THURSDAY, MAY 5, 1910.

CRYSTALLOGRAPHIC RESEARCHES.

Crystalline Structure and Chemical Constitution. By Dr. A. E. H. Tutton, F.R.S. Pp. viii+204. (London: Macmillan and Co., Ltd., 1910.) Price 5*s.* net.

THE series of science monographs projected by Messrs. Macmillan and Co. has opened auspiciously with a fascinating account by Dr. Tutton of the exhaustive crystallographical researches upon which, for the past twenty years, he has been engaged. It is a goodly story that he has to tell, and well is it told; without wearying the reader with an unwieldy mass of details, he presents in all essential completeness a vivid picture of an unusually coherent series of investigations. The immensity of the labour involved can be fully appreciated only by those who may have undertaken work of somewhat similar character, but the most casual reader can scarcely fail to be amazed at the extraordinary amount of work the author has contrived to squeeze into the leisure hours of a busy official life; by strenuously utilising every spare moment he has found time to accomplish a task which has set an ideal of what a complete study of the physical properties of crystallised substances should be. Those at least who have at heart England's position in the world of science are grateful to Dr. Tutton that, thanks largely to his efforts, in crystallography, at any rate, she stands so high.

Dr. Tutton completed his scientific training, and was looking round for a field for research at an opportune moment. It was at that time being increasingly felt by those speculating on the molecular arrangement of crystals that little real advance could be made towards a solution of the problem until more numerous and more accurate measurements of crystallised substances, especially those constituting isomorphous groups, were available. Principal Miers had already published his important memoir upon the characters of the red-silver minerals, pyrargyrite and proustite. From that and similar work it seemed clear that small, but perceptible, differences existed between the crystalline forms of the constituents of an isomorphous series; in fact, the conclusion established by Dr. Tutton's investigations was not so wholly unforeseen at that date as might be supposed from the opening pages of his book. It was, however, very desirable that research of a similar, and, if possible, more comprehensive, character should be extended to artificial salts, because in such the purity of the material, and the perfection of the crystals, could be secured with far greater certainty than when the process had been in nature's unfettered control. To an investigation of this kind Dr. Tutton determined to devote himself, and he selected for his initial task the three members containing potassium, rubidium, and cæsium of the isomorphous group of which $K_2Mg(SO_4)_2,6H_2O$ may be taken as a type; their crystalline form had not previously been properly studied.

It was part of Dr. Tutton's design that his research should be carried out with instruments as perfect as mechanical skill could produce. He found, indeed, at hand a most efficient goniometer for the measurement of interfacial angles of crystals, but, when he came to the determination of the optical and other vectorial characters, he was compelled to design an entirely novel equipment, since nothing of the requisite standard had hitherto been constructed. The first of these instruments was a grinding and cutting goniometer, by means of which it was possible to prepare sections and prisms with absolute confidence in the accuracy of their orientation in the crystal. The natural faces are seldom suitably developed for optical research, and the lapidaries' method was far too untrustworthy for Dr. Tutton's standard. This apparatus naturally called for a companion instrument, which should provide light of any desired colour at will. Sodium light, which is adopted as the standard in all measurements of refractivity, is, of course, readily available, but no optical investigation can be considered complete unless the colour dispersion has also been studied; previously crystallographers had been restricted to the lithium and thallium flames, of which the latter is actually poisonous, and, moreover, the study of interference figures often demanded light of intermediate wave-lengths. Dr. Tutton accordingly designed a most efficient monochromatic illuminator, in which the dispersive agent is a single prism of very dense glass. Spurred by the success achieved, he proceeded next to plan, using the principle of the interference of light, an instrument of extraordinary delicacy for the measurement of variations in length. He himself employed it in conjunction with the necessary additional apparatus, which he fully describes, for the measurement of thermal expansion and elasticity constants, and an interferometer of his design was recently installed in the Standards Department of the Board of Trade (NATURE, vol. lxxxii., p. 338). The whole of Dr. Tutton's instrumental apparatus has been characterised by the painstaking care bestowed upon those apparently small details which have such an important bearing upon efficiency of performance.

