THURSDAY, JUNE 18, 1908.

THE FRESH-WATER FISHES OF CENTRAL AMERICA.

Biologia Centrali-Americana. Pisces. By C. Tate Regan. Pp. xxxiii + 203; with 26 plates and 2 maps. (1906–8.)

WE have to congratulate the editor of this magnificent work on the regularity with which the issue of the parts, now 200 in number, is proceeding, thus bringing its completion within measurable distance. Many a time, when, during its progress, collection after collection arrived, each bringing insects in tens of thousands, besides specimens of almost every other class of animals, the prospect of completing the work must have appeared almost hopeless, and this still more so when the editorial labours were thrown entirely upon Mr. Godman after the death of his coadjutor, Osbert Salvin. When the founders of the "Biologia" planned the work, now some forty years ago, they were moved to this grand enterprise by a clear perception of the important bearing which an intimate knowledge of the fauna of Central America, as a transition area between the Nearctic and Neotropical regions, must have upon the wider questions of the changing distribution of animals generally, and of their evolution since Tertiary times. But we believe that their original estimate, both of the number of species and of the extent of the work, was greatly exceeded in the course of those years. Nevertheless, their determination and energy have never failed them.

The volume with which we propose to deal on the present occasion is that containing an account of the fishes. Its appearance marks also the completion of the whole division of vertebrates. The preparation was entrusted to Mr. C. Tate Regan, who by his previous work on Neotropical fishes had shown himself eminently qualified for the task. The editor was most fortunate in his selection, for in the short space of two years he saw a work completed which was not only difficult in itself, but was rendered more laborious by the numerous contributions to Central American ichthyology which have appeared during the last two decades, and which, of course, had to be carefully consulted and studied.

The author has restricted himself almost entirely to fresh-water fishes and to such marine forms as are known to ascend rivers beyond the influence of the tide. In accordance with the plan generally followed in the "Biologia," detailed descriptions, with full references to previous publications, are given in the case of groups or species which to the author appeared to need revision, and for which the requisite materials were to be found in the British Museum. The remainder are merely mentioned by name, with the addition of such distinctive characters as may be compressed in a synopsis or key.

We find, then, that the number of species described is 330, including some truly marine forms which for comparison, or other reasons, had to be referred to. This is a surprisingly small number considering that about 700 reptiles and 200 batrachians are known from the same area—an area which has been peopled from two regions, the Nearctic and the Neotropical, and also by migrations from two oceans; offering every variation of physical condition most favourable to the development of fish-life; intersected by networks of river systems, without intercommunication; and with large expanses of water severally containing numerous representatives of the same genus. An area such as this must nourish a multitude of specific forms, of which only a fraction are as yet known to us. We can therefore fully concur with the author when he says that our knowledge of the fishes of Central America and Mexico must still be regarded as very incomplete. He directs attention to the fact that not a single fresh-water fish has as yet been described from Honduras or from Nicaragua north and east of the Great Lakes. He might have added that fishes, for obvious reasons, are not favourites with the generality of collectors. Extensive collections are only made by those who are especially interested in the subject; and we believe that since Salvin, assisted by Capt. Dow and Mr. Godman, formed his collection, no other of equal extent has been made, unless it be that of Mexican fishes, brought together by Dr. Meek. We must not omit to mention here that the acquisition by the British Museum of numerous types or co-types from various, especially American, sources is chiefly due to the efforts of Mr. Regan himself.

The systematic work has been carried out in every detail with painstaking care and accuracy. Generally we notice with pleasure that in nomenclature he has kept free from the crotchets of modern reformers, and has remained faithful to the classical spirit which one expects to find in a Cambridge graduate. With the rich materials at his disposal, and the additional information contained in the writings of his contemporaries, he has aimed at a precise definition of genera and species, by which their identification has been much more facilitated than if he had prepared those lengthy descriptions which too frequently prove a snare for the student.

We cannot enter more fully into the treatment of the subject in the systematic section of the work, involving in the case of almost every species questions of a purely technical nature. But there is one point which may be mentioned, if only as a suggestion to other authors engaging in similar work. Students would find it a great boon if direct references to good illustrations were always admitted in the "synonymy," instead of references merely to some recent publication, in which they learn for the first time that such illustrations exist. Furthermore, in the case of the "Biologia," it would have been particularly appropriate to give direct references to figures of species discovered by Salvin, and drawn from specimens collected by him. We allude, *inter alia*, to the genus Heros and its allies, for which Mr. Regan has adopted the Swainsonian name "Cichlasoma." [1]

[1] Should be superseded, according to modern nomenclature, by the prior Cichlaurus!

In his Introduction the author discusses some questions of more general interest. After having devoted a chapter to the classification of fishes, with special reference to the Central American families, explaining the grounds on which he differs from some of the generalisations proposed in recent years, he proceeds to summarise the conclusions at which he has arrived with regard to the geographical distribution of the fresh-water fishes. He begins with a description of the range of the ten Central American families and of many of their genera, tracing their origin and migrations. Thus he says of the Cichlidæ (*alias* Chromides) :—

"The Mexican and Central American Cichlidæ are more specialised than the South American ones, and have certainly been derived from them; not one of the genera with three anal spines is found north of the Isthmus of Panama, and all the South American Cichlidæ have simple conical teeth."

He rejects the hypothesis of a northern origin of Cichlidæ and of their southward migration into South America, Africa, and Southern India, and adopts the view expressed by other zoologists that

"In early Eocene times Africa was connected by land with South America on the one side, and with India, *via* Madagascar, on the other."

On the other hand, he takes the Cyprinodontidæ to be an originally Holarctic group, which, moreover, was confined primarily to fresh water. His principal reasons for the latter assumption are :—(1) their absence from the Australian region, except for a species of Haplochilus in Celebes and Lombok [1]; and (2) the fact that all fossil Cyprinodonts known are from fresh-water or estuarine deposits. Singularly enough, while in the old world all the species retained their oviparous habit, a very large number of the American forms became viviparous; and it is in Central America that some of the most specialised genera were developed within comparatively limited districts. Anableps is considered to be endemic to South America, one Central American species being an immigrant from the South.

The Centrarchidæ are also a northern type which is making its way southwards into Central America. Of about thirty species, six extend southwards to the Rio Grande, and one a little further into Tamaulipas. We are glad to see that the author vindicates the North American integrity of this group from the attempt to associate with it the Indo-Pacific Kuhlia and its Australian fresh-water allies.

These brief extracts will suffice to direct attention to the many very interesting points on which the author's thorough acquaintance with the subject enables him to speak with authority. Several woodcuts accompany the text, illustrating the distribution of the Central American families over the globe; and on two plates the northern range of Neotropical and the southern range of Nearctic families and subfamilies are shown.

In the division of the Central American subregion into provinces, the author does not carry us on firmer ground than had been reached by previous inquiries. However, he expresses it as his opinion that

"for fresh-water fishes the volcanic chain of mountains which stretches across Mexico from Colima nearly to Vera Cruz may be taken as the boundary between the Arctic and Tropical regions. This range has proved an insuperable obstacle to the northward migration of the Neotropical fishes."

Having thus established a northern and southern division, he distinguishes in the former three provinces, viz. :—

(1) Northern Mexico, west of the Sierra Madre.
(2) Rio Grande province.
(3) The Lerma system.

And in the latter :—

(1) The Rio Balsas system.
(2) Rio San Juan, with lakes Managua and Nicaragua.
(3) Guatemalan province.
(4) Isthmian province (Costa Rica and Panama).

The author cautiously adds that any division into provinces must be regarded at present as merely provisional, owing to our incomplete knowledge of the fish fauna of this area. We cannot help thinking that he would have much facilitated the labours of future inquirers had he followed the plan of other contributors and given a systematic index of species with a table showing their range so far as at present known.

Finally, in the last chapter of the introduction the author explains his views as regards the partial identity of the fish faunas of the two sides of the isthmus. He adopts the opinion of American ichthyologists that there are very few of the truly marine forms the representatives of which on the two sides cannot be shown to differ in some point; but on the present occasion he takes into consideration such only of the shore fishes as are known to enter fresh water. He has prepared a list of eighteen pairs of such fishes, each pair consisting of an Atlantic and a Pacific representative. The members of each pair differ from each other in various degrees; some of them differ in three or more "tangible," "substantive" characters (and no systematic ichthyologist would deny them specific rank), while others can scarcely be regarded "as more than subspecifically distinct." Thus, whatever method is followed by ichthyologists for taxonomic distinction, with the object of accentuating either the amount of differentiation that has taken place since the individuals were separated and isolated, or their previous and still more or less apparent identity, the similarity between species of both sides must be admitted by all to be so great as only to be explicable by a former communication between the two oceans.

The work is illustrated by twenty-six lithographic plates executed by Mr. J. Green in his usual excellent style, and we have to express our hearty thanks to Mr. Tate Regan for having contributed so careful and important a work to Godman and Salvin's great undertaking.

[1] Prof. Max Weber could hardly allow even this exception, having incontestably proved that the scanty fresh-water fauna of Celebes is merely an immigration from India.

ROULETTE AT MONTE CARLO.

La Loi des petits Nombres. By M. Charles Henry. Pp. xiv+71. (Paris: Laboratoire d'Énergetique d'Ernest Solway, 1908.) Price 4 francs.

THE question discussed by the author may be given in his own words:—

"Est-il possible de prévoir une loi de séquence plus ou moins fragmentaire dans les phénomènes fortuits comme les arrivés de la rouge et de la noire à la roulette?"

He considers that the theory of probabilities is only verified in practice when the number of throws of the ball is indefinitely great, and that new principles are required when the period of play is short. He takes what he terms a psycho-physical point of view, and bases his researches on the ultimate vibrations of particles and the musical interval, the fifth—the ratio 3 : 2. He adopts the latter as governing the sequences at roulette without giving any scientific reason whatever.

It is difficult to take the author seriously, but as he pretends in chapter iv. of the work to give rules of play which will enable a player to win at Monte Carlo, it is necessary to inform the reader that the system of M. Henry is not based upon scientific truth, and can have no effect upon his winning or losing. It still remains true that the construction of the Monte Carlo roulette table gives an advantage to the bank, which, roughly, may be stated to be 1·35 per cent. on the even chances and 2·7 per cent. on the longer chances. The percentage refers to all the money placed upon the table that was originally in possession of one of the players. Should a player stake five francs on one of the even chances, the piece becomes immediately depreciated in value so as to be only worth four francs ninety-three centimes. Placed anywhere else on the table it is worth but four francs eighty-six centimes. If the stake be left upon the table for another coup, with or without previous winnings, a like depreciation takes place, and it is the sum of all these depreciations which in the long run constitutes the profit of the bank.

Statistics show that each table earns about 400*l.* per diem on the average. This shows that the amount staked at each table is about 20,000*l.* per diem. The nine tables in use during the winter months thus earn about 3600*l.* per diem, and the amount staked probably reaches the large figure of 180,000*l.* per diem. It may be regarded as certain that a large majority of the players leave off losers. Of these, certain individuals lose a small sum which they consider is sufficient to leave in the rooms; others a sum which they had previously determined not to exceed; others sums which are in excess of what they wished to lose. On the other hand, a minority of the players will be winners, but this minority becomes smaller as the average time during which the players remain at the table becomes larger.

Many of the players have probably been winners at some time or other during the play. They determined to become larger winners, with the final result that they were losers. Few players know when to stop the game and to hold their hands when a reasonable sum, reasonable in proportion to the playing capital, has been won. The consequence of a player with a moderate capital thus settling down to play the bank for immoderate winnings is in the long run certain ruin, whether the bank has between one and three per cent. in its favour or not.

The large capital of the bank gives it an advantage over the player, whose capital is relatively small, which is quite separate from the advantage derived from the design of the table.

The influence of capital can be well seen in an ordinary even game of rouge et noire. We may suppose Peter and Paul to be the players, and the stake to be 1*l.* at each coup. It is quite certain, whatever be the capital of each, that after a sufficient number of coups one or other will lose all his capital. Which of the two has the greatest chance of being ruined depends upon the ratio between the capitals. It can be shown that Peter's chance of ruining Paul bears the same ratio to Paul's chance of ruining Peter that Peter's capital bears to Paul's. If Peter's capital be 50*l.* and Paul's 40*l.*, it is 5 to 4 that Peter ultimately ruins Paul. The circumstance that the game, if continued long enough, will inevitably lead to the ruin of one of the players may seem surprising to one who has not given the subject special attention. There is a popular fallacy that in the long run Peter and Paul will win very nearly the same number of coups. The fact is that in the result of a large number of coups the ratio of the numbers of coups won by the players approaches unity, but that the difference between these numbers has a tendency to increase beyond any limit. Great as is the advantage of a large capital, it cannot be inferred that the bankers at roulette could afford to play with tables not constructed to their advantage, because then there would be nothing to hinder a combination of capitalists from placing themselves on more than even terms with the bank. So great is the advantage of the bankers due to their large capital that, failing a combination against them, they could afford to play with a table constructed against themselves and in favour of the players.

If the respective capitals of the bank and of a player be known, it is not difficult to design a table which will place the two sides on an exact equality as regards play on the even chances for an unlimited time. When the bank has practically an unlimited number of stakes the solution is very simple, and may be stated as follows:—If the player possess a certain number of stakes, he should be able, from the construction of the roulette, to win on the average a majority out of four times that number of coups. A player with fifty stakes should be able to win 101 coups out of 200. In this case the roulette should have one zero and 100 numbers, and the zero should be in favour of the player. On the existing roulette tables a player with nineteen stakes and the zero in his favour would be on even terms with the bank. There would not be more than an even chance of his final ruin.

The above facts should become known to intending players, so that they may not be misled into thinking that they will make their fortunes by following the advice given in M. Henry's book. That book adds nothing to our knowledge of the probabilities connected with roulette at Monte Carlo.

THE THEORY OF LIGHT.

The Theory of Light: A Treatise on Physical Optics. By Richard C. Maclaurin. In three parts. Part i. Pp. viii+326. (Cambridge: University Press, 1908.) Price 9*s.* net.

THIS is the first instalment of a work on optics arranged on a somewhat novel plan. The volume treats mainly of the propagation of light in homogeneous media, isotropic or crystalline, and of the laws of reflection and refraction at plane boundaries. It is to be followed by a second dealing with the subjects of diffraction, dispersion, aberration, &c.; whilst a concluding volume is to be devoted to the history of optical theory. The method followed is deductive; a medium of the McCullagh type is postulated, and the laws of wave-motion are obtained by an application of the principle of Action. This is practically, of course, the electric theory of light in the form adopted by Larmor. The subsequent developments are naturally almost entirely mathematical, experimental methods being rarely referred to. For this reason the work cannot claim to be, indeed does not profess to be, a complete handbook of the subject; but this is hardly to be regretted, since the English student already has within his reach two masterly expositions from the physical standpoint in Lord Rayleigh's *Encyc. Brit.* article, and in Prof. Schuster's "Optics." A more serious matter is that some recent speculations of importance are ignored. For instance, we read on p. 29:—

"The answer forced upon us by the experimental evidence is that we must regard the [components of white] light as polarised elliptically . . . for an interval of time which is long compared with the period of vibration, but very short compared with the time required to make any impression on the retina or on a photographic plate."

This brings us back to the standpoint of Airy's "Tracts." It is to be hoped that the author will return to this question in his second volume, and that the bearing on it of Rayleigh's and Schuster's work on interference will receive due consideration.

The real value of the book consists in the systematic mathematical discussion of various classes of phenomena from a common point of view. In particular, many readers will be glad to have in an easily accessible form the author's own investigations of the effect of a thin transition layer in the phenomena of ordinary and crystalline reflection and refraction, and metallic reflection. Regard being had to the point of view, the style is clear and attractive, and the reader will appreciate the numerous excellent graphical representations of the somewhat complicated theoretical results.

In a lively introductory chapter the author discusses the methods and aims of science, the object being apparently to anticipate criticisms which might be directed against the special theoretical basis which he has adopted for his exposition. This discussion is pleasant reading enough, but it is to be hoped that future writers on mathematical physics will not always think it necessary to begin in this way. From the student's point of view the procedure has this disadvantage, that he may find the introduction much harder than the book, and perhaps even not intelligible until he has read the book. In the present instance the opening sentence tells us that "the first question in the catechism of every physicist" should be "what is the chief end of science?" The author's own reply to this question is interesting, and has the present writer's sympathy, but one cannot help wondering what degree of uniformity would be found among the answers which would have been given by, say, Archimedes, Galileo, Newton, Pascal, Laplace, Young, Maxwell, Kelvin. Fortunately history shows that the progress of science is not really conditional on the correct resolution of so formidable a question, any more than art has ever stood still for want of a definitive reply to the other secular question, what constitutes the Beautiful?

The remaining volumes will be looked forward to with interest, and the historical section in particular should prove of great value. H. L.

GEOLOGICAL EPITOMES.

Die Alpen. By Dr. Fritz Machaček. Pp. iv+146. (Leipzig: Quelle and Mayer, 1908.) Price 1.25 marks.

Eiszeit und Urgeschichte des Menschen. By Prof. Hans Pohlig. Pp. viii+142. (Leipzig: Quelle and Mayer, 1907.) Price 1.25 marks.

THESE two books, bound in cloth and convenient for the pocket, are members of Dr. Paul Herre's series entitled "Wissenschaft und Bildung." They are printed in the older German type, presumably to give them a popular and untechnical aspect; and their cheapness prevents their half-tone illustrations from being more than suggestive. But the text is by no means of the "nature-study" order, or merely intended to lead a young reader on to better things; it is rather a summary of the results of a wide range of specialised research.

