: New observations on the fossil flora of the Cantal.—Eugène **Collin**: A determination of the nature of the wick of a Punic lamp. The author believes the fibres to have been undoubtedly of flax.—Rémy **Perrier** and Henri **Fischer**: Some particular points in the anatomy of molluscs of the genus Acera.—MM. **Jammes** and **Martin**: The *rôle* of the chitin in the development of nematode parasites.—Henry **Penau**: The cytology of *Endomyces albicans* (P. Vuillemin).—Amédée **Delcourt** and Émile **Guyénot**: The possibility of studying certain Diptera in a definite medium.—Charles **Nicolle** and E. **Conseil**: Experimental reproduction of exanthematic typhus by direct inoculation with human virus.—M. **Lucet**: The presence of Spirochetæ in a case of hæmorrhagic gastro-enteritis in a dog.

CAPE TOWN.

Royal Society of South Africa, June 15.—Mr. S. S. Hough, F.R.S., president, in the chair.—Dr. A. **Theiler**: Note on *Anaplasma marginale*, a new genus and species of the Protozoa. This Anaplasma is transmitted by ticks, and it is a noteworthy fact that the incubation time by tick transmission is much longer than that after inoculation of the animal with blood; in the experiments carried out it varied from fifty-five to seventy-five days. Blood of an immune animal is infective; such an animal forms the reservoir of the virus. This is a peculiarity of the piroplasma diseases, to which group Anaplasmasis also belongs. Dr. Theiler's opinion is that Anaplasmasis is probably the disease which the farmer has hitherto called "gall sickness." Up to the present four different parasites are, in South Africa, found in the blood of immune cattle, and they can all be transmitted by the inoculation of the blood and by ticks.—Dr. R. **Gonder**: The development of *Piroplasma parvum* (Protozoa) in the various organs of cattle. The author suggests an explanation of the fact that the blood of animals suffering from East Coast fever injected into healthy animals does not transmit the disease. It is possible, he thinks, that the blood contains forms which can develop in the tick, and which, when injected, die. Concerning the place of the East Coast fever parasite in protozoology, he thinks the proposition justifiable to separate it from Piroplasma, and to substitute a new generic name, "Theileria," as suggested by Bettencourt.

FORTHCOMING CONGRESSES.

AUGUST 1–6.—International Congress of Entomology. Brussels. Chairman of Local Committee for Great Britain: Dr. G. B. Longstaff, Highlands, Putney Heath, S.W.

AUGUST 1–7.—French Association for the Advancement of Science. Toulouse. President: Prof. Gariel. Address of Secretary: 28 rue Serpente, Paris.

AUGUST.—International Congress of Photography. Brussels. Correspondent for United Kingdom: Mr. Chapman Jones, 11 Eaton Rise, Ealing, W.

AUGUST 2–7.—International Congress on School Hygiene. Paris. General Secretary: Dr. Dufestel, 10 Boulevard Magenta, Paris. Hon. Secretaries for Great Britain: Royal Sanitary Institute, 90 Buckingham Palace Road, S.W.

AUGUST 15–20.—International Zoological Congress. Graz (Austria). President: Prof. Ludwig von Graff. Address for inquiries: Präsidium des VIII. Internationalen Zoologen-Kongresses, Universitätsplatz 2, Graz (Österreich).

AUGUST 18–26.—International Geological Congress. Stockholm. General Secretary: Prof. J. G. Andersson, Stockholm 3.

AUGUST 29 TO SEPTEMBER 6.—International Union for Cooperation in Solar Research. Mount Wilson Solar Observatory. British Member of Executive Committee to whom inquiries should be addressed: Prof. A. Schuster, F.R.S., Victoria Park, Manchester.

AUGUST 31 TO SEPTEMBER 7.—British Association. Sheffield. President: Prof. T. G. Bonney, F.R.S. Address for inquiries: General Secretaries, Burlington House, W.

SEPTEMBER 4–7.—Swiss Society of Natural Sciences. Bâle. Secretary: Dr. H. G. Stehlin, Museum of Natural History, Augustinergasse, Bâle.

SEPTEMBER 8–14.—International Congress of Americanists. Mexico City. General Secretary: Sr. Lic. D. Genaro Garcia, Museo Nacional, Mexico, D.F.

SEPTEMBER 13–15.—International Congress of Radiology and Electricity. Brussels. General Secretary: Dr. J. Daniel, 1 rue de la Prévôte, Brussels. Correspondents for United Kingdom: Prof. Rutherford and Dr. W. Makower, University of Manchester, and Dr. W. Deane Butcher, Holyrood, Ealing, W.

SEPTEMBER 18–24.—German Association of Naturalists and Physicians. Königsberg. Secretaries: Prof. Lichtheim and Prof. F. Meyer, Drummstr. 25–29, Königsberg.

SEPTEMBER 27–30.—International Physiological Congress. Vienna. President: Prof. S. Exner. General Secretary for United Kingdom: Prof. E. B. Starling, University College, London, W.C.

OCTOBER 6–12.—Congrès International du Froid. Vienna. Correspondent for United Kingdom: Mr. R. M. Leonard, 3 Oxford Court, Cannon Street, E.C.

CONTENTS.