As already stated, Dr. Tutton opened his researches with a study of the crystalline form of the double sulphates of potassium, rubidium, and cæsium, with magnesium. He subsequently extended his investigation to similar compounds of ammonium and thallium, which were found to possess closely related properties, and also to the corresponding selenates. Up to date he has studied the sulphates and selenates, and many of the double sulphates and selenates with magnesium, zinc, iron, nickel, cobalt, copper, manganese, and cadmium. Altogether forty-four salts—Dr. Tutton gives the number as fifty-four, but appears to have inadvertently reckoned ten of them twice—have been prepared and investigated, the greatest possible care being taken to ensure their purity and perfection of development; no fewer than 25,000

angles were measured, and upwards of four hundred sections, and the same number of prisms, have been cut. The optical study incidentally raised some interesting points in connection with the phenomenon known as crossed-axial-plane dispersion. Beautiful photographs of the interference figures given by cæsium magnesium sulphate in light of different wave-lengths at ordinary temperatures and at 78° are reproduced on p. 169. The thermal expansion of the sulphates of potassium, rubidium, and cæsium alone have as yet been determined; the exacting nature of this work may be gathered from the remark on p. 71 that each series of observations, sixty-four in all, entailed five hours' continuous labour.

Certain definite conclusions have been established by Dr. Tutton's work. The variation in the morphological and physical properties of the members of the same isomorphous series, though slight, is progressively related to the atomic weights in the case of the three elements belonging to the same family group. The relations between members containing these elements are, indeed, so intimate that they may be regarded as forming an inner circle—a eutropic series, as it is termed—within the isomorphous series; members containing ammonium and thallium, though undoubtedly belonging to the same isomorphous series, show greater deviations from the general properties. Corresponding changes of the same order, but in the reverse direction, take place when selenium is substituted for sulphur. The results are so tabulated that the relations and differences are easily grasped.

Throughout the book Dr. Tutton has realised the importance of not intruding upon observed facts about which no possible doubt could be raised any speculative matter which might be open to dispute, and he refrains from dwelling at any great length upon the many interesting questions relative to molecular arrangement which are suggested by the results of his investigations. He does, however, argue that the possibility of ammonium replacing a single atom without much effect upon the crystalline form is incompatible with Barlow's theory of close-packing, which has recently been attracting so much attention. On the other hand, Pope and Barlow, in their first paper, discussed the isomorphism of potassium chloride and ammonium chloride, and showed that the relationship in this case was in strict consonance with the close-packing of the spheres of influence. Close-packing is, indeed, merely a way of representing the state of equilibrium between the mutual interactions of atomic forces emanating from definite centres; it is difficult to attach any physical significance to loose-packing in connection with crystalline structure.

Enough has been written to show that the book is one that should be read and studied by all interested in crystals, their properties, and their formation. Finally, we hope that Dr. Tutton may enjoy, for many years to come, health and strength to carry on the splendid work that constitutes his recreation.

SOIL MANAGEMENT AND PLANT GROWTH.

The Principles of Soil Management. By Profs. T. Lyttleton Lyon and E. O. Fippin. Pp. xxxiii+531. (New York: The Macmillan Company; London: Macmillan and Co., Ltd., 1909.) Price 7*s.* 6*d.* net.

THIS book is the first of a new series designed by Dr. Bailey for "class-room work and for special use in consultation and reference," and the volumes are therefore larger and fuller than those of the Rural Science Series, which were meant for general reading and popular use. In the present series the subject is to be presented in such a way that it shall develop "clear thinking, sound argument, constructive imagination, and effective application to the needs of life."

Dr. Bailey contributes a vigorous introduction, strong in its condemnation of our present lack of interest in soil problems.

"We are accustomed," he says, "to think of the power of man in gaining dominion over the forces of nature,—he bends to his use the expansive powers of steam, the energy of electric currents, ... but while he is doing all this he sets at naught the powers in the soil beneath his feet, wastes them, and deprives himself of vast sources of energy."

Among the national resources that demand conservation the soil takes a high rank.

Turning to the volume itself, the subject is treated under seven headings; the soil is considered as a medium for root development; as a reservoir for water; as a source of plant food; the organisms of the soil are studied, the composition of the soil air, and the relation of soil to temperature. Finally, methods of soil management are discussed. The general idea is to treat the soil as a medium for plant growth, to regard it from the agricultural and not so much from the geological point of view. There is, of course, no particular novelty in this position, and several books have already been written in which the subject is dealt with in the same way; the arrangement of the matter therefore calls for no comment.