Dr. Machaček in his volume compares the views of various authors on the structure of the eastern and the western Alps, and discusses the origin of the present surface-relief. He accepts the theory of glacial erosion for the "Zungenbecken" of the North Italian lakes as a logical outcome of observations on the deepening of the main glaciated valleys further up among the Alps; and he attributes the rich variety of pictorial features (p. 56) in the central chain to the denuding activities of the Ice-age. Surely no one can nowadays deny the efficacy of "frost-nibbling" in producing crags and *cirques* and wild *arêtes*, when combined with the presence of glaciers, which carry off the débris from the scene of severest action. Nor can the modification in form of the original valleys excavated by streams be ascribed to anything but the

eroding power of the glaciers themselves, well armed with materials gathered all along their course.

Dr. Machaček proceeds to describe the Alpine climate, the flora and fauna, and the influence of the topography upon human occupations. We cannot help thinking that a similar book for English readers would have been written with the view of attracting the ordinary tourist. Dr. Machaček, on the other hand, in pursuance of the plan of the series, aims at giving systematic information to those who may never see the Alps, but who regard them as features about which something should be known. There is a Teutonic touch in this; but to pursue this aspect of a cheap handbook, which is presumably meant to sell by thousands, would be to raise all manner of questions about the level of our own public education.

Prof. Pohlig has also a good deal to say about glaciation. His sketch of the geological history of the earth (pp. 2–4) leads up to the glacial epoch, and presumes with some audacity that the first continents appeared in Carboniferous times, and that the first marked differentiation of climatic zones took place in the later part of the Cainozoic era. An Ice-age affecting the whole globe seems a very chilly preparation for the coming of man, though Dr. Pohlig regards these occurrences as in some way connected. We are tempted to ask what organic change was heralded by the Permo-Carboniferous Ice-age, which does not seem to be referred to? The book is based on lectures by the author, and retains the vigour of style of one who is not afraid of controversy. There are even references, thinly veiled, to persons who have come off badly in the fray (pp. 74 and 96). The descriptions of the types of early man, and of the mammals associated with him, are of special interest. A larger number of specific names is employed for the latter than zoologists usually accept. From the description of the splendid Scandinavian boulders scattered over Holland and North Germany (which surely travelled more rapidly than the author suggests), down to the subdivisions of the giant deer, the book has an individuality about it which marks it out agreeably among compendiums of useful knowledge.

G. A. J. C.

NEW ZEALAND PLANTS.

Plants of New Zealand. By R. M. Laing and E. W. Blackwell. Second and revised edition. Pp. xii+454; illustrated. (Christchurch, Wellington, and Dunedin, New Zealand; Melbourne and London: Whitcombe and Tombs, Ltd., 1907.) Price 15*s.* net.

WE are glad to welcome the second edition of this interesting book, which is essentially a popular account of the flowering plants of New Zealand, exclusive of the grasses. It appears that no less than 1400 species of flowering plants are now known to be indigenous within the limits of the dominion, and doubtless others remain to be discovered in the more remote mountain ranges and outlying islands. No less than three-quarters of the whole appear to be endemic, comprising many species of singular beauty and scientific interest. Thanks to the energy of local botanists, great strides have been made during recent years in our knowledge of this wonderful flora, and the earlier descriptive work of Hooker, based largely upon dry material, has been to a great extent supplemented by investigations of the living plants in their native environment.

The chief merit of the volume before us lies in the numerous beautiful photographic illustrations of the more conspicuous species, upon the selection and execution of which the authors are to be sincerely congratulated.

A general introduction gives a short account of the principal features of the vegetation of the open country, the fern land, the bush, the scrub, and the alpine regions. Throughout the work, indeed, a large amount of attention is devoted to œcological problems, very extensive use being made of the recent work of Dr. Cockayne in this direction. This feature, together with the frequent references to Maori legend and tradition, give to the work an unusual interest. The general introduction also includes a discussion on the affinities of the New Zealand flora, which is perhaps a little out of place in a work of this character, though interesting in itself. The relationship to Australia is emphasised by the statement that 80 per cent. of the genera are common to the two countries, and explained by the common origin of a large part of the two floras from the north by way of a northern extension of the land in Eocene times, which also accounts for the subtropical facies of the New Zealand flora as a whole. The absence of many of the most important Australian genera, such as Eucalyptus, Acacia, Casuarina, Hakea, is perhaps to be explained in accordance with Wallace's well-known theory of the separation of Australia into two islands in Cretaceous times, to the western of which the most characteristic Australian genera were confined.

Other important elements in the New Zealand flora are the South American and sub-Antarctic. The former, illustrated by the genera Fuchsia and Calceolaria, may perhaps be explained in accordance with the late Captain Hutton's theory of a Pacific continent connecting New Zealand and New Guinea with Chili in Cretaceous or early Eocene times, while the latter may be similarly accounted for by the existence of a number of islands in the Antarctic ocean in Pliocene times which have since disappeared.

A very short "Botanical Introduction" appears to us to require elaboration and illustration in order to make it really intelligible to the uninitiated, to whom it is apparently addressed. A considerable advance upon previous works on the New Zealand flora is made in the abandonment of the familiar system of Hooker and Bentham in favour of Engler's arrangement of families.

The book is well got up, but somewhat uncomfortably heavy, especially as a travelling companion, for which purpose it ought to be largely in demand. In future editions a little more care might advantageously be given to the page headings, several of which are at present very misleading.

A. D.

OUR BOOK SHELF.

Soils: their Nature and Management. By Primrose McConnell. Pp. xii+104. (London: Cassell and Co., Ltd., 1908.) Price 1s. net.

IN this little book the working farmer or gardener will find set out clearly and from his own point of view just that basis of the scientific knowledge of the soil that he ought to possess for the intelligent management of his land. The author, Mr. Primrose McConnell, is well known as a practical farmer, who has been trained in science and has shown a special interest in the application of scientific principles to the implements used for cultivating the land.

Mr. McConnell begins with an account of the origin of soils, their composition, classification, and distribution on the different formations of Great Britain, in which he gives some indication of where good and bad soils occur, and of their characteristic trees and weeds. The more valuable part of the book is, however, that which deals with soil physics and the effect of cultivation and management upon the all-important factor of the texture of the soil. The author is, as might be expected from a man accustomed to tillage operations, free from the temptation to regard the soil purely from the chemical point of view as a medium for the supply of the plant with certain salts; again and again he lays stress on the importance of tilth and the way it can be affected by the operations, both manurial and mechanical, of the farmer. In this direction it is very desirable that more experimental work should be done; the basis of the statements usually made as to the effect of various acts of husbandry upon the water content and temperature of the soil is astonishingly slight. For example, we should doubt a statement on p. 97 that rolled soil 1½ inches below the surface may be 10° F. warmer than the same soil not rolled, as also the explanation which follows—but the experimental evidence we could bring against it is not so strong as the importance of the question would warrant.

Here and there throughout the book there are small mistakes and misreadings in dealing with scientific matters, but they are of small account, and do not touch the general course of the argument, so that we can cordially recommend the book to the class of readers for whom it was designed.

The Life and Work of George William Stow, South African Geologist and Ethnologist. By R. B. Young. Pp. vii+123. (London: Longmans, Green and Co., 1908.) Price 3s. 6d.

SOUTH African geology has yielded many results of world-wide interest, including the extinct fauna of the Karroo and the Palæozoic glaciation of South Africa. The debt due to George William Stow, the pioneer in the discovery of both subjects, will now be paid more easily owing to the admirable sketch of his career by Prof. R. B. Young. Geologists would, however, have been still more grateful for this biography if it had included a table of contents, an index, and a bibliography.

Stow was born at Nuneaton in 1822, and educated at a school on the Isle of Dogs. Though anxious to be an engineer, he was trained for medicine; but he did not qualify for practice, emigrated to South Africa in 1843, and lived there until his death in 1882. Considering the time and place in which his life was spent, it was apparently not rich in striking incidents or adventures. It was, however, during a trek to dodge the rebellious Kafirs in 1850 that he found in the Rhenosterbergen the first of the extinct reptiles of the Karroo. He fortunately reported his discovery to Prof. Rupert Jones, to whose help and encouragement Stow's services to geology are largely due. Stow's life was unsettled; he was thrice married, and in the search for a livelihood he was at different times teacher in the schools of the Colonial Church, bookkeeper, trader at Queenstown, wine merchant at Kimberley, diamond merchant, geologist to the Orange Free State, and manager of the South African Free State Coal and Mineral Mining Association. His main scientific achievements were his discovery of the fossil reptiles of the Karroo, his recognition and proof of the glacial origin of the Dwyka conglomerate, his collection of Bushman drawings, his valuable memoir on the geology of Griqualand West, published by the Geological Society, and his two reports on the geology of parts of the Orange Free State, in which he described the geology of the area on the southern border of the Rand basin and part of the Vereeniging coalfield. Unfortunately, Stow's detailed account of the geology of Griqualand was never published, and the manuscript is now in the library of the Geological Society of South Africa.

Stow claimed the discovery of a second Cainozoic glaciation of South Africa, and in his glacial enthusiasm he described the diamond pipes of Kimberley as due to the action of ice. His view of a late Cainozoic glacial action in South Africa was at one time accepted in Europe, but is now discredited. His discovery, however, of the Upper Palæozoic glaciation has been confirmed, and will always give Stow's name an honoured place in the list of South African geologists. J. W. G.

Lessons in Hygienic Physiology. By W. M. Coleman. Pp. ix+270. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1907.) Price 3s.

OF the many school physiologies, this is one of the best written, best arranged, and best proportioned. Since Huxley set the fashion more than a generation ago, the range of school physiology has remained pretty much the same; but there have been improvements in method. The method of this book is specifically adapted to the needs of teacher and pupil. All through, there are suggestions for making the teaching concrete, for "founding the study on facts and not mere words" (preface to the teacher). The illustrations are very varied, and set forth with many small original touches. The "review" and "thought questions" are obviously the careful work of an experienced teacher. Principles are never lost sight of, and the exposition never becomes mechanical or irrelevant, as so often happens when written examinations are the objective. But the book is admirably suited even for examinations. Taught as it may and should be taught, this little book should yield excellent results. Food and stimulants are specially discussed. The volume is one of a graded series.

L'Aérobisation des Microbes Anaérobies. By Georges Rosenthal. Pp. 107. (Paris: Félix Alcan, 1908.)

Anleitung zur Kultur der Mikroorganismen. By Dr. Ernst Küster. Pp. v+201. (Leipzig: B. G. Teubner, 1907.) Price 7 marks.

IN his interesting essay, Mr. Rosenthal first describes the methods by which anaërobic microbes may be isolated and cultivated, then methods for measuring the degree of anaërobiosis, either by a pressure gauge fitted to an exhausted chamber or by the degree of growth occurring from above downwards in a tube containing a deep layer of culture medium, and, finally, the technique whereby different anaërobic organisms may ultimately be transformed into aërobic ones. This, according to the author, may be accomplished by simultaneously gradually admitting air

and subculturing, so that a gradual acclimatisation to an aërobic condition is brought about; other methods are also described. The author then relates his experiences with such anaërobic organisms as the *Bacillus perfringens*, the bacillus of malignant œdema, and the bacillus of tetanus, and concludes with a critical examination of his results in order to detect fallacies.

Dr. Küster's little book will be very useful in the laboratory, as it gives a fairly complete summary, with bibliography, of the methods of isolation and cultivation of micro-organisms, including protozoa, myxomycetes, algæ, fungi, and bacteria, together with the formulæ and mode of preparation of the nutrient media. A book covering so wide a field will naturally be unequal, and the best sections are probably those dealing with the algæ, fungi, and special groups of bacteria. R. T. HEWLETT.

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.*]

Distant Electric Vision.

REFERRING to Mr. Shelford Bidwell's illuminating communication on this subject published in NATURE of June 4, may I point out that though, as stated by Mr. Bidwell, it is wildly impracticable to effect even 160,000 synchronised operations per second by ordinary mechanical means, this part of the problem of obtaining distant electric vision can probably be solved by the employment of two beams of kathode rays (one at the transmitting and one at the receiving station) synchronously deflected by the varying fields of two electromagnets placed at right angles to one another and energised by two alternating electric currents of widely different frequencies, so that the moving extremities of the two beams are caused to sweep synchronously over the whole of the required surfaces within the one-tenth of a second necessary to take advantage of visual persistence.

Indeed, so far as the receiving apparatus is concerned, the moving kathode beam has only to be arranged to impinge on a sufficiently sensitive fluorescent screen, and given suitable variations in its intensity, to obtain the desired result.

The real difficulties lie in devising an efficient transmitter which, under the influence of light and shade, shall sufficiently vary the transmitted electric current so as to produce the necessary alterations in the intensity of the kathode beam of the receiver, and further in making this transmitter sufficiently rapid in its action to respond to the 160,000 variations per second that are necessary as a minimum.

Possibly no photoelectric phenomenon at present known will provide what is required in this respect, but should something suitable be discovered, distant electric vision will, I think, come within the region of possibility.

A. A. CAMPBELL SWINTON.

66 Victoria Street, London, S.W., June 12.

Prominences and Coronal Structure.

PRESSURE of work in other directions prevented me from writing these lines before to-day. They have reference to an article contained in NATURE for April 2, in which Dr. Lockyer describes what he considers a triple concentric arc formation in the upper chromosphere similar to coronal structures observed during the eclipses of 1898, 1901, and 1905. Through the kindness of Prof. Hale, the British Astronomical Association is in possession of a photographic slide showing a composite calcium spectroheliogram taken of the sun's disc and chromosphere on July 17, 1907, *i.e.* the same date as the South Kensington one. Prof. Hale took the picture at 6.46 a.m. P.S.T., while Dr. Lockyer took his at South Kensington at 3.14 p.m. G.M.T. There is thus a difference of something like half an hour between the two exposures, that at Mount Wilson being the earlier one. Comparing the two spectroheliograms, it becomes evident that what Dr. Lockyer considers concentric coronal arcs, due to eruptive action either immediately in front or in the rear of the formation, constitute in reality the débris of an eruptive prominence. I happened to be observing the sun at the time, starting about 1.30 p.m. L.T., having also had the sun under observation early in the morning, and an extract of my notes reads thus:—

"July 17, 1907, 7 a.m.—In S.L.E. there is something hatching, the limb looking very uneven and the chromospheric lines contorted, with strong D_3 absorption effects being on view there from time to time.

"Ditto, 1.30 to 2.20 p.m.—Fine eruptive prominence in L.S.E., where something was preparing this morning. Great displacement of Hα to red side, and the prominence seems to rush *en bloc* away from the observer and in an almost horizontal direction towards the south, rising radially but little, and dissolving from a stout, dense, and bright stem into a number of bright, more or less parallel layers or striæ."

Great activity continued in the S.E. quadrant for the next three days. The Mount Wilson picture shows what I observed in the spectroscope, viz. a strong dense stem breaking forth in lower L.S.E., curving immediately over to the south (as can be gathered from the great displacement observed, the real direction must have been *south-east*), the stem dissolving into a complicated structure of branches a good distance away to the south of the point of origin.

I had to leave the instrument at 2.20 p.m., when a few minutes later Prof. Hale in far-away California exposed his plate, to be followed soon after by Dr. Lockyer in South Kensington. It is quite feasible to think that when the exposure was made at South Kensington, the fragments, already in parallel arrangement when I left the instrument, partook also of some kind of concentric curvature, which is, indeed, indicated on Prof. Hale's spectroheliogram. As Dr. Lockyer mentions the absence of an *underlying* prominence to the concentric arcs he discerns in his picture, I deemed it in order to mention the above facts. I have not the slightest intention by so doing to doubt the great likelihood that concentric coronal arcs, such as those observed, for instance, by Mr. Wesley, are due to eruptive action from underneath, but in the case at present under consideration this seems not to have been the case in this more limited sense. I feel sure that Dr. Lockyer will come to the same conclusion when he compares the two spectroheliograms in the light of my observational notes given above.

ALBERT ALFRED BUSS.

2 Lansdowne Terrace, Grosvenor Square, Ashton-on-Mersey, near Manchester, May 28.

The Action of Radium Salts on Glass.

THE letter of Mr. Phillip in NATURE of April 9 led me to examine some tubes containing radium salt which have been in my possession for some years. Some had become very purple owing to the action of the radium, whilst others were not coloured at all. The amount of coloration did not seem to depend upon the activity of the preparation; in fact, the deepest coloration—with one exception—was that due to a salt supposed to contain only one-thousandth of its weight of radium salt.

Certain kinds of glass when exposed to the bright sunshine of South Africa take a coloration similar to that produced by radium salt; I therefore thought that it might be interesting to observe the effect of sunlight upon a specimen of glass coloured by radium. With this object I exposed one of the coloured tubes to the action of the sunlight, and after twelve days' exposure the colour has been almost removed.

I have one tube which contained radium salt of about one million units activity; where the salt had rested against the tube almost black spots have developed. I shall expose this tube to the continued action of sunlight.

W. A. DOUGLAS RUDGE.

University College, Bloemfontein, O.R.C., May 14.

A FIELD METHOD OF DETERMINING LONGITUDES BY OBSERVATIONS OF THE MOON.

A SHORT note appeared in these columns on April 23 (p. 590) with reference to a valuable paper by Mr. E. B. H. Wade, published by the Survey Department of Egypt. The paper, however, is one showing so much originality, and the instrument and method appears to be of such value, that a more extended notice is called for, the more so as the paper in question is by no means generally accessible.

Mr. Wade considers the case of field survey operations where at least one point, and preferably more, should be determined independently by a direct astronomical method. Latitudes are easy enough, and longitudes would be if telegraphic connection with an observatory were available. Until wireless time-signals are distributed over the world which might be picked up with portable receiving apparatus, the observer has to rely upon his chronometers, which become cumulatively misleading, or upon lunar observations. These latter, Mr. Wade points out, may be divided into two classes—those which depend directly upon the rotation of the earth, of which moon culmination observations serve as an example, and those which do not, for instance, lunar distances and occultations, and these have the advantage of being about thirty times less sensitive to errors of time.

PLATE II.

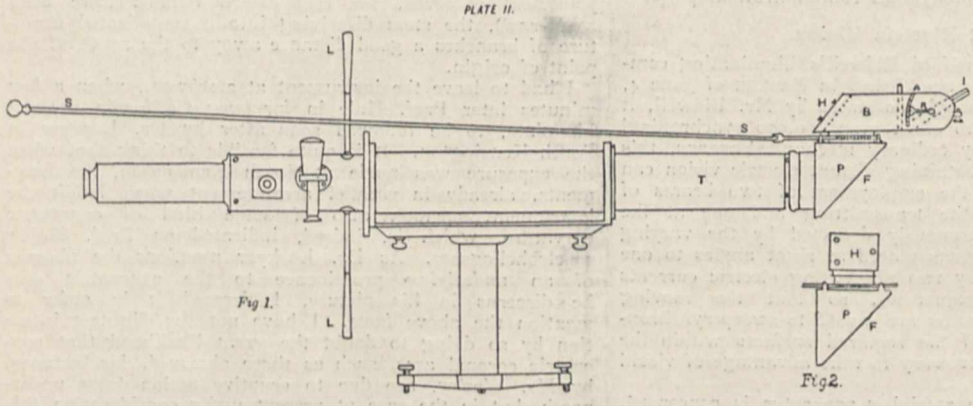


Fig 1.

Fig 2.

The telescope T with its reflector F is mounted as an altazimuth, the motion in altitude being given by the handles L, L, the box-sextant, containing the horizon mirror H and index mirror I, is actuated by worm gear by means of the long handles, and so is made to turn about the reflected optic axis of the telescope, *i.e.* about a line at right angles to the axis of the actual telescope.

Mr. Wade has set himself to devise a method of making lunar distance observations with an accuracy outside the possible range of the sextant with apparatus that is easily portable. He refers to Talcott's method of determining latitude by observations of the equidistance of the zenith from two stars as compared with the actual measurement of its distance from a particular star. "In quite the same way" he suppresses "the graduated circle of the ordinary sextant and finds the moon's apparent position from the condition that it is equidistant from two or more stars, one of which, of course, must precede and the other follow the moon." By suppressing the graduated circle he removes the principal obstacle to the evolution of the sextant.

In order to arrive at this result, he starts with a good telescope of $2\frac{1}{2}$ inches aperture and magnifying 40 diameters, carrying a reflector set at 45° in front of the object-glass. The telescope is always horizontal, and can turn upon its longitudinal axis as well as upon its stand in azimuth. It therefore commands all points of the sky, and the observer can sit in comfort, a point essential for accuracy. The view of half the object-glass is intercepted by a second mirror set at 45°, which receives light from a third, which may be parallel with it or may be inclined at an angle of 10° or so, roughly indicated by a pointer. The real point is that at whatever angle it is set, it may be clamped infallibly until the observations are complete. The box containing these two last-mentioned mirrors is capable of slow rotation by means of a worm from the eye end of the telescope, so that if, for instance, these two mirrors were set at an angle of 5° and the worm were turned, the observer would see successively all points in a circle of 10° radius round the point to which the unintercepted part of the instrument was directed. Supposing now the moon to be observed directly, and a following star, which is just too far away to be brought into contact with the limb, to be seen by double reflection, then a slight sweeping motion may be given so as to ascertain the exact time of tangential contact. Similarly a preceding star which is just too near for a tangential contact may be observed until the moment at which this is seen also. Actually it is the star, not the moon, which is looked at directly, as by that means the moon's light after two reflections from unsilvered glass is sufficiently subdued to allow sixth-magnitude stars to be observed in contact. The designer has ingeniously introduced the equivalent of the spider lines of a transit instrument by providing a slightly prismatic plate which may be set in any one of three positions in one of the optical paths, thus making small but invariable differences in the apparent angle, so that three observations are possible for each star.

It will be seen, then, that the accuracy obtainable is only limited by the optical definition of the telescope.

Space is not available for following the author of the paper through his discussion of the observations or for referring to his excellent graphic methods for shortening the calculations where they are available. It is sufficient to say that with his apparatus he has found that the probable error of a single observation is of the order of 1·5 seconds of longitude.

C. V. BOYS.

THE CAVENDISH LABORATORY.

ON October 10, 1870, the seventh Duke of Devonshire wrote to the then Vice-Chancellor of the University of Cambridge, offering to provide funds for a building and for apparatus for the teaching of experimental physics. The building was opened on June 16, 1874, when the Chancellor received the thanks of the University, and at the same time expressed his "wish to provide all instruments for the Cavendish Laboratory which Prof. Maxwell may consider to be immediately required either in his lectures or otherwise."

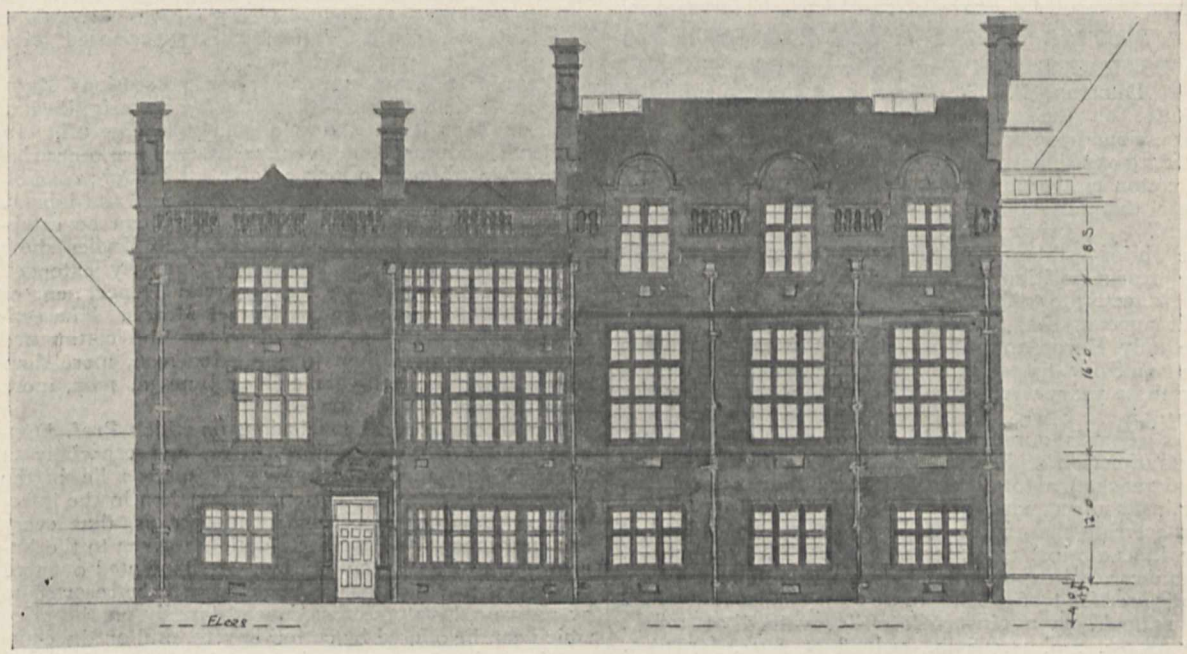
Twenty years later the laboratory was increased towards the south by a new building, running along Free School Lane, which contained, amongst other rooms, a spacious elementary laboratory. For this

the University supplied the funds. The "Cavendish" is now, for the second time, being added to by a building which stretches along Free School Lane to the north, the new building being about 80 feet in length, and varying in width from 40 to 50 feet. The front to Free School Lane is of Weldon stone, with Ancaster dressings to the windows and where mouldings occur.

The new wing consists of three floors. The ground floor is occupied by a large class-room, two students' rooms, and two dark rooms. The lecture room, 40 feet by 30 feet, on the first floor, adjoins the preparation room containing a dark room, and there are also two other rooms, one for a library, the other for a common room for the demonstrators. On the second floor are nine students' rooms, a room for chemistry, and another dark room. Two floors of the new extension are thus devoted to research. There is ready access from all these rooms to the main laboratory.

The cost of the building will be between 7000*l.* and 8000*l.*, and the University has only been enabled to undertake this work by the munificence of the Chancellor, Lord Rayleigh, who presented the whole of the Nobel Prize to Cambridge. Of this prize 5000*l.* is given towards the expense of the new laboratory, and Prof. Thomson has undertaken to provide 2000*l.*, which has accumulated from laboratory fees. On Tuesday, June 16, thirty-eight years ago to the day, the first building of the Cavendish Laboratory was opened by the then Chancellor, and two days ago this latest addition to one of the most renowned institutions in the world was opened by a short ceremony by the new Chancellor, Lord Rayleigh, whose arms appear over the portal. It is appropriate that the first official act of the new Chancellor should be to declare open a building which his generosity alone has enabled the University to erect.

Owing to the room in which the Chancellor spoke being of limited dimensions, the number of those present at the actual ceremony was not large, but after the ceremony Prof. and Mrs. Thomson entertained a large company of guests at a reception. There was an interesting exhibition of scientific experiments and apparatus by students working in the laboratory.



New Wing of the Cavendish Laboratory, Cambridge. Elevation to Free School Lane.

LANDSLIP AT LYME REGIS.

AN extensive landslip occurred at Lyme Regis on June 10, and was the occasion of many more or less inaccurate paragraphs in the daily papers. The account which was published in the *Western Morning News* of June 12 was, however, fairly full and accurate, being based upon information given by Mr. A. C. G. Cameron, late of the Geological Survey, and now resident at Uplyme. From this and from some additional particulars supplied by the same observer, we are able to state what really occurred on and previous to the date mentioned.

It is needless to say that no volcano or any kind of volcanic action is concerned in the phenomena. Spontaneous combustion took place at one spot on the cliff east of the town, owing, doubtless, to the decomposition of iron pyrites and the rapid oxidation of the iron. As some of the shales contain lignite, and others may be more or less bituminous, the conditions are favourable to the continuance of combustion, and the mound of smoking shale has been an object of great local interest from January to the present time. There is, however, no connection between it and the recent landslip.

The slip took place about 2 p.m. on June 10 below the road which leads from Lyme to Charmouth. The ground here consists of Greensand in the upper part, and of Lias shales in the lower part, the latter forming a succession of cliffs and terraces from a height of about 300 feet down to the beach. There are three tiers of cliffs, and it is the middle one for a distance of about 500 yards (rather more than a quarter of a mile) which is the scene of the slip. A great slice of this cliff suddenly gave way, and slid into the sea with a loud rumbling noise, and the production of semi-circular waves in the water. The slice inter-

sected the mound of burning clay, and Mr. Cameron states that the interior of the mound thus disclosed resembled an old brick-kiln, from the baked appearance of the clays and shales. Falls from the cliffs continued all the afternoon, and the whole range of cliff is still in an unstable condition.

With regard to the cause of the landslip, it is somewhat remarkable that the fall should have occurred during a spell of dry weather, and not after heavy rain. This fact points to some other cause than rain or springs, and such a cause exists in the practice of digging out and taking away the cement-stones and layers of limestone which occur in the lower part of the cliffs. The abstraction of these must have weakened the cliff above, and have caused the cracks which have long been apparent in it; water issuing from the base of the Greensand would find its way into the cracks, and would still further loosen the cohesion of the masses. Finally, the dry weather caused contraction and widening of the cracks, with the result above described.

BRITISH COTTON CULTIVATION.[1]

ABSTRACTS of a series of reports by Prof. W. Dunstan, F.R.S., Director of the Imperial Institute, on the quality of cotton grown in British possessions have been issued as a Parliamentary paper, which gives details with regard to the progress made in cotton cultivation in various parts of the Empire, other than India and Egypt, during the past two years. As instructive as the actual abstracts are brief statements prefixed to each, wherein the present position of cotton cultivation in the colony or protectorate referred to is reviewed.

It appears that the export of cotton from Cyprus, the only European possession dealt with, was much the same for 1905–6 and 1906–7, but that the figures for these years were more than double the figures for 1904–5.

As regards our East African possessions, the exports of cotton and cotton-seed from the Sudan during 1906 reached a total value of more than 45,000*l*., as against some 23,000*l*. for 1905. From the East African Protectorate the exports during 1906–7 were valued at 1400*l*., as against 1273*l*. for 1905–6 and 285*l*. for 1904–5. The increased export from Uganda was more marked, the figures for 1906–7 being more than 390,000 lb., valued at 11,400*l*., as against 96,000 lb., valued at 1089*l*., for 1905–6, and 21,566 lb., valued at 236*l*., for 1905. From Nyasaland the exports for 1906–7 were 526,119 lb., valued at 15,345*l*., a slight decrease on the figures for 1905–6, which were 776,621 lb., valued at 16,180*l*., but a marked increase on those for 1904–5, when 285,185 lb., worth 5941*l*., were exported.

As regards West Africa, we learn that exports of cotton from Gambia have ceased; the inhabitants will not take up cotton cultivation, the ground-nut industry being more profitable. The exports from Sierra Leone in 1906 were 87,800 lb., valued at 1829*l*., as against 68,800 lb., worth 509*l*., in 1905. A similar increase is recorded from the Gold Coast, whence the exports in 1906 were 92,886 lb., worth 1022*l*., as against 29,200 lb., valued at 516*l*., in 1905; also from Lagos, whence in 1906 the quantity exported was about 2,440,000 lb., worth 40,000*l*., as against 1,281,000 lb., valued at 25,000*l*., in 1905. On the other hand, the exports from southern Nigeria in 1905 only reached 85,000 lb., as against 285,000 lb. in the preceding year. In Lagos it is stated there are large areas suitable for cotton-growing, but the transport difficulties are great.

The reports dealing with the South African colonies show that Rhodesia and the Transvaal are capable of yielding cottons of excellent quality, and that experimental cultivation in the Orange River Colony, in Cape Colony, and in Natal has given results sufficiently encouraging to warrant further trial. Difficulties with regard to labour and to transport will, however, have to be overcome before an industry can be established. The reports regarding Seychelles and Mauritius indicate that much the same conditions obtain there as prevail in South Africa.

The reports from Asia refer to the Straits Settlements, where the climate is said to be not altogether favourable to the industry, and British North Borneo, where the conditions are expected to be favourable, and there is an ample supply of labour though the exports are small.

As to the Australian colonies and New Guinea, we learn that there are extensive districts in which the soil and climate are suitable for cotton cultivation, but that considerable difficulty is experienced with regard to the supply of labour.

The reports from our American possessions show that in British Guiana the industry is insignificant, and, small as it is, shows a steady falling off. In British Honduras, though the conditions are otherwise favourable, there is a lack of efficient labour; and in Bermuda, owing to the high price of land and labour, it is unlikely that a profitable industry can be established. But the exports from the West Indies show that cotton-growing is there being rapidly extended under the guidance of the Imperial Department of Agriculture, directed by Sir Daniel Morris. The estimated value of the exports of cotton and cotton-seed for 1905 was more than 63,000*l*.; for 1906, more than 90,000*l*.; for the half-year ending June 30, 1907, more than 167,000*l*.

One of the general conclusions on which Prof. Dunstan insists is that in most cases, and especially in West Africa, the best chances of success lie in the improvement of native cottons rather than in the introduction of foreign cottons; another is that every encouragement and facility should be given to the improvement of native cultivation. It is pointed out that the extent to which cotton-growing will be resorted to by native cultivators must depend largely on the price which can be offered by cotton-buyers, and on the competition of other occupations and other agricultural crops.

[1] Colonial Reports—Miscellaneous. No. 50, British Cotton Cultivation. Reports on the Quality of Cottons grown in British Possessions. By Prof. Wyndham Dunstan, F.R.S., Director of the Imperial Institute. (Cd. 3997.) Price 2½*d*.

NOTES.

THE council of the London Mathematical Society has awarded the De Morgan medal for 1908 to Dr. J. W. L. Glaisher, F.R.S., for his researches in pure mathematics.

THE Belgium Academy of Science, Literature, and the Fine Arts has elected Sir James Dewar an associate in the section of mathematical and physical science.

THE inaugural meeting of the Research Defence Society will be held at the house of the Royal Society of Medicine, 20 Hanover Square, W., to-morrow, June 19, at 5 o'clock. The Earl of Cromer, president of the society, will occupy the chair.

THE executive committee and science committee of the Franco-British Exhibition are issuing invitations for a reception to be held in the Science Court of the exhibition on Tuesday, June 30.

AN exhibition will be held at Faenza from August 15 to October 15 to commemorate the third centenary of the

birth of the Florentine physicist, Evangelista Torricelli. The exhibition will include international sections for meteorology and terrestrial physics, ceramics, and agricultural machinery. Prizes will be offered for competition in the two first-named sections. Inquiries should be addressed to Conte Cav. Carlo Cavina, president of the executive committee, at Faenza.

A MONUMENT to the memory of Boucher de Perthes was unveiled at Abbeville on June 8. Boucher de Perthes, who made important discoveries in prehistoric anthropology in the neighbourhood of Abbeville, died there in 1868. In 1832 he found at Thuison, near Abbeville, the first stone engravings, and in 1863, in the Moulin Quignon cave, the remains of Quaternary man with flint axes. The collections made by Boucher de Perthes were bequeathed to the State, and are preserved in the Museum of Saint-Germain-en-Laye.

THE American Association for the Advancement of Science will devote a day during its meeting at Baltimore to the celebration of the centenary of the birth of Charles Darwin and the jubilee of the publication of the "Origin of Species." The programme includes, according to *Science*, arrangements for an introductory address by Prof. T. C. Chamberlin, of the University of Chicago, president of the association, and a number of discourses by American biologists and others. Among the latter we notice that Prof. E. B. Poulton, F.R.S., will speak on natural selection from the point of view of zoology.