Liberal use is made of photographs to illustrate the various points brought up, and there are some very good photomicrographs showing the structure of certain common rocks. A considerable amount of time and trouble must have been spent on these, and also on the tables of figures which have been pretty freely introduced. The results obtained at the various experiment stations in the United States have been drawn on, and a good deal of material is collected that will be new to the English reader and interesting to the American student.

But when all this is said, it must be admitted that the book somehow leaves an unsatisfactory impression. In spite of the attractiveness of the subject, the present writer has to confess that he found the volume rather boring. It is hardly a book that the American student would "enthuse" about, and it does not adequately repay all the labour that must have been bestowed upon it. We somehow get a suspicion that the authors have searched more amongst the latest text-books and the latest bulletins

than amongst the depths of the subject they are expounding, and so the book lacks that invigorating freshness that can only be given by men who are for ever probing the secrets of nature and working among the things they talk about—its atmosphere is wrong.

We cannot help thinking that the authors would have obtained much better results had they worked on the model set many years ago by Johnson, one of the best writers on agricultural chemistry the United States, or, for that matter, any other country, ever produced. He sets before the student accounts of the investigations that have made the subject, shows pictures of the apparatus used in the classical experiments, and gives some details of the actual working. The result is a book that after forty years still retains its freshness and its power of inspiration, because it shows how men have wrestled with nature to win her secrets. If when a second edition of the present book is called for the authors would, in a similar way, make room for some of the classical work of the great masters, without extending the size of the book, it is certain that their industry and painstaking efforts would meet with a more fitting reward. E. J. R.

MECHANICS OF HEREDITY.

Das Vererbungsproblem im Lichte der Entwicklungsmechanik betrachtet. By Prof. E. Godlewski, Jun. (Being Part ix. of Roux's "Vorträge und Aufsätze über Entwickelungsmechanik.") Pp. 301. (Leipzig: W. Engelmann, 1909.) Price 7 marks.

IN this book the author attempts a critical review of our knowledge of the mechanism by which hereditary characters are transmitted, and makes it his chief object to distinguish clearly between ascertained facts and the inferences based upon them. Part i. contains an outline of the facts of heredity, only so much being given as is necessary to an understanding of their relation with developmental mechanics. The possible inheritance of "acquired" characters is discussed, inheritance in non-sexual reproduction, including an account of Winckler's recent work on graft-hybrids, and, finally, inheritance in sexual reproduction. This is classified under the heads of blended, mosaic, and alternative. Under mosaic heredity, cases like Toyama's gynandromorphic silkworm are included, which seems scarcely justifiable. Under alternative inheritance and Mendel's law the author seems not thoroughly to grasp the independence of the facts of dominance and segregation, and the same want of clearness in this respect reappears in the general summary. Also in discussing the relations of the different forms of heredity we note a couple of slips in his account of Galton's and Pearson's statements of the law of ancestral heredity.

In part ii. the author is more completely master of his subject. Essentially the problem to be solved is whether a substance which determines the appearance of inherited characters exists and is transmitted from generation to generation; if so, where it is localised and how it acts, so as to produce the different kinds of heredity found in different characters in the same or different organisms. The theory originally made familiar by Roux and Weismann, that the nucleus, and especially the chromosomes, are the "bearers of heredity," is first discussed, and the work of Driesch and his hypothesis of "Entelechy" are explained, and, finally, the theories of Semon and others are reviewed. It is pointed out that writers are divided into two schools—those who believe in a transmitted substance as the basis of inheritance, and those who regard such a substance as a medium for the action of inherent properties. The next four sections deal with work which seeks to discover a transmitted substance, and especially with work on the nucleus. Recent work on amitosis, the structure of the germ-cells, and the facts of fertilisation leads the author to conclude that from these phenomena no "nuclear monopoly" in inheritance can be deduced. A review of recent work on the chromosomes leads to the same conclusion; although their constancy in number and form for each species is admitted, Fick's "Manövrierhypothese" is regarded as equally consistent with the facts with Boveri's theory of individuality. Perhaps insufficient weight is attached to the work, especially of American cytologists, on the behaviour of the chromosomes in the maturation divisions, and in the general summary the author admits that he regards the appearance of their conjugation, and of the relative independence of paternal and maternal elements, as illusory. Since the reality and cause of Mendelian segregation is nowhere fully discussed, this question might have been treated more completely with advantage.