A REUTER message from Auckland states that a remarkable volcanic outburst began in the island of Savaii, in the Samoan group, on May 10. The flow of lava was the greatest in the history of the island. It amounted to between 2000 and 3000 tons a minute, and streamed down in a great river from 6 inches to 6 feet deep, stretching in an almost continuous sheet over a width of eight miles. On reaching the coast it flowed over the cliffs into the sea, causing steam to rise in great quantities. The lava destroyed many native houses, and for a time threatened the town of Matatua.

AT the General Conference on Weights and Measures, held at Paris in October last, a resolution was unanimously passed urging the universal adoption of a metric carat of 200 milligrams as the standard of weight for diamonds and precious stones. This proposal, which received a large measure of support on the Continent, especially in France, Germany, Spain, and Belgium, was brought under the notice of the principal diamond dealers in this country by the Board of Trade early in the present year, but it has not met with a favourable reception from the trade, and unless the proposed new standard is generally adopted abroad it is unlikely that any further action in the matter will be taken by the Government. The French Ministry is now introducing a Bill to legalise the "metric carat" of 200 milligrams in that country, and to prohibit the use of the word carat to designate any other weight. A recent resolution of the Bombay Chamber of Commerce shows that the proposal for an international standard carat is receiving favourable consideration in India.

THE ninety-first annual meeting of the Société Helvétique des Sciences naturelles will be held from August 30 next to September 2 at Glaris. A provisional programme states that at general meetings on August 31 and September 2 the following addresses will be delivered:—Prof. K. Schröter, of Zurich, on an excursion to the Canary Islands; Prof. H. Schardt, of Montreux, on the great erratic boulders of Monthey and neighbourhood; Prof. A. Riggenbach-Burckhardt, of Bale, on gravity measurements of the Swiss Geodetic Commission; Prof. Ch. E. Guye, of Geneva, on the electric arc as a powerful aid to science and industry; Dr. H. Greinacher, of Zurich, on radio-active substances; and Prof. R. Chodat, of Geneva, on Palæozoic ferns, their significance in modern plant palæontology. September 1 will be devoted to sectional meetings and to the annual meetings of the Swiss Geological, Botanical, Zoological, and Chemical Societies. A more detailed programme of the meetings will be available in July.

THE Sunday Society, which exists to obtain the opening of museums, art galleries, libraries, and gardens on Sundays, has been making attempts, though as yet unsuccessfully, to secure the opening on Sundays of the science and art collections at the Franco-British Exhibition. The experience gained during the last twelve years would appear to show that the Sunday opening of national museums and galleries has been greatly appreciated, and that there has been no abuse of the privilege. The last published returns show that in 1906 the number of Sunday visitors to the British Museum was 57,738, an average Sunday attendance of 1110; at the Natural History Museum for the same year the corresponding numbers were 61,151 and 1176. In 1905 the number of visitors to the Victoria and Albert Museum on Sundays was 93,005, an average Sunday attendance of 1755; the corresponding numbers in the same year for the Bethnal Green Museum were 74,990 and 1415.

ON Saturday last Mr. E. W. C. Kearney gave a demonstration of his high-speed railway system in the temporary building on the east side of Aldwych. Mr. Kearney runs his car upon a single rail, supporting it upon a two-wheel bogey at each end. Above the car there is a second rail engaging a second two-wheel bogey at each end. The upper and lower bogeys are carried upon the same shaft, and so turn together. The intention is to run out of the ground-level stations down an incline of 1 in 7 until a speed possibly of 200 miles per hour is attained, then along the level, and so up to the next station. If this could be done safely and successfully, then, without question, much time would be saved; but nothing which was said or demonstrated on Saturday with the help of a scale model about one-fifteenth the full size in any way made it evident that this would be the case, or that the great economy in first and in running cost claimed would be attained in practice. While the steep declivity would be convenient in the case of tube railways, it hardly meets the requirements of elevated or of long-distance railways, for which the motors would have to provide the whole acceleration. Might it not be well to revive the old brachistochrone problem which the brothers Bernoulli invented before its time and travel on cycloidal routes from place to place? Even Mr. Kearney would find it difficult to compete with this.

AFTER four months' canvassing among metal manufacturers and users, and two preliminary meetings held in Manchester, a new technical society called "The Institute of Metals" was formed at a meeting held at the Institution of Mechanical Engineers, Westminster, on Wednesday, June 10. Sir William White, K.C.B., F.R.S., who occupied the chair, has been for some years the chairman of the Alloys Research Committee, instituted by that body, which has concerned itself to some extent with the non-ferrous metals and their alloys. The following resolution was, after some discussion, adopted unanimously:—"That in view of the widely recognised need for a medium of communication for the advance of knowledge in connection with the production, manufacture, and use of the non-ferrous metals and their alloys, a society to be called 'The

Institute of Metals' shall be and is hereby constituted." Sir William White was unanimously elected the first president, and an interim council, composed of prominent metal manufacturers, ship-builders, marine and locomotive engineers, electric cable constructors, &c., and including representatives of pure science, was appointed to take the necessary steps to bring the institute into working order. The joint hon. secretaries are Prof. H. C. H. Carpenter, the University, Manchester, and Mr. W. H. Johnson, c/o Johnson, Clapham and Morris, Ltd., Manchester. Promises of support have been received from more than 200 persons.

THE late Dr. Oswald Seeliger, professor of zoology in the University of Rostock, whose death in his fifty-first year has just been announced, was well known for his many valuable contributions to knowledge, and particularly for his writings on the morphology of the Tunicata. The articles on this group in Bronn's "Klassen und Ordnungen" and in Brehm's "Thierleben" were from his pen. The researches with which his name is most familiarly associated are upon questions connected with the process of budding in Tunicata, Cœlenterata, and other animals. His statement that the nervous system of the ascidiozooids of Pyrosoma is derived from the mesoblast of the parent Cyathozooid, undermining, as it seemed to do, the theory of the germ layers, gave rise to a long and interesting controversy. More recently he repeated Boveri's famous experiment of fertilising the enucleated egg of one species of Echinoderm with the spermatozoon of another, and, like Delage and others, came to the conclusion that the hybrid thus produced does exhibit some of the maternal characters, and that, in consequence, the theory that the hereditable characters are alone borne by the nuclei of the germ cells is untenable. Seeliger's writings were clear and forcible, and as he was free from the ordinary prejudice of orthodox opinion in biological matters, his loss to science is severe.

THE second part of the Memoirs of the National Museum, Melbourne, is devoted to a monograph of the Silurian bivalve molluscs of Victoria, in the course of which the author, Mr. F. Chapman, palæontologist to the museum, describes and figures a number of new species.

WITH the June number *British Birds* commences its second volume, to which we wish every success. To that number Mr. W. H. Mullens commences a series of articles on the older British ornithologists, the first name on the list being that of William Turner, who was born just about 400 years ago, and was therefore a contemporary of the founder of Caius College, Cambridge. Previous to Turner's time, exact knowledge of British birds was practically *nil*, while ornithology was but little more cultivated on the Continent. Turner was the author of no fewer than thirty-nine works, among which the most famous is that dealing with the birds mentioned by Aristotle and Pliny. To this wonderful work may be attributed the rise of British ornithology.

WE have received a separate copy of a paper by Messrs. Huene and Lull, from the February number of the *American Journal of Science* (vol. xxv., p. 113), on the Triassic reptile *Hallopus victor*, which was regarded by its original describer, the late Prof. O. C. Marsh, as a theropod dinosaur. In some respects the pelvis is, however, more like that of an orthopod dinosaur, although in the form of the pubis, the calcaneum, the extreme thickness of the astragalus, the contour of the scapula, and the height of the ilium, the skeleton differs from all known members of that group. In the opinion of the authors (the grounds of which are promised in a later memoir), the genus appears to be most nearly related to Aëtosaurus and its allies.

TO the April number of *Spolia Zeylanica* Commander Boyle Somerville communicates a thoughtful paper on the submerged plateau surrounding Ceylon at an average distance of about a dozen miles from the coast, with depths shoaling from south to north from 40 to 20 fathoms. Everywhere there is a sudden drop to oceanic depths on the outer margin, but a slightly deeper channel or gully occurs in the centre, tapering off to the northward and ending in a marked shoaling, and the existence of banks, which begin at Mount Lavinia and extend northward. After referring to the occurrence of lakes or lagoons near the coast nearly all round the island, the author concludes that while the high-ground of Ceylon has existed as land for an extremely long period, the low-country has in the main been formed by the denudation of the central elevated area, and was laid down on a plateau of which the present fringe is a remnant. This accounts for the absence of coral reefs round most of the coast.

STONE implements from the Bulawayo district form the subject of an illustrated paper by the Rev. F. Gardner in vol. vii., part i., of the Proceedings of the Rhodesia Scientific Association. The account is based on the large collection in the Rhodesia Museum. Many of the implements are of well-defined shape and show workmanship of a high order, although not rising to the standard frequently noticeable in their corresponding (Neolithic) European prototypes. In the author's opinion, they represent a mixture, and are the product of many ages, some, perhaps, having been manufactured in quite recent times.

THE latest issue (vol. iii., No. 1) of the *Journal of Economic Biology* is devoted to an investigation, by Miss J. S. Bayliss, of the basidiomycetous fungus *Polystictus versicolor*, that grows as a saprophyte on dead wood, causing it to rot and crumble. The bracket-like fruiting body is characterised by a velvety zoned upper surface. In laboratory cultures spore sowings produced oidia and conidia, and on infected blocks of wood incipient fruiting bodies were produced, but full development was only obtained when the blocks were exposed under natural conditions. Similarly, it was observed that the sporophores will not develop in the dark or when revolving on a clinostat. The zoning is shown to be due to changes in the rate of growth dependent upon the temperature of the air and the amount of moisture present.

THE botanic station in St. Vincent occupies a portion of the site of the old botanic garden, established in 1765, that reached a high state of prosperity during the tenure of Dr. Anderson as superintendent. The station was re-established by Mr. H. Powell in 1890, who with the present curator, Mr. W. N. Sands, has contributed to its present standard of efficiency. A historical account, accompanied with reproductions of photographs taken in the gardens, appears in the annual report for 1906–7. Conditions in recent years have led to a remarkable increase in cotton cultivation, and a great reduction in the area devoted to sugar-cane. Arrowroot still supplies the most valuable asset of the colony, but the value of the cotton exported will shortly exceed that of the former product.

TWO Bulletins received from the University of Illinois afford evidence of the value of the investigations carried on by the Engineering Experiment Station. Prof. A. N. Talbot (Bulletin No. 20) gives the results of tests of concrete and reinforced concrete columns, throwing light on

the properties of plain and hooped concrete. The additional strength of the hooped column over that for an unreinforced column of the same quality averages for each 1 per cent. of hooping 955 lb. per square inch for spiral hooped columns and 669 lb. per square inch for band-hooped columns having a diameter of 12 inches. Tests of a liquid-air plant are recorded by Mr. C. S. Hudson and Mr. C. M. Garland (Bulletin No. 21). The tests were made for the purpose of determining the most economical conditions for operating the liquid-air plant belonging to the University.

WE have received from the Rev. O. Fisher a letter commenting on the distinction drawn by Mr. R. D. Oldham between "earthquakes" and "earthshakes" in a communication published in the issue of NATURE for May 28. Mr. Oldham on that occasion wrote:—"We may say that earthquakes, or at any rate severe earthquakes, are frequently, if not invariably, caused by rupture of the earth's crust and the formation of fractures or faults in the solid rock, but these fractures, which are the primary cause of the earthquake, are only the secondary result of the earthshake, the action of which arises at a greater depth, and the ultimate cause of which lies beyond our present ken" (vol. lxxviii., p. 78). Mr. Fisher read this to imply that Mr. Oldham applied the term "earthshake" to the deep-seated cause of the "snap and jar" caused by a rupture of the rocks, which gives rise to the vibratory movement constituting an earthquake, and suggests, as more probable, that the deep-seated cause is of the nature of an accumulating stress, which goes on increasing until the crust gives way suddenly, producing the "snap and jar" which produces world-shaking results. "What we want," says Mr. Fisher, "is a term to express the molar displacement of the ground as distinguished from the vibratory." Mr. Oldham informs us that in reality he is in agreement with Mr. Fisher. "The word earthshake," he writes, "was not intended to apply to the slowly accumulating stresses, but to the molar displacements accompanying the abrupt relief of the strain induced by these stresses." Mr. Oldham says "it might have been better to have suggested a wholly new word, such as bathyseism, carrying with it no connotation of meaning, but so many 'seisms' have already been suggested, and so loosely used, that I was chary of inventing yet another."

WE have received from Prof. H. Mohn two valuable publications relating to the meteorological service of Norway for the year 1907:—(1) the year-book, containing complete observations or results at sixty stations, and (2) rainfall observations, containing daily measurements at 200 stations, with monthly or yearly amounts at a much larger number of places, for some of which the results are quoted so far back as 1867. These publications have been issued in the same excellent form for many years, and the data are of exceptional importance, due to the exposed position and topographical features of the country.

THE report of the observatory department of the National Physical Laboratory for the year 1907 shows that the only very large magnetic disturbance was that of February 9–10, already referred to in NATURE (February 14, 1907, vol. lxxv., p. 367); the mean declination for the year was 16° 23′ W. The largest seismological disturbances recorded took place on April 15 (the Mexican earthquake), maximum amplitude, 15 mm., September 2, and December 30. The lowest temperature, 23°·3, occurred on January 27, and the highest, 77°·7, on September 25; the total rainfall was 23·85 inches. The verification of instruments (exclusive of watches and chronometers), one of the most active branches of the useful work of the observatory, again shows a large increase, the total number of instruments tested being 34,700, or 5133 more than in the previous year, and was chiefly due to increased numbers of clinical and ordinary thermometers. A large part of the time devoted to experimental work has been occupied by observations on atmospheric electricity and on solar radiation.

IN *Engineering* of June 5 there is an illustrated article on electric iron and steel furnaces, in which the leading types are described. At the present time, electric iron smelting is still in its infancy, while electric melting and refining furnaces have been added to many notable works. There is a good deal of electric melting, but, so far, little smelting. The reasons are not far to seek. All furnaces are wasteful; the electric furnaces do not form an exception, and electricity is not inexpensive, whether generated by water-power or by coal. The advantages of water-power have been much over-rated. When water-power begins to develop, it becomes subject to rates and taxes. Hydro-electric installations are by no means simple. The water may fail in summer owing to drought and in winter owing to frost, and reserve steam-power has to be provided; if a good load-factor is to be maintained, the reserve must be of ample capacity. Manufacturers are, moreover, becoming sceptical as to the advantages to be gained by installing works close to the mines and to the waterfalls, so as to secure cheap power and to avoid the transport of ores. The power item is not, as a rule, the decisive factor, and the crude ore transport may, after all, prove economical.

THE practical value of the fascinating study of diatoms as a test of the powers of the microscope is illustrated by a note on *Biddulphia mobiliensis* contributed to the April Journal of the Royal Microscopical Society by Mr. Edward M. Nelson. The secondary structure of this diatom is so delicate that Mr. Nelson was unable to draw or even retain the image for any length of time, and in pointing out that the secondaries have only been seen with long-tube microscopes, the author states as his conclusion that "the ultimate appeal concerning any very minute structure must go to a long-tube microscope."

PROF. H. FEHR, editor of *L'Enseignement mathématique*, has reprinted from that journal the results of his inquiry on the work of mathematicians. It will be remembered that some time ago a circular was addressed to mathematicians containing thirty questions regarding their habits of life, the way in which they acquired an interest in mathematics, the advice they would give to a young mathematician, and other matters of a personal character. The classification of the answers has been undertaken by Profs. Th. Flournoy and Ed. Claparède, of the psychological department of the University of Geneva. Perhaps the diversity of the answers is one of the most noticeable features of the inquiry.

A NEW periodical entitled *Popular Electricity* has just been issued by the Electricity Publishing Co., of New York. The first number—for May—consists of thirty-six well illustrated pages dealing with such subjects of general interest as electric lighting in the house, how to read an electricity meter, the new metallic filament lamps, &c. The language is free from technicalities, and the treatment humorous on occasions. It would be interesting to know how far the electric milking machine and the electric shoeblack described are commercially successful in America.

THE March number of *Terrestrial Magnetism and Atmospheric Electricity* contains an article by Dr. L. A. Bauer on the question of the exact nature of the action of the earth on a magnet, which, according to our present ideas, should reduce to a couple. Most careful and accurate weighings of a magnet with its axis pointing in various directions have been made on a balance specially constructed to be free from magnetic material, and show that on the average for stations in Alaska, British Columbia, Kansas, Maryland, and Washington, the weight when the south pole of the magnet was to the north exceeds that when the magnet is reversed by 1 part in 1,000,000. In disturbed regions the differences of weight observed exceeded 1 part in 100,000. Preliminary experiments on the influence of magnetisation on the weight of a magnetisable material show an increase of the order of 1 part in 1,000,000 on magnetisation.

THE Transactions of the English Ceramic Society for the session 1906–7 show that a great deal of active experimental work is being done by members of the society, and that very considerable progress is being made, with the aid of scientific method, in elucidating obscure points in pottery work. A number of useful investigations are described in the Transactions, of which a few may be referred to as possessing more than a purely technical interest. Mr. Page contributes a paper on the properties of refractory clays, dealing principally with the connection between chemical composition and fusibility; Dr. J. W. Mellor and Mr. F. J. Austin have examined the changes in the microscopic character of various types of refractory substances when subjected to prolonged heating; and Dr. Mellor deals at length with the behaviour of pyritiferous clays on weathering and when heated. The members of the society are to be congratulated on the work they are doing in extending our knowledge of a very difficult subject.

AN eighth edition of "A Treatise on Qualitative Analysis and Practical Chemistry adapted for Use in the Laboratories of Colleges and Schools," by Dr. Frank Clowes, has been published by Messrs. J. and A. Churchill. The present edition has undergone revision mainly in the section on the preparation and detection of gases, and in sections dealing with the reactions and detection of organic substances.

IN Prof. D'Arcy Thompson's paper "On the Shapes of Eggs" in NATURE of June 4, the formula on p. 113 should be $p_n + \frac{T}{r} + \frac{T'}{r'} = P$, and in paragraph 13 the words "the egg is invariably spherical" should be "the yolk is invariably spherical." The first word on the penultimate line of this paragraph should also be *yolk* and not *egg*.

OUR ASTRONOMICAL COLUMN.

ENCKE'S COMET, 1908*b*.—According to the ephemeris given by M. Kamensky in No. 4241 of the *Astronomische Nachrichten*, the southerly declination of Encke's comet is increasing, and the comet is apparently travelling rapidly through the southern constellations Sculptor and Grus towards Indus. Its position on June 21 will be

R.A. = 24h. 0m., dec. = −41° 25′.

From an announcement in No. 4252 of the same journal (p. 71, June 3) we learn that the position determined by Mr. Woodgate, at the time of re-discovery on May 27, gave corrections of +5m. 22s. and −33′ to the ephemeris.

A FOURTH MINOR PLANET NEAR JUPITER.—Elements calculated by Dr. Ebell for the orbit of the minor planet 1908 C.S. indicate that this object belongs to the Achilles group of asteroids, which travel in orbits near to that of Jupiter. This makes the fourth member of this group to be discovered (the *Observatory*, June, p. 257, No. 397).

OBSERVATIONS OF JUPITER'S EIGHTH SATELLITE.—A note by Prof. E. C. Pickering, published in No. 4253 of the *Astronomische Nachrichten* (p. 87, June 5), states that, according to a telegram from Prof. Campbell, the eighth satellite of Jupiter was observed by Prof. Perrine, at the Lick Observatory, on April 1 and 29. The last observation at Greenwich was made on April 24, so that Prof. Perrine's second observation will serve to extend the path already observed, and will provide a useful check on the ephemeris calculated from the results of the Greenwich observations.

PHOTOGRAPHIC DETERMINATION OF STAR COLOURS.—In No. 3, vol. xxvii., of the *Astrophysical Journal* (April, p. 169) there is an interesting paper by Messrs. Parkhurst and Jordan, of the Yerkes Observatory, on the photographic determination of star colours and their relation to spectral types. The method employed is based on that suggested by Schwarzschild, in which it is assumed that a satisfactory measure of a star's colour may be obtained by comparing the visual magnitude of the star with the magnitude derived from photographs taken on ordinary plates, but the present workers have modified it by determining the "visual" magnitudes by photographic means. With this object in view, they regularly exposed pairs of ordinary ("Seed") and "Pan-iso" plates, the latter giving the "visual" magnitude. Their results show that this method furnishes a simultaneous comparison of the visual and photographic magnitudes of a star freed from most of the uncertainties of ordinary visual methods. As the colour intensities thus derived correspond, in general, to definite spectral types, this procedure furnishes a method of determining the spectra of stars which are too faint for the ordinary spectrographic method.

THE MAXIMUM OF MIRA IN OCTOBER, 1907.—During the period July 13, 1907, to March 9, 1908, Prof. A. A. Nijland made a series of observations of the magnitude of Mira, and in No. 4253 of the *Astronomische Nachrichten* (p. 79, June 5) he publishes the results obtained. These show that the maximum (mag. 3·25) was attained on October 30, 1907 = J.D. 2417879. The four last maxima observed are compared, as regards their dates, with the ephemeris published by Dr. Guthnick, and the differences (O–C) are thus shown to be +2, −19, −13, and −16 days respectively. The magnitudes at maximum range from 3·9 (J.D. 2417214) to 2·0 (J.D. 2417552), and the periods between the four most recently observed maxima, are shown to have been 310, 338, and 327 days respectively.

DETERMINATION OF LONGITUDE DIFFERENCE.—Bulletin No. 130 from the Lick Observatory describes the recent determination of the difference of longitude between the Lick and Mare Island Observatories, carried out by Messrs. Tucker and Sanford during April. The difference determined was 2m. 30·74s., with a probable error of ±0·01s., and, accepting that of the Lick Observatory as 8h. 6m. 34·81s. W., this gives the longitude of the Mare Island Naval Observatory as 8h. 9m. 5·55s. W.

CORONAL STREAMERS.—In No. 4, vol. xxvii., of the *Astrophysical Journal* (p. 286, May), Prof. J. A. Miller describes a method whereby it becomes possible to determine the heliocentric position of a certain class of coronal streamers. The streamers discussed are those which first curve away from, and then towards, the projection of the pole of the sun, or *vice versâ*. Applying his method to the discussion of such a streamer, shown on the photographs taken by Prof. Cogshall and himself in Spain in 1905, he finds the latitude and longitude of the point from which the streamer matter was projected, and also shows that the force of repulsion is so nearly equal to the attraction of the sun (the ratio being as 0·99 : 1·0) that the particle considered had probably been ejected some 251,860 seconds—or about seventy hours—before the eclipse occurred. At the time of the eclipse this particle was at the point of the streamer, where it reversed its direction of curvature, and was about 1·3 radii of the sun from its centre.

LOW TEMPERATURE GALVANISING.

THE coating of iron with zinc in order to protect it from atmospheric corrosion is an industry which dates back to 1846, and is employed upon a very large scale. The original process, and still the chief one in vogue, was to dip the cleaned iron surface into a bath of molten zinc. The zinc forms an alloy upon the surface of the iron, and as zinc is very little acted upon by the atmosphere, whereas iron rapidly rusts and corrodes, a protective coating is obtained. Furthermore, in the case of tanks, buckets, &c., it is not necessary that the joints should be absolutely water-tight, because when dipped into the molten zinc any slight leaks are filled in with this metal.

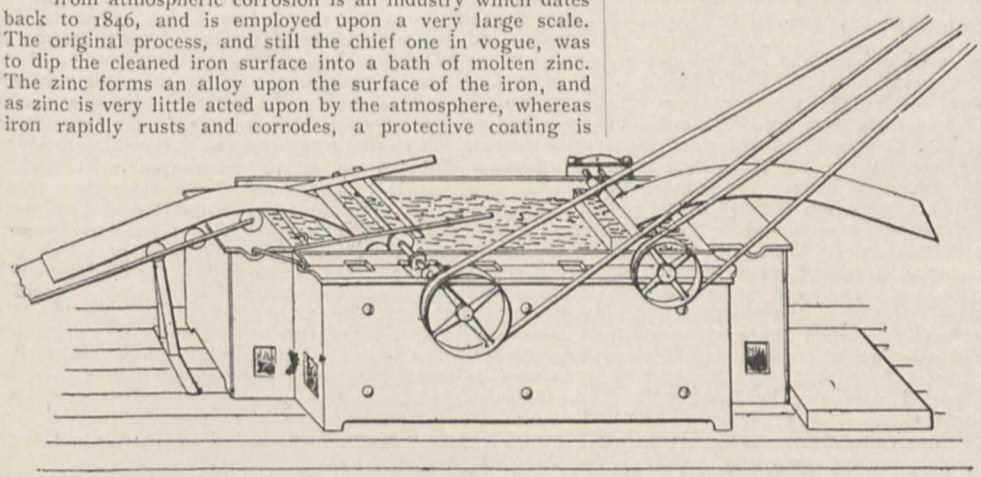


FIG. 1.

The great advantage of employing zinc as a coating for iron is that it is electropositive to this metal, and thus the tendency is for the zinc to go into solution and become oxidised, instead of the iron with which it is in contact being acted upon. The zinc, however, takes on a protective coating of oxide or oxycarbonate, and thus further corrosion is prevented, or at any rate will only take place very slowly.

There are, however, disadvantages in connection with hot galvanising. In the first place it is expensive to keep large quantities of zinc in the molten condition. Secondly, there is considerable loss of zinc through oxidation. Thirdly, the zinc tends to alloy with the iron and to form a difficultly fusible alloy. The higher the temperature of the bath the greater the tendency for alloy formation, but, on the other hand, the thinner the coating obtained upon the metal to be galvanised, and thus in this direction a saving in cost. The alloy of iron and zinc produced is extremely hard, and is sometimes used for making bearings, but as it is difficult to separate the iron from the zinc it is a distinct disadvantage to the galvaniser. Finally, the hot zinc is apt to destroy the temper of the iron, and sometimes to distort the shape of the article to be galvanised.

Consequently, it is necessary to keep the bath at as low a temperature as possible, the excess of zinc being removed by passing the sheets through rollers (Fig. 1).[1]

Cold galvanising or electrolytic galvanising has therefore been suggested, and is actually employed for specific purposes, but there are a good many reasons which have prevented it coming into general use. In the first place, the articles to be galvanised require a more thorough cleansing than is the case with hot galvanising, the least trace of grease being fatal to a good deposit. If there happen to be flaws or the joints are not quite tight, these are not filled in by the wet galvanising process. There are also difficulties in connection with the use of zinc anodes owing to disintegration. As a rule, therefore, lead or iron anodes are employed, and the strength of the electrolyte is maintained constant by circulating it through a filter bed consisting of coke and powdered zinc or coke and zinc oxide (Fig. 2). The disadvantage that flaws are not coated by electrolytic galvanising is in certain cases made use of.

For example, steam tubes employed for marine boilers may have slight flaws which are practically impossible to locate by mere inspection, but which, if the tubes were actually used in boiler construction, might lead to very serious accidents. If such tubes are electro-galvanised, the flaws are made apparent owing to the inequality of the galvanising, probably partially produced by local action.

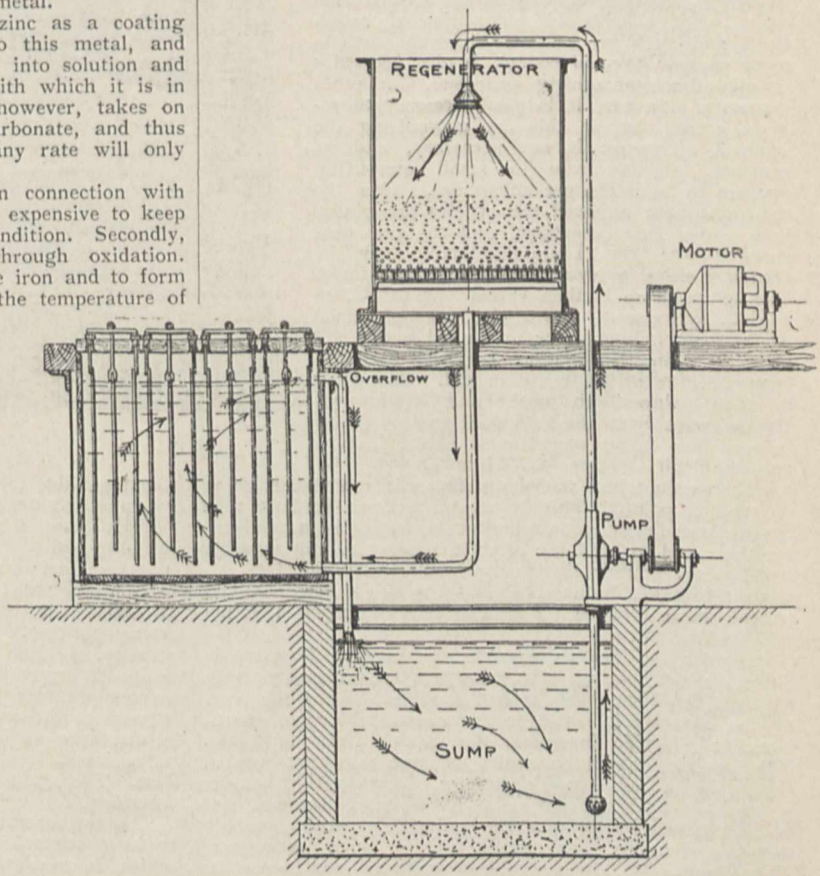


FIG. 2.

Therefore electro-galvanising has been, and is, employed for coating steel tubes used for the construction of boilers for the navy, not to act as a protective coating, but in order to expose flaws or inequalities.

Electro-deposited zinc is of a uniform grey colour, and

[1] The diagrams accompanying this article have been reproduced from the Transactions of the Glasgow Technical College Scientific Society from a paper read by Mr. S. Cowper-Coles.

does not exhibit the artistic crystalline structure produced in hot galvanising. It is very even, and takes on a beautiful polish, so that actually it can be made more artistic than zinc deposited by hot galvanising, which, owing to its crystalline structure, cannot very well be polished.

But beside the actual cold galvanising and the galvanising by means of molten metal, there is a low temperature dry process which was accidentally discovered by Mr. Sherard Cowper-Coles some little time ago. In order to temper certain articles, Mr. Cowper-Coles imbedded them in zinc powder, and they were then heated to a temperature which was considerably below the fusing temperature of zinc. After cooling the articles were taken out, and were, to the surprise of the operator, found to be homogeneously coated with metallic zinc. The zinc was firm and adherent, and on cutting a rod of metal through, it was found that the zinc had penetrated an appreciable depth into the other metal. Experiments were then undertaken to ascertain what was the lowest temperature which could be employed, and whether all metals would thus react with the zinc. It was found that metals could be evenly and completely coated with zinc by heating to a temperature of from 250° C. to 330° C. (zinc melts at 418° C.). The process is now called Sherardising, after the name of the inventor, and is worked essentially as follows:—

Zinc dust, which is obtained as a by-product in the metallurgy of zinc, is the raw product employed. This substance, which amounts to about 10 per cent. of the zinc produced, and can therefore readily be obtained in large quantities, consists of very finely divided zinc mixed with considerable quantities of oxide. Scale and oxide are removed from the articles to be coated; this, of course, is also necessary in all other galvanising processes. In other processes, however, it is also necessary to remove grease, but in this dry galvanising the removal of grease is not necessary, and its presence, at any rate in small quantities, appears to be a distinct advantage. After the scale has been removed the articles are placed in a closed iron receptacle, and the zinc dust charged in; the containing box may be arranged either to work stationarily or rotated. The temperature is then raised to 250° C. to 330° C. by means of gas firing, and maintained so for from half an hour to several hours, depending upon the coating required and the nature of the article to be coated. The drum is then allowed to cool, and discharged. Owing probably to the individual grains of zinc in zinc dust being coated with oxide, it is a very difficult matter to cause it to melt together even when the temperature is raised far above its melting point. This is one of the troubles met with in the metallurgy of zinc, that is, there is a tendency for the metal to condense as dust and not to run together and liquefy. But in the Sherardising process this is a distinct advantage, because, should the drum become overheated, there will be no danger in its melting together and spoiling the articles to be galvanised.

In order, so far as possible, to prevent increase in oxide during heating, the receptacle is preferably made air-tight, but when this is not possible about 3 per cent. of fine charcoal is added to the zinc. Otherwise, as the quantity of oxide increases, the deposit lacks in lustre. The fact that small quantities of grease do not prevent the production of a good deposit is of importance, because it enables machined work, such as bolts, screws, &c., to be placed directly into the galvanising drum without previous cleaning. For small articles, such as screws, rings, nuts, &c., a closed iron cylinder which can be rotated or oscillated is the most suitable form of furnace. For tubes, oblong or cylindrical work, it is most satisfactory to have the door at the end of the furnace, and oscillate it on its axis. A number of Bunsen burners are arranged below the drum, and the whole is enclosed in an iron shell lined with asbestos. For larger work, stationary iron boxes are employed, as illustrated in Fig. 3.

A plant has been erected near London containing four furnaces capable of taking drums 6 feet by 2 feet, with a cubic capacity of two tons of material at one charge. The furnaces are heated with Dowson gas. It is essential that the zinc dust be dry before being added to the furnace, otherwise the zinc is oxidised, and hydrogen is given off on heating.

It is stated that in practice dry galvanised or Sherardised steel and iron will withstand the ordinary corrosive agents to which galvanised ware is usually exposed to a remarkable degree. Even after the apparent removal of the zinc by abrasion, the iron will retain its resistivity.

This resistivity is probably due to the protective action of the zinc-iron alloy formed below the actual zinc coating. The temper of steel wire is not reduced by dry galvanising, owing to the low temperature at which the process is carried out. In Sherardising, the zinc does not form a more or less thick coating or skin, but actually sinks into the metal. As a consequence, the fine lines of screws and other articles which have been machined are not blurred. For example, the minute screws which are employed in making watches can be Sherardised, and fit the holes tapped to receive them quite as well as before being zinced.

In the ordinary method of galvanising it has not been found possible to produce patterns, because, of course, the whole article has to be dipped, and there are also difficulties in doing this with electrolytic galvanising owing to the electrolyte getting beneath the stopping material which may be used; but with the Sherardising process it has been found possible to produce some very artistic effects. In order to do this, the article is coated with a stopping-off composition. The composition is about the consistency of soap, so that it can be easily cut with a knife. The design is traced with an edged tool, and the portions to be removed are lifted away, so that a clean surface is exposed to the action of the zinc. The object so prepared is placed in an iron drum containing the metal which is to be inlaid in the powdered form, for example, the zinc dust. The galvanising is then carried out as already described.

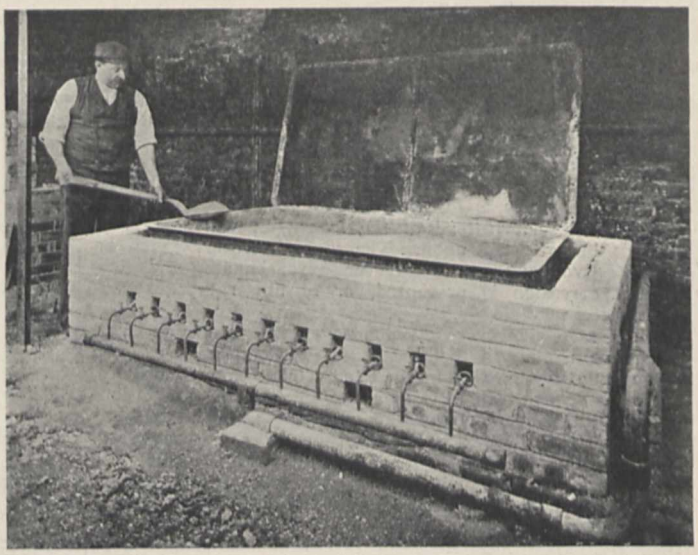


FIG 3

The temperature and the time which the heating has to be continued are regulated according to the thickness which is required for the inlaying, and may vary from a few minutes to several hours. After inlaying it is found that the part inlaid is much harder than the brass or copper into which it is inlaid.

Furthermore, it is possible to obtain a variety of colours by means of the process. Suppose, for example, one wishes to inlay a copper vase, and convert some parts of it into brass; this can be done by variations in the thickness of the stopping-off composition and by heating to a higher

temperature than is generally done. By proceeding in this manner some portions can be converted into yellow-coloured brass, and other parts remain pure copper.

The contrasts between copper and brass are very marked,

FIG. 4.—Copper and brass coal vase inlaid with zinc.

but softer effects can be obtained with zinc, aluminium, tin, and other metals. Fig. 4 shows such an inlaid copper vase.

One beauty about this process of inlaying metals which differentiates it from other processes is the soft transition which shades the inlaid metal from the surrounding metal. For instance, it will be observed that when inlaying zinc into copper, the zinc is surrounded by a halo of the brass-coloured alloy.

Mr. Cowper-Coles has also another process, which he calls Cowperising, and in which he uses vapour of zinc; the articles to be coated are *not* brought into contact with dry or molten zinc, but are placed in a chamber into which zinc vapour is passed. The chamber or drum is slowly rotated inside an outer cylinder in which the metallic zinc is heated by means of a gas or electric furnace. Hydrogen gas is also passed into the apparatus from a tube, and a pilot light is kept burning to make sure that air is not being sucked back.

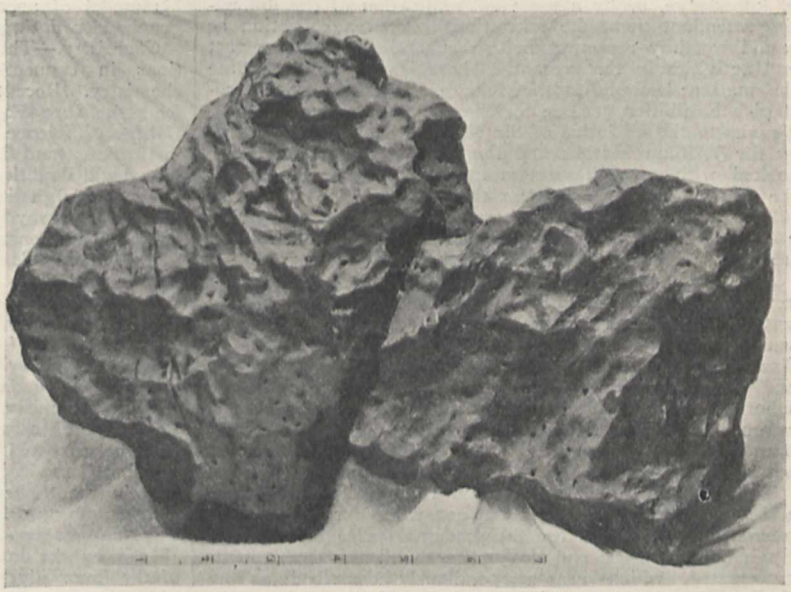
The process has been found successful for decorating porcelain and metallic surfaces with a brilliant coating of zinc. The remarkable part about the action of zinc powder upon metals is the manner and speed with which it, at temperatures much below its melting point, sinks into and alloys with them. In this, Sherardising rather resembles Sir W. Roberts-Austen's experiment in which he placed pieces of gold and lead together, and showed that diffusion took place even at ordinary temperatures; in his case, however, the diffusion was very slow. But with the Sherardising process the zinc sinks in in a few minutes to an appreciable depth. Another peculiarity is that the zinc does not require to be pure, but is the commercial dust which is coated with oxide, and with this zinc dust I have found that it is practically impossible to get an electric current to pass through even a centimetre thickness, although 100 volts pressure was employed. Cadmium and a few other metals can also be employed, but they are not so satisfactory as zinc.

It looks as if the zinc has a very distinct vapour pressure even a very long way below its melting point, not to say its boiling point. The zinc vapour being immediately able to alloy with the iron or other metal in contact with it, equilibrium is destroyed, and a further portion of the zinc becomes vaporised. F. M. P.

STUDIES OF SOME AMERICAN METEORITES.

THE large crater, three-quarters of a mile across and 500 feet in depth, near Canyon Diablo, in Arizona, which it is supposed was produced by the impact of an enormous meteorite, has already been described at some length in NATURE (1906, vol. lxxiv., p. 490). Since that date the locality has been visited by Dr. George P. Merrill, of the United States National Museum, and in a paper published in the Smithsonian Miscellaneous Collections (1908, vol. l, pp. 461–90, with fifteen plates) he gives the results of his observations, and reviews the evidence for and against the meteoric hypothesis. In the hope of finding a large mass of metallic nickel-iron, Messrs. D. M. Barringer and B. C. Tilghman have made a detailed examination of the crater, and have put down a number of bore-holes to the depth of 1100 feet in its floor. Beneath the surface débris from the sides of the crater there is a thick bed of lake deposits; this lies on a crushed and pulverised sandstone containing fused and pumiceous fragments and particles of nickel-iron, while at a depth of about 600 feet the undisturbed red sandstone of the district was met with. No large mass of meteoric iron was encountered; and with the exception of four small pieces, the numerous masses of Canyon Diablo meteoric iron have all been found outside the crater. All the evidence undoubtedly points to the crater having been formed by the impact of a meteorite.

Prof. O. C. Farrington, in his "Meteorite Studies, II.," published in the geological series of the Field Museum of Natural History (Chicago, 1907), gives a collection of miscellaneous notes respecting nine different meteoritic falls in the North and South American con-



Mass produced by joining the two individuals of the Chupaderos meteorite. $\times \frac{1}{8}$.

tinents, most of which have been previously described, though one, an iron from Lampa, in Chile, is now described for the first time. The paper is illustrated with fifteen excellent plates of photographic reproductions; special attention may be directed to those representing the large masses of meteoric iron mounted in the School of Mines in the city of Mexico, which, though long known, do not appear hitherto to have been figured. The two masses of the Chupaderos iron, found at a distance of about 800 feet apart, and known in Mexico since 1852, evidently formed part of the same mass, the total weight of which would have been about twenty-one tons. Particulars are also given respecting the fall of stones near Modoc, in Kansas, on September 2, 1905; fifteen stones with an aggregate weight of 35 lb. were found over an area of seven by two miles, the several masses gradually increasing in size from west to east, this being the direction in which the meteor fell. The same distribution of the stones according to size is noted in the fall at Weston, in Connecticut, in the year 1807.

THE SCIENCE COURT OF THE FRANCO-BRITISH EXHIBITION.

ALL international exhibitions have contributed in some measure to the advancement of science. The assembling before the public of a great array of machinery has from time to time acted as a stimulus to inventions in which science was applied to promote safety, comfort, or luxury. The competition between manufacturers of scientific apparatus, encouraged by medals and other awards of excellence, doubtless resulted in improved workmanship and better design in the tools which the scientific investigator or teacher has to employ. The sporadic display of original or merely antique instruments (*e.g.* clocks) did little more than hint at an evolution of scientific knowledge, and fell far short of exhibiting in any adequately organised manner the actual progress of such evolution, full as it was—and is—alike of human and philosophical interest.

Happily, we need not discuss the causes which hitherto prevented the realisation of an exhibition dealing with all branches of research by scientific experiment; whether the managers of international exhibitions have been deterred by lack of faith in the popularity of a section devoted to purely scientific exploration of the boundaries of knowledge, or by a too vivid realisation of the difficulties attendant upon the formation of such a collection as would worthily represent British achievements in the past and activities in the present. There is no need to debate the matter; visitors to the Science Court of the Franco-British Exhibition can see for themselves the *fait accompli*. Thanks to the initiative of Sir Norman Lockyer, supported by Sir William Mather and the executive committee, and backed with equal heartiness and ability by members of the British Science Guild, for the first time in the history of international exhibitions there has been brought together a collection of exhibits devoted to the illustration of methods and results of scientific research.

As chairman of the Science Section, Sir Norman Lockyer expressed regret that it has not been found possible to organise a French section, and we shall all echo this sentiment the more fully from seeing what an instructive display is contributed by the limited area of Great Britain and Ireland. By its very nature scientific investigation subordinates national rivalry to national cooperation, and anyone may point to the fact that no department could have attained its present state of efficiency had its progress not been furthered by the genius of the *savants* of France.

The catalogue, a closely printed volume of one hundred and ninety pages, has a permanent value for purposes of reference, and is sold for the moderate price of sixpence. No individual critic can do justice to all the departments represented, which are compendiously described as including instruments and methods used in and results obtained from the exploration of (1) the land; (2) the sea; (3) the air; (4) the heavens. Visitors will be impressed with the richness of the collection in apparatus and documents of historic interest, and with the complete subordination of the trading element. To indicate the character of this unique exhibition we give short notes on a few of the interesting features.

Heat.—The Manchester Municipal School of Technology lend Joule's laboratory note-books and MS. of researches, and his apparatus used for observing the heat-effects of compression and rarefaction of air. Portraits of Joule and some models of apparatus and reprints of papers are also shown. The physical department of the Imperial College of Science and Technology, South Kensington, exhibits modern appliances used in recent calorimetric, thermometric, and barometric determinations, including sunshine receivers and recorders. One recorder shown registers electrically to 1 part in 10,000 the variations produced in a receiver distant a mile or more. With the platinum grid thermometer for determining the temperature of the air is shown a record obtained during the solar eclipse of August 30, 1905. The Cambridge Scientific Instrument Company show Boys's radiomicrometer, a Féry pyrometer, Callendar and Griffiths's bridge, &c.

It will be seen that we have, on the one hand, the historic apparatus and documents, on the other, the methods and means of up-to-date research. This is typical. All the numerous sections into which the Science Court is divided and subdivided show the same contrast of ancient and modern research. As a consequence, the serious student will everywhere find interesting material, and it may well happen that he will learn more and get fresher views of his subject from the early investigators.

Magnetism and Electricity.—This is a strong department, the evolution of telegraphy in all its branches being particularly well illustrated. From the Wheatstone Laboratory of King's College, London, come the original Daniell's batteries, the original resistance box, bridge and chronograph of Wheatstone, while Sir William Preece and H.M. Postmaster-General contribute numerous specimens dating from 1837 to 1908 which present a miniature of progress in the electric transmission of signals. Signor Marconi sends thirty-three items, including some of the apparatus used in Newfoundland for the first Transatlantic reception in 1901. Much of the evolution of the Ayrton-Perry instruments can be traced. The early and recent forms of lamp contributed by Sir J. W. Swan are particularly interesting. It is hardly necessary to say that Kelvin instruments find a place, as do the devices associated with the recent researches of H. A. Wilson, P. E. Shaw, Duddell, and Fleming. Dr. Shelford Bidwell shows his selenium cell, and attention will no doubt be attracted to his model of apparatus for transmitting pictures by telegraph, also dating from 1881.

Chemistry.—There is an excellent collection of preparations in connection with both physical and technical chemistry. Recent research is represented by contributions from the Davy-Faraday Research Laboratory, the Imperial College of Science, the University of Manchester, and many institutions and investigators too numerous to mention. Many will doubtless be interested in the apparatus used by Lord Rayleigh in the discovery of argon, and by Sir William Ramsay in his researches on helium and the new gases. The penetration of the physicist into the domain of the chemist is nicely illustrated by the inclusion of Sir Oliver Lodge's "ether machine" in the chemistry division. Magnificent specimens of salts of the platinum group were on view, lent by Messrs. Johnson, Matthey and Co. But of all the items in this division we were most attracted by (1) Black's original balance, dating from 1766—the foundation-stone of modern chemistry; (2) original mauvein preparations made by the late Sir William Perkin between 1868 and 1872. The general public may be expected to be interested in the "oldest lucifer matches," made by Walker, of Stockon-on-Tees, in 1827; also in the "chemistry of a bottle of eau de Cologne," contrasting natural and synthetic methods of production.

Metallography.—Micro-sections of metals prepared in 1863–4 by the late Dr. Sorby are shown; the remainder of the items illustrate modern developments of this branch of science, to further which a special institution was founded quite recently.

Biology.—The members of the biology subcommittee have secured an exhibit of profound interest from the Liverpool School of Tropical Medicine, which has sent specimens illustrating sleeping sickness, ngana, malaria,

yellow fever, bubonic plague, and other terrible scourges. We were glad to see portraits of Major Ronald Ross and other leaders in the campaign which science is waging on behalf of humanity, and especially on behalf of the native races of the tropical regions of the Empire. The evolution of the microscope is excellently demonstrated by the instruments lent by the Royal Microscopical Society, ranging from the copy of the simple microscope of Leeuwenhoek (1675) to the 1848 pattern of Powell and Lealand. A full account of them may be found in Dr. Dallinger's editions of "Carpenter on the Microscope." Modern methods of mounting microscopical preparations are represented, also the processes for the preservation of anatomical structures on the larger scale.

Anthropology.—Anthropometric contrivances are numerous, and gain some additional interest from recent regulations with regard to the medical inspection of schools and from the efforts being made to secure an anthropological survey of Britain.

Geography and Geodesy.—The Government has given but little assistance to the science section as a whole, but in this division we find much instructive material lent by the War Office and the Board of Agriculture and Fisheries, the former through the topographical section of the General Staff and the latter through the Ordnance Survey. The production of the topographical map of the Orange River Colony is illustrated in all its stages, and there is a fine collection of Ordnance Survey maps of the United Kingdom. The Royal Geographical Society contributes photo reproductions of original MS. maps by British explorers in Africa, including Livingstone, Burton, and Speke. Surveying instruments used in famous pre-Victorian expeditions are to be seen, and also those of the latest 1908 pattern.

Geology and Geodesy.—The Geological Society shows facsimile reproductions of early tables and maps by William Smith, 1799 to 1801. Photographs of British scenery illustrative of geological features are contributed by the Geological Survey and the British Association Committee, of which Prof. Watts is secretary. We direct attention to a new small geological map of the United Kingdom, scale 1 inch to 25 miles, published by the survey to provide teachers with a cheap and accurate map. In the palæontological division *systematic* research is illustrated by the grouping, viz. :—(*a*) collecting of fossils; (*b*) preparation of fossils; (*c*) study of fossils; (*d*) literary aids to research; (*e*) presentation of results.

Oceanography.—The Admiralty has lent the gear used by H.M.S. *Challenger*, 1872–6, photographic reproductions of Captain's Cook's original charts, and various pieces of apparatus used in sounding, both antique and recent. Biological specimens brought by the *Scotia* from the Antarctic can be seen, while the submarine cable companies contribute an attractive exhibit.

Meteorology.—No fewer than twenty-five pages of the catalogue are required for the enumeration of the items in this remarkably complete division. Here one may study the equipments of stations of the first, second, and third orders, and the methods of dealing with observations and results. Applications of meteorological statistics to agriculture and public health are instructively set forth. Apparatus for investigating the upper air, for observations on board ship, and for such special purposes as dust-counting, are on view. The historical collection includes Merle's weather journal, kept from 1337–44, and the earliest treatise on the barometer, published in 1688. Photographs of lightning flashes and of cloud-forms are numerous and of high quality. In the subdivision devoted to terrestrial magnetism will be found the results of the *Discovery* Antarctic Expedition.

Astronomy.—Though placed last in the official classification, this section is second to none in extent and interest. The observatories of Greenwich, Cape of Good Hope, Edinburgh, Cambridge, Oxford, Stonyhurst, and the Solar Physics Observatory of South Kensington have all contributed to a wonderful display of instruments and photographs. The subcommittee has arranged a stand to show the more important instruments required to equip a modern astrophysical laboratory. The large variety of objects of historical interest include an equatorial by Abraham Sharp (*circa* 1674), an astrolabe constructed for Sir Francis Drake, a Newtonian telescope made by W. Herschel, an Arabian astrolabe dated 1224 A.D., and autograph letters of John Flamsteed relating to Greenwich Observatory in 1712. In an adjoining case we found a photograph of the new satellite of Jupiter, discovered by Mr. Melotte on February 28, 1908. We cannot imagine a better way to view the progress of astronomy during the last two centuries than by visiting this exhibition.

The National Physical Laboratory sends photographs and duplicates of apparatus used in standardising and research. Regarding such an exhibit as a gauge of the degree of advancement attained in the branches of knowledge for which the instruments are employed, and of the degree of skill reached by our manufacturing firms, we may feel legitimate pride in recent advances, particularly in electro-technics.

In dealing with a new enterprise, it is, of course, easy to find details which are susceptible of improvement, but in this case the only faults we observed were minor ones, and will mostly disappear under the capable directors who have brought so large an undertaking to such a high pitch of attainment with commendable punctuality. We cheerfully omit minor criticisms, and express our strong feeling of indebtedness to the workers who have done so well. We also thank the executive of the exhibition for endowing the Science Section to the extent of about 7000*l*. The best return for this labour and generosity will be an attendance of visitors such as the merits of the exhibition deserve.

G. F. DANIELL.

CONFERENCE OF TEACHERS IN TECHNICAL INSTITUTIONS.

THE second annual conference of the Association of Teachers in Technical Institutions was held in London last week. The following are among the matters of wide interest discussed at the conference :—

(1) The necessity for the provision of two types of schools for the continuance of the education of boys and girls from the ages of fourteen to seventeen years. The first of these types corresponds with the present existing first-class "secondary" school, the second with the "trade" or "preparatory trade" school, which should be a secondary school with a marked "technical" bias. This school should prepare definitely for the trades, crafts, or industries.

(2) As a small but distinct educational advance, the minimum age of exemption from obligatory school attendance should be fourteen years, without any exceptions, as provided in clause 2 of the Education (Continuation Schools) Bill promoted by Mr. Chiozza Money. This, however, is only one step forward. The leaving age for trades, industries, or crafts, where the conditions of the trade permit, should be sixteen or seventeen years. From fourteen to sixteen years, the boy or girl should attend a school provided in accordance with paragraph (1) above.

(3) The technical institution has to deal with students who have received their preliminary training in the primary and secondary schools, often in the primary schools only. The average quality of the material from the primary and secondary schools is far from satisfactory. There is too often a certain lack of intellectual "grip" and thoroughness. How far this is due to the widening of the school curricula in recent years it is impossible to say. Signs are not wanting that in many schools the old evils of stringent individual examinations are being replaced by an evil almost as great, namely, the cramming of a number of pupils for the valuable borough and county scholarships now offered in such profusion. Technical colleges and schools have still to devote much valuable time, space, and equipment to work which should have been done in the secondary schools.

(4) In the case of a large number of students attending evening classes in technical schools, their sole previous educational training has been in the primary school up to the age of thirteen or fourteen years. About sixteen or seventeen years of age, or later, they enter the technical schools, after a period of three or four years during which

they have failed to receive any systematic education. The remedy for this blank period lies in the continuation school. At present, however, the continuation schools, except in a few isolated cases like Manchester, Leeds, Bradford, and Birmingham, fail almost completely in this aspect of their work. This is particularly the case in London, where one of the many pressing questions is the improvement of the evening continuation schools and the correlation of the schools to the polytechnics.

(5) Technical institution teachers are, naturally, keenly interested in the Imperial College of Technology. They look forward to sending their best students (day and evening), by means of scholarships or bursaries, to this institution for the highest *technical* training and research. Judging by the present rate of progress, this will be impossible for a number of years. There is danger that, instead of the college being a "college of technology," it will merely be an organised group of institutions doing practically the same kind of work as that which is done in an ordinary university college. The governing body of the college needs to be brought more closely into touch with the main current of English technical education than it is, apparently, at present, in order that the work of the college may be properly coordinated with that of existing technical institutions. The "preliminary" work now being done in the college, which is done also by a considerable number of institutions all over the country, should cease at the earliest possible opportunity, and the whole energies of the college concentrated on the highest possible technical training and research. We need an institution which shall bear the same proportion to the Manchester Municipal School of Technology as the latter does to the technical institute of a small provincial town.

(6) There is a pressing need for the establishment of a common matriculation or school leaving examination for admission to all British universities, the professions, and the (day) technical colleges, in place of the multiplicity of examinations and examining bodies existing at present. Coupled with this is the need for a revision in the syllabus of some of the chief matriculation examinations as at present conducted.

(7) Reference was made during the conference to the scheme recently put forward by the King's College (London) authorities for instruction in "household economics," based upon a thorough introductory course of chemistry, physics, elementary bacteriology, physiology, &c. While this would be undoubtedly beneficial in many ways, for example, in raising the status of "domestic science" teaching, it is felt by many technical institution teachers engaged in similar teaching in polytechnics and technical schools that the promoters of the King's College scheme have hardly done justice, in their preliminary publications and notices in the Press, to those engaged in such work in technical institutions. The impression given in these publications is that, up to the present, domestic science teaching has been empirical, "rule of thumb," and not based upon a knowledge of scientific "first principles." This is scarcely correct. For the last fifteen years the training schools of domestic economy attached to the polytechnics and technical institutions have increasingly, year by year, laid stress upon attendance at compulsory courses of chemistry, elementary physics, theory of education, and in some cases elementary bacteriology.

J. WILSON.

SOUTH-EASTERN UNION OF SCIENTIFIC SOCIETIES.

THE thirteenth annual congress of the South-Eastern Union of Scientific Societies was held at Hastings on June 10–13.

Sir Archibald Geikie, K.C.B., F.R.S., who followed Prof. Silvanus P. Thompson, F.R.S., in the presidential chair, took as the subject of his address "The Weald." He chose the subject because research in the problems connected with the Wealden area was eminently suitable for that combined action which local societies and field clubs are well fitted to provide. He spoke against the natural predisposition of the mind, in re-constructing the geography of former geological periods, to be too much influenced by the present grouping of sea and land. He sketched the part played by Godwin-Austen in the discovery of coal at Dover in consequence of his brilliant generalisation, after his profound study of the geology of N. France, Belgium, and S.-E. England (work which recalls, too, the names of Prestwich, Etheridge, and Boyd Dawkins). Having sketched the problem of the Palæozoic rocks, and having passed on to the deposition of the Purbeck and Wealden strata, he said that it was not easy to find the place whence the remnants of the terrestrial life of the Wealden deposits were derived, but indicated his belief that the crystalline and Palæozoic rocks of Brittany seem to be the greatly denuded core of an ancient land; for the Wealden deposits thin out rapidly in northerly, easterly, and westerly directions, and the only quarter which seems to offer itself as possibly that in which some vestige of the Wealden land may still remain lies to the south. Since the resources of modern petrography have armed the geologist of to-day with far ampler and more effective means of conducting the inquiry than his predecessors possessed, it would be well for some member of the union to undertake research into the origin of the pebbles found in the Ashdown Sand, the Wadhurst Clay, the Tunbridge Wells Sand, and occasionally in the Weald Clay.

The president sketched the various divisions of the Cretaceous rocks above the Weald Clay, emphasised the break between the Secondary and Tertiary periods, and then proceeded to discuss the evidences of the Ice age afforded by the Wealden area. Prestwich was disposed to think that the uplands of the Weald may have been a separate source of snow and ice, but he (Sir Archibald Geikie) did not think the evidence on which Prestwich relied was, perhaps, strong enough to warrant that conclusion. The decaying nature of the various rocks made observation of glaciation of the Wealden area difficult. But Prestwich may be right, and there may be other indications yet discoverable of "the traces of the Ice age in the Weald."[1]

The president also directed attention to the problem of the Coombe rock, and Mr. Clement Reid's ingenious solution of its origin, but thought that more directly convincing proofs of the Ice age were to be found in the transported boulders—granite, syenite, and mica-schist—found in such numbers along the south coast from Worthing to Portsea, brought thither on floating ice, perhaps from the region of crystalline rocks in the N.W. of France. Before the Arctic conditions finally passed away, there appear to have been some alternations of milder seasons, and the time was further marked by oscillations in the relative levels of land and sea, indicated, on the one hand, by lines of raised beach, and, on the other, by submerged forests.

Mr. E. A. Martin read a paper on some considerations concerning dew-ponds, a subject on which he has been engaged some time, encouraged by a grant from the Royal Society. Mr. W. J. Lewis Abbott read a valuable paper on Pleistocene vertebrates of the S.E. of England, and conducted an excursion to all the salient geological features of the district, which, after eleven years' observation, he is well qualified to do. He considers the Hastings uplift the most important, and his paper will modify previous views on this important area. Mr. Edward Connold contributed a paper on local sponges, which was a valuable contribution to this somewhat neglected branch of inquiry, and the same remark refers to Butterfield and Bennett's paper on the spider fauna of the Hastings district. Mr. W. H. Mullens discoursed on Gilbert White's connection with Sussex, and Mr. John Ray on mediæval timbered houses of Sussex and Kent. Mr. Wilfred Mark Webb touched upon a lighter theme in Darwinism as applied to dress, tracing the origin of some peculiar survivals in male and female attire.

Next year the meeting place will be Winchester, at the invitation of the Mayor and Corporation, and the president is to be Dr. Dukinfield Scott, F.R.S., president of the Linnean Society.

R. A. B.

[1] Mr. Lewis Abbott supplied some in his paper on "Pleistocene Mammalia of S.E. England," subsequently read to the Congress.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The general board of studies will shortly proceed to make the following appointments:—(1) A reader in zoology, in succession to Mr. Bateson; stipend, 100*l.* a year. (2) A reader in metallurgy; the stipend is the net income arising from the benefaction of 10,000*l.* given for this purpose by the Goldsmiths' Company. (3) A lecturer in economics, in succession to Prof. Pigou; stipend, 100*l.* a year. (4) A lecturer in historical and economic geography; stipend, 150*l.* a year. (5) A Royal Geographical Society lecturer in regional and physical geography; stipend, 150*l.* a year. (6) A Royal Geographical Society lecturer in surveying and cartography; stipend, 50*l.* a year. Candidates are requested to send their applications to the Vice-Chancellor, with testimonials if they think fit, on or before July 28.

The electors to the Frank Smart studentship in botany give notice that they will shortly proceed to the election of a student. Any graduate of the University is eligible for the studentship provided that not more than fourteen complete terms have elapsed after his first term of residence. The successful candidate must devote himself to research in botany. The studentship is ordinarily tenable for two years. The value of the studentship is 100*l.* per annum, or such larger or smaller annual sum as the fund may produce. A candidate must send his name, with a statement of the course of research which he proposes to undertake, and such evidence of his qualifications as he thinks fit, to the Vice-Chancellor, Gonville and Caius College Lodge, on or before Tuesday, June 23.

The general board of studies has appointed Dr. Anderson university lecturer in physiology, Mr. F. H. A. Marshall university lecturer in agricultural physiology, Mr. C. G. Lamb university lecturer in electrical engineering, and Mr. C. E. Inglis university lecturer in mechanical engineering, all for five years.

The first examination for the diploma in mining engineering will be held in the Michaelmas term. The examiners nominated are Mr. E. H. Liveing, formerly professor of mining in the Yorkshire College, Leeds; Prof. H. Louis, Armstrong College of the University of Durham; and Mr. C. T. Heycock, of King's College.

Mr. R. C. Maclaurin, St. John's College, has been approved by the general board of studies for the degree of Doctor in Science.

LONDON.—The assembly of the faculties of University College has been fixed for Thursday, July 2, at 3 o'clock, when Prof. A. F. Pollard will read a report on the work of the session, and the results of the University, scholarship and class examinations will be announced. Scholars and medallists will be presented to Sir Edward Fry, F.R.S., who will deliver an address.

MR. A. D. HALL, director of the Rothamsted Experimental Station, will deliver a course of lectures on July 13–18 at the Graduate School of Agriculture, which the United States Department of Agriculture is holding this year at Cornell University. Mr. Hall will also deliver two lectures at the University of Illinois, Urbana, on July 7 and 8.

IN an address at the University of Wisconsin, Madison, on Sunday, Mr. Bryce is reported by the *Times* to have dwelt upon the useful relation which the State universities of western America bear to the States, commenting on the immense service rendered to scientific agriculture by the University of Wisconsin in increasing the product of the soil and the quality of the live-stock, making the farmer's life more interesting, and checking the influx of the people to the cities. It is wise, he remarked, not to allow practical subjects to oust theoretical physical science and human subjects. Theoretical science is the source and strength of progress in all industries and practical arts.

ONE of the departments of the Hungarian Exhibition at Earl's Court illustrates the progress and present position of education in Hungary. Starting with a section devoted to kindergartens and elementary schools, all the grades of education up to the universities, and colleges of university standing, are explained by suitable exhibits. A sketch of this part of the exhibition, which appeared in the *Times* of June 12, says that in every one of the grades photographs are on view illustrating the pupils and students at work in their classes. A very interesting feature is the model State farming school, in which all branches of farm work are taught to pupils between the ages of twelve and fifteen. Nursery-gardening instruction forms part of the curriculum at these schools also, and attention is paid to home and industrial work. The age at which education in Hungary is compulsory is in the kindergarten from three to six, and in the ordinary elementary school from six to twelve, while evening classes are given to pupils between the ages of twelve and fifteen. A *minimum* collection of implements used in all elementary schools is on view, embracing a wide selection of objects from chemical, mechanical, and electrical appliances to natural history specimens. The training college section contains excellent specimens of woodwork, and equally fine articles of lace and embroidery. Another feature is the attention paid to hygiene. So keen are the State authorities on securing a high standard of physical culture that every boy when he enters has his height measured and his strength tested. These details are entered in a register, which is kept as a record of his physical growth during his school years.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, March 19.—"Secondary β Rays." By Prof. J. A. **McClelland**. Communicated by Prof. J. Joly, F.R.S.

This paper deals with the secondary radiation of β particles from a plate exposed to the β rays from radium. It contains, in the first place, a detailed investigation of the intensity of this secondary radiation in different directions in the plane of incidence of the primary rays, and for different values of the angle of incidence.

The results show that the secondary β particles may be divided into two parts. One portion of the radiation has a maximum value in the direction of ordinary reflection, and is referred to as the "reflected" rays. The reflected rays differ very little in intensity for different substances.

The author in previous papers has compared the intensity of the secondary β rays from a large number of substances, and showed that it depends on the atomic weight of the substance. The secondary radiation increases with the atomic weight, and in such a way that the elements fall into divisions corresponding to the chemical periods. When the secondary radiation is analysed, as in the present paper, and the observations so taken as to exclude or reduce to a minimum the portion referred to above as the reflected rays, the connection with the atomic weight is brought out even more clearly than before.

The reflected rays are a more important fraction of the whole in the case of elements of low atomic weight, as for these substances the other portion of the radiation—the true secondary—is small.

The reflected rays are more marked when the angle of incidence is large.

Further evidence that there is a decided difference between the reflected rays and the other portion of the secondary rays, is given by measurements of the absorption in a direction in which the reflected rays are a maximum and in a direction where they are absent or a minimum. The reflected rays are similar in velocity to the primary rays, and vary little with the substance emitting them; the velocity of the true secondary rays is less than that of the primary rays, and depends on the substance emitting them.

The origin of the two parts of the secondary radiation is discussed in the paper, and the view taken that the reflected rays are some of the primary particles which in their path in the exposed plate have not entered into or caused change of energy in any atomic systems, thus retaining their original velocity and obeying approximately the law of reflection. The true secondary rays, on the other hand, are looked upon as β particles expelled from the atoms of the exposed substance by the entry of the primary particles.

The paper further contains the results of measurements with a hemispherical ionisation vessel which give the sum

of the secondary radiations in all directions from the exposed plate for different angles of incidence of the primary rays. A comparison of these results with those referring to the plane of incidence only, shows that the reflected rays are not strictly confined to the plane of incidence. Further work on this subject is in progress.

May 7.—"Helium and Radio-activity in Rare and Common Minerals." By the Hon. R. J. **Strutt**, F.R.S.

(1) Helium can be detected in almost all the minerals of the earth's crust.

(2) The quantity is in most cases about what might be anticipated from the traces of uranium and radium which the minerals contain. This is illustrated by the following selected results, which are given in round numbers only:—

Mineral	Helium present, c. mm. per kilo.	Helium ratio, *i.e.*, ratio of helium to uranium oxide
Samarskite	1,500,000	14
Hæmatite	700	9
Galena	2	17
Quartz	2	10

(3) Where much higher helium ratios than the above have been observed, the excess of helium can always be connected with the presence of thorium, except in one outstanding case. Thus the experiments afford no evidence in favour of helium production by radio-activity of ordinary elements.

(4) The outstanding case is beryl, which contains abundance of helium, without anything approaching a sufficient radio-activity to explain its presence. This helium cannot be connected with any known constituent of beryl.

(5) Igneous rocks, and probably siliceous minerals generally, contain small quantities of argon. In other minerals its quantity is negligible, at all events in comparison with the helium present. Nor is there any indication that it increases with the amount of radio-active material.

May 21.—"A Further Note on the Nutrition of the Early Embryo: with Special Reference to the Chick." By E. **Emrys-Roberts.** Communicated by Prof. C. S. Sherrington, F.R.S.

(1) The secretion of the resting mammalian uterus contains protein, mucin, and salts; during the pro-œstral stage the proportion of mucin is decreased.

(2) The profuse mucinous secretion of mammalia during pro-œstrus is derived, not from the body of the uterus, but from the cervix and vagina.

(3) The nutrition of the embryonic chick is not dependent upon the yolk alone, but also upon the egg-white.

(4) Assimilation of the egg-white is divisible into three heads—the water, the salts, and the proteid.

(5) Of the three, the water is at first extracted at the most rapid rate, *i.e.* the percentage of water decreases as incubation proceeds.

(6) The percentage of salts in the egg-white remains more or less unchanged throughout incubation.

(7) The proteid of the egg-white is assimilated, not by a process of osmosis, but by a process of digestion performed by the chorionic cells.

(8) During this process the egg-white is considerably altered in composition and reaction, being converted, as incubation proceeds, into a more and more vitreous mass with a peculiar set of reactions, the outstanding reaction being that demonstrating the presence of albumoses and peptones.

Physical Society, May 22.—Dr. C. Chree, F.R.S., president, in the chair.—The spectrum top: F. P. **Sexton.** The coloured bands seen when a Benham top is rotated are explained. The effect depends upon the position of the sector lines and on a contrast. The rates of growth of the colour sensations are assumed to be in the order red, green, and blue, where red is the greatest, and the rates of decay are assumed to be in the inverse order. The colour in the inner ring with an anti-clockwise rotation, and also the second ring, are explained.—The coefficient of diffusion: B. W. **Clack.** The practicability of a new method for the determination of the coefficient of diffusion of salts through water, and to find how this coefficient varies with the concentration of the solutions, is discussed. The apparatus consists of a special kind of flask of about 450 c.c. capacity fitted with a vertical glass tube of known dimensions. The flask, filled with the salt solution, was suspended in cooled distilled water. The apparatus was so designed that one end of the vertical tube was maintained in contact with a salt solution of constant concentration, while the other end was kept in contact with distilled water. As the salt diffuses through the tube the weight of the flask varies, and an expression was deduced by which it is possible to find the value of the coefficient of diffusion from this rate of change in weight, which was automatically recorded. The salts experimented upon were NaCl, KCl, and KNO_3. The coefficient for NaCl and KCl decreases as the concentration of the solution decreases. For KNO_3 the opposite phenomenon is exhibited.—The production of small variable frequency alternating currents suitable for telephonic and other measurements: B. S. **Cohen.** A new method for producing these currents is described; this consists of a form of vibrating wire interrupter which operates a make-and-break contact. This is used to put a source of potential on and off a resonating circuit tuned to any desired frequency. The alternating current is taken from a small transformer in the resonating circuit. A series of damped wave-trains of any frequency can be produced by this means, the trains following each other with the frequency of the wire vibrations. The theory of action of the various circuits, and some applications of the waves to both telephonic and general electrical measurements, are given.

Mathematical Society, June 11.—Prof. W. Burnside, president, in the chair.—Relations between the divisors of the first n natural numbers: Dr. J. W. L. **Glaisher.**—Electrical resonance: Prof. H. M. **Macdonald.**—A form of the eliminant of two binary quantics: A. L. **Dixon.**—Perpetuant syzygies of the nth kind: H. **Piaggio.**

Royal Astronomical Society, June 12.—Mr. H. F. Newall, F.R.S., president, in the chair.—An example of Prof. Karl Pearson's calculation of correlation in the case of the periodic inequalities of long-period variables: H. H. **Turner.** After tabulating Chandler's periodic inequalities, the author worked out the correlation according to Prof. Pearson's method, and then made an examination of eight stars in detail for which special information was available.—Report of the expedition to Flint Island for the observation of the total solar eclipse of 1908 January 3: F. K. **McClean.** The author gave an account of his expedition, to undertake which he chartered a steamer to start from Auckland for Tahiti and Flint Island, being joined by a small party of astronomers from Australia and New Zealand. The difficulties of landing were overcome, and all preparations made, in spite of almost continual rains. Heavy rain came on upon the morning of the eclipse, and only ceased just as totality commenced. Very successful photographs of the corona and prominences were taken, which were shown to the meeting. Mr. McClean recommended the observation of the eclipse of 1910 in Tasmania, and Mr. Crommelin remarked that Halley's comet would come to perihelion about the time of the eclipse, and could be much better observed in the southern than in the northern hemisphere.—Observations of the sixth, seventh, and eighth satellites of Jupiter from photographs taken at the Royal Observatory, Greenwich: **Astronomer Royal.**—The orbit of Jupiter's eighth satellite: P. H. **Cowell** and A. C. D. **Crommelin.** Two hypotheses were considered, the one of direct and the other of retrograde motion; the question was not finally decided, but retrograde motion seemed much more probable. The orbit had 31° inclination from the ecliptic, and a period of about two years, but no definitive orbit could be obtained until the satellite had been again observed at the next opposition of the planet.—The mathematical theory of two star drifts, and on the systematic motions of zodiacal stars: A. S. **Eddington.**—The lunar bright rays: H. G. **Tomkins.** The author showed the different characteristics of the bright rays on the moon, and explained his theory that they are caused by salt efflorescence. Photographs were shown of saline regions in India and other countries, as well as specimens of saline deposits. He considered that there was evidence of a radial arrangement of terrestrial salt districts.

EDINBURGH.

Royal Society, May 4.—Prof. Crum Brown, vice-president, in the chair.—Sunset and twilight curves and related phenomena: D. M. Y. **Sommerville.** The objects of the paper were (1) to describe certain curves which approximate to the graphs of the time of sunset (or sunrise) and end of twilight (or daybreak) all the year round for various latitudes; (2) to tabulate the yearly phenomena of light and darkness for different latitudes under various conditions. The case of the earth was first discussed, and then the investigation was extended to cases in which the inclination to the ecliptic was given arbitrary values ranging from 0° to 90°, and in which also the same range was given to the limiting depression below the horizon of the sun's centre consistent with twilight conditions. The various possible combinations of daylight, twilight, and true night which make up any complete day were examined, and some interesting mathematical relationships obtained.—The electromotive force of iodine concentration cells in alcohol and water: Principal A. B. **Laurie.** The results show that if the E.M.F. is calculated from the mass equation constant determined by Jakowkin and the Nernst equation for osmotic pressure and E.M.F., the experimental results agree very closely where the potassium iodide is present in excess, but only approximately where the potassium iodide and iodine are present in sensibly the same proportions. In alcohol cells the E.M.F. results show a very close agreement with the Nernst equation for cells in which the potassium iodide is in excess, and also show that there is evidently a similar complex formed in the presence of alcohol as there is in the presence of water. The E.M.F. of cells in which mixtures of alcohol and water are used indicates that at 0° C. the dissociation of the potassium iodide is less for such mixtures than it is for alcohol or water, this effect disappearing at 25° C. Experiments with cells in which solutions of equal strength of iodine and potassium iodide were used, dissolved in water round the one electrode and dissolved in alcohol round the other electrode, show an E.M.F. of nearly two-tenths of a volt, the water solution being positive, and the action of the cell transferring iodine from water to alcohol and potassium iodide from alcohol to water. This alcohol-water cell has a considerable temperature coefficient, showing that heat is being absorbed during the passage of the current, but not so large as would be required by the Nernst equation if it was a purely gas-pressure cell. When connected to a galvanometer this cell gives a current for some hours.—Preliminary statement on the morphology of the cone of *Lycopodium cernuum* and its bearing on the affinities of Spencerites: Dr. W. H. **Lang.** The cone of *Lycopodium cernuum* is the most complex in the genus, but it was shown that in Spencerites certain of the most characteristic features were either distinctly visible or at any rate strongly suggested. Whatever view of their relationship be taken, there appeared to be a *prima facie* case for regarding the morphology of the cone as essentially the same in the two forms.—The origin of the adaxially curved leaf trace in the Filicales: D. T. Gwynne **Vaughan** and Dr. R. **Kidston.** As exhibited in *Thamnopteris Schlechtendali*, the leaf traces leave the stele in a thoroughly protostelic manner when free, at first appearing as an oval mass of xylem with a central protoxylem. While in this form an island of parenchyma appears adaxially to the protoxylem, which, gradually increasing, eventually displaces the centripetal xylem. By progressive stages the characteristic leaf trace becomes curved, and assumes the characteristic horse-shoe form so common to the Filicales.—A new species of Dineuron and of Botryopteris from Pettycur, Fife: Dr. R. **Kidston.**—The inca or inter-parietal bone, its homology and nomenclature: Dr. W. R. **Smith.**

May 18.—Prof. A. Gray, vice-president, in the chair.—The cohesion of steel, and on the relation between the yield points in tension and in compression: G. H. **Gulliver.** In a homogeneous isotropic solid the directions of maximum shearing stress are inclined at 45° to the directions of principal stress. Because of internal friction, the surfaces of sliding will be inclined to the direction of maximum tension at an angle which is greater than 45° by half the angle of friction. Experiments on steel bars lead to the value 0·176 for the coefficient of friction, a value which corresponds closely with the ordinary coefficient of friction for dry metallic surfaces. The shearing stress along a surface of sliding is always greater than the frictional resistance due to normal stress upon the same surface. Assuming this to be due to a cohesive force acting normally to the same surface, the author calculated the value of this cohesion for steel as being 3·384 times that which corresponds with the tension yield point, or 2·384 times that which corresponds with the pressure yield point. Experiment fully corroborated this conclusion. Experiments also confirmed the further conclusion that the fracture of a bar under tension begins in a direction normal to the axis.—The preparation of a glass to conduct electricity: C. E. S. **Phillips.** A mixture consisting of thirty-two parts of sodium silicate, eight parts of borax, and one part of Powell's glass is fused in a platinum crucible. The air bubbles are rapidly removed from the mass by means of a vacuum pump, and the resulting glass pressed into plates or cast in the usual way. The conductivity of this material is comparatively high, being about 1000 times greater at 20° C. than ordinary soda glass at 100° C. Its specific resistance is 5×10^8 ohms at 20° C. The index of refraction is 1·6, the density 2·6, and the softening point 551° C. On account of the high coefficient of expansion, viz. 0·00015, the conducting glass cannot be welded to ordinary tubing except by means of glasses with intermediate coefficients of expansion. The study of the surface changes was made by means of an electrical method depending upon the negative electrification of cadmium when in contact with a moist surface of the conducting glass. It was found in this way that the substance attracted less moisture with time, and therefore slowly improved. Some experiments were shown which proved that the glass conducts electricity through its mass, and that the effect is not merely a surface one.

PARIS.

Academy of Sciences, June 9.—M. H. Becquerel in the chair.—An apparatus designed for micrometric levellings: M. **Gouy.** A microscope furnished with a wire micrometer, and standing upon a tripod the feet of which are ivory points, slides on a plane horizontal disc of polished glass. The micrometer wire being first set on the object the position of which is to be measured, its position on the standard scale is found by sliding the tripod over the disc until the divisions of the scale are in focus. As showing the accuracy obtainable by this simple method, the probable error of a setting of the micrometer, the microscope remaining fixed, was found to be 0·043 μ, whilst when the microscope was moved over the disc between each setting the probable error of a setting was 0·042 μ.—The direct addition of hydrogen to the polyphenols: Paul **Sabatier** and A. **Mailhe.** Previous attempts to apply the Sabatier and Senderens reaction to the diphenols and triphenols have failed, due, as is now found, to the employment of too high a temperature in the reaction. At a temperature of about 130° C., in a rapid current of hydrogen, hydroquinol, pyrocatechol, resorcinol, and pyrogallol give good yields of the corresponding *cyclo*hexadiols and triols respectively. Hydroquinol gave the *cis*-quinite exclusively, and pyrocatechol and resorcinol also appeared to give the *cis*-compounds, although this point has not yet been completely proved. Since this method yields these compounds easily, and in a very pure state, a special study is being made of the properties of these derivatives.—Magnetic observations at Tananarive: E. E. **Colin.** Three tables are given showing the results of the absolute measures of declination, of inclination, and of the horizontal intensity, from May, 1907, to April, 1908.—The exact analysis of marsh gas. The dissociation of several hydrocarbons obtained in the grisoumeter and eudiometer: Nestor **Gréhant.**—The regulation of electrogenic groups: J. L. **Routin.**—The development in a continued fraction of an algebraical number: M. **Auric.**—The true cause of the doubling of the curve of loss of activity of conductors covered with a dielectric layer, rendered radio-active, and with an electric charge: Ed. **Sarasin** and Th. **Tommasina.**—The sign of electric dichroism and of magnetic dichroism: Georges **Meslin.**—The self-induction spark: André **Léauté.** The essential cause of the striæ

observed for the first time in the photographs of M. Hemsalech is the existence of two circuits in parallel.—Catalytic dehydrations of organic compounds: J. B. **Senderens.** Several inorganic substances have been found by the author to possess catalytic properties, the most active being precipitated alumina dried at a temperature below a red heat. This substance at about 300° C. splits up ethyl ether into ethylene and water, acetic acid (at 350°) into acetone, water and carbon dioxide, propionic acid into diethylketone, water and carbon dioxide, ethyl acetate into water, ethylene, carbon dioxide and acetone, and ethyl oxalate into water, carbon monoxide and dioxide, and ethylene.—The action of silver nitrate upon chloroauric acid, and the preparation of fulminating gold: Jules **Jacobsen.** Pure chloroauric acid, prepared by the action of chlorine upon pure gold in suspension in hydrochloric acid, is precipitated by silver nitrate, the precipitate having the composition $Au(OH)_3.4AgCl$. A solution of ammonia removes the silver chloride from this substance, leaving a yellow, flocculent precipitate of fulminating gold. Analyses of this latter gave figures corresponding to the formula $Au(OH)_2NH_2$.—The separation of ammonia and the amines by means of boiling absolute alcohol: Jean **Bertheaume.** It is shown that this commonly used method of separation is imperfect, a determination of the solubilities of ammonium chloride and methylamine hydrochloride proving that at least 8·5 per cent. of ammonium chloride is always present in methylamine hydrochloride purified in this manner.—Contribution to the study of the artificial peroxydiastases: J. **Wolff.** A study of the oxidation of pyrogallol by hydrogen peroxide in presence of colloidal ferrocyanide of iron. The effects of the latter are shown to be in all respects comparable with those of the natural peroxydases.—A new mica of the paragonite group: Ph. **Barbier.** This mica is characterised by its proportions of soda (7·6 per cent.) and lithia (1·2 per cent. to 2·0 per cent.), the association of these two elements, sodium and lithium, being unusual. The name hallerite is proposed for the new mineral.—A certain function of hepatic replacement exercised by the feather in birds: Jean **de La Riboisière.** For any species of bird the amount of liver and feathers, referred to 100 grams of the total weight, may undergo extensive variations. But it would appear that in each species those individuals having more liver have less feathers, and reciprocally.—The *rôle* of the yeasts and the nature of the vine in the formation of bouquet in wine: A. **Rosenstiehl.**—The iron deposits of Coatquidan: F. **Kerforne.** This deposit was worked for iron ore in 1825, but after some time was abandoned. The ore is a red hæmatite, containing a considerable proportion of fine quartz grains. Its geological level is at the base of the Armorican grit.—The principles to be applied to render buildings aseismic: Montessus **de Ballore.** Armoured concrete is the best material for building purposes in countries liable to earthquakes.

DIARY OF SOCIETIES.

THURSDAY, JUNE 18.

ROYAL SOCIETY, at 4.30.—(1) An Electrical Method of Counting the α Particles from Radio-active Matter; (2) The Charge and Nature of the α Particle: Prof. E. Rutherford, F.R.S., and Dr. Hans Geiger.—The Scattering of the α Rays by Matter: Dr. Hans Geiger.—Studies of the Processes Operative in Solutions. Part VI., Hydration, Hydrolation and Hydrolysis as Determinants of the Properties of Aqueous Solutions; VII., The Relative Efficiencies of Acids as deduced from their Conductivities and Hydrolytic Activities; VIII., The Influence of Salts on Hydrolysis and the Determination of Hydration Values; IX., The Determination of Optical Rotatory Power in Solutions; X., The Changes Effected by the Reciprocal Interference of Cane Sugar and other Substances (Salts and Non-electrolytes): Prof. H. E. Armstrong, F.R.S., and others.—The Electrolytic Properties of Dilute Solutions of Sulphuric Acid: W. C. D. Whetham, F.R.S., and H. H. Paine.—The Giant Nerve Cells and Fibres of *Halla parthenopeia*: Dr. J. H. Ashworth.—On Methods for the Continuous (Photographic) and Quasi-continuous Registration of the Diurnal Curve of the Temperature of the Animal Body: Prof. A. Gamgee, F.R.S.

CHEMICAL SOCIETY, at 8.30.—The Thermal Decomposition of Hydrocarbons, Part I., Methane, Ethane, Ethylene and Acetylene: W. A. Bone and H. F. Coward.—The Rusting of Iron: W. A. Tilden.—Studies on Elementary Zirconium: E. Wedekind and S. J. Lewis.—(1) The Constituents of Canadian Hemp, Part I., Apocynin; (2) A New Synthesis of Apocynin: H. Finnemore.—The Constitution of the Diazonium Perbromides: F. D. Chattaway.—Cholestenone: C. Dorée and J. A. Gardner.—A New Form of Potash Bulb: A. E. Hill.—Solubility of Silver Chloride in Mercuric Nitrate Solutions: B. H. Buttle and J. T. Hewitt.

LINNEAN SOCIETY, at 8.—Altitude and Distribution of Plants in Southern Mexico: Dr. Hans Gadow, F.R.S.—The Marine Algæ collected in the Indian Ocean by H.M.S. *Sealark*: A. Gepp.—Nudibranchs from the Red Sea, collected by Mr. C. Crossland: Sir Charles Eliot, K.C.M.G.—The Algæ of the Yan Yean Reservoir, Victoria: G. S. West.—Bryozoa from the Indian Ocean, chiefly from the Collections made by H.M.S. *Sealark*: A. W. Waters.—On *Gardenia Thunbergia*, Linn., and its Allies: Dr. Otto Stapf, F.R.S., and J. Hutchinson.—*Exhibits:* Portfolio of Coloured Drawings illustrating the Flora of Bombay Island: Mrs. Harry Gay.—Specimens of *Melitella pusilla*, Somm., belonging to a New Genus of Compositæ, recently discovered by Cavaliere S. Sommier, in the Island of Gozo, near Malta: J. F. Duthie.

TUESDAY, JUNE 23.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—The Kurdish Tribes of the Ottoman Empire: Mark Sykes.

FARADAY SOCIETY, at 7.45.—Annual General Meeting.—At 8.15.—Recent Developments of the Kjellin and Rochling-Rodenhauser Electric Induction Furnaces: J. Härden.—New Applications of Electrometallurgical Alloys: Adolphe Jouve.

THURSDAY, JUNE 25.

ROYAL SOCIETY, at 4.30.—*Probable Papers:* Have Trypanosomes an Ultra-microscopical Stage in their Life-history? Colonel D. Bruce, C.B., F.R.S., and Captain H. R. Bateman.—The Action of Chlorine upon Urea whereby a Dichloro Urea is Produced: Dr. F. D. Chattaway, F.R.S.—Further Note on a Luminous Glow generated by Electrostatic Induction in an Exhausted Vessel made of Silica: Rev. F. J. Jervis-Smith, F.R.S.—On the Reflection of Waves from a Stratum of Gradually Varying Properties, with Application to Sound: Dr. J. W. Nicholson.—The Electrical Forces of Mitosis and the Origin of Cancer: A. E. and A. C. Jessup, E. C. C. Baly, F. W. Goodbody, and E. Prideaux.—The ω-Function—a Class of Normal Functions: E. Cunningham.—And other papers.

FRIDAY, JUNE 26.

PHYSICAL SOCIETY (at the National Physical Laboratory, Bushy House, Teddington), at 3.30.—Demonstrations of Work in Progress in the Laboratory.

CONTENTS.