Perhaps the most important section of the book deals with experimental work on hybridisation and fertilisation of non-nucleated fragments (Boveri, Seeliger, Delage, &c.), combination of artificial parthenogenesis and hybridisation (Herbst), and the results of polyspermy (Boveri). These experiments are very thoroughly described, and the conclusion is arrived at that from them also no evidence for nuclear monopoly is obtainable. That the nucleus is of primary importance is proved, but the relations between nucleus and cytoplasm, rather than the nucleus itself, are regarded as the basis of heredity. At the end of this section a summary of the evidence for the action of the cytoplasm is given; although relatively little work has been done in this field, yet one feels that the treatment is rather meagre compared with that devoted to the nucleus.

In the last sections are discussed the nature of the determining substances (possibly enzymes, &c.), and work on the influences of external factors on changing the "Vererbungsrichtung." The work of Guthrie and Magnus on transplantation of ovaries is mentioned, but the author does not seem to know the paper of Tower on the beetle Leptinotarsa.

The book, on the whole, is eminently readable, and succeeds well in its difficult task of summarising the results of recent work and of disentangling ascertained fact from deduction. The author regards experimental facts as the only legitimate proofs of the basis of heredity, and a tendency to be perhaps

unduly critical of all other evidence is a fault on the right side. He has succeeded in including work which appeared almost up to the time of publication of the book, and has produced a most valuable account of what is known of the subject.

AMERICAN GEOLOGY.

Geology: Shorter Course. By Thomas C. Chamberlin and Rollin D. Salisbury. Pp. xviii+978. (London: John Murray, 1909.) Price 21*s.* net.

A College Text-book of Geology. By the same. Pp. xviii+978. (New York: Henry Holt and Co., 1909.)

THESE are respectively the English and American editions of the same work, and each weighs 3 lb. 10 oz., without in any way approaching the dimensions of a German "Handbuch." We are not clear in this case if the insertion of an English title-page adds to the price of the work; but we note that the larger text-book by the same authors costs 63*s.* in London and 50*s.* in New York. This "shorter course" is not one that could be used in colleges in our island, except as a description of the geology of North America; while as a reference-book on this subject and on the valuable original views of the authors the larger work is manifestly superior.

It is a misfortune, which often must be felt in our own colonies, that text-books on natural history require a local setting and foundation; even the first 413 pages of Messrs. Chamberlin and Salisbury's shorter course, dealing with physical geology, are almost entirely illustrated from American sources, and are, of course, all the better on that account, in view of the intentions of the authors. Maps of the United States Topographic Survey are utilised effectively, as in Mr. Salisbury's treatise on physiography; and the photographs of landscape-features, such as the rippled sand-dune on p. 100, the Bad-land topography on p. 135, and the dust-cloud of Pélée on p. 381, are so beautifully reproduced that we cannot blame the publishers for their choice of heavy paper. "La Croix," by the by, in the description of the last-mentioned picture, should be Lacroix; "Gyrvan" on p. 406 is our Scottish Girvan; and "the Achäischen earthquake" on p. 348 is surely an accidental hybrid. The esker of Punkaharju, shown on p. 273, is not in Scandinavia, but in Finland. But there are very few misprints in this handsome volume.

The account of glacial phenomena is of especial interest, and the views of various writers as to glacier-motion are carefully stated (pp. 280–8). There is probably less difference between the views of Tyndall and James Thomson (not "Thompson") than is here suggested; Tyndall himself wrote in his "Forms of Water,"

"the gist of the Regelation Theory is that the ice of glaciers changes its form and preserves its continuity under *pressure*, which keeps its particles together."

He does not appear to have insisted upon actual fracture as *necessary* to glacier-motion.

Other interesting discussions are that of the planetesimal origin of the solar system, which is here concisely treated (p. 420), and that of the depth to which water from the surface may penetrate the earth (p. 197). Excellent diagrams are given of the effects of faulting and folding on the outcrops of strata on a level surface.

In the stratigraphical section of the book, we may note that an Archeozoic era is accepted, its rocks being in part sedimentary, but lying unconformably in most places beneath those of the Proterozoic (Algonkian) era. Diagrammatic maps after De Lapparent are given to show the distribution of certain strata in Europe; but their scale is too small to render them serviceable as guides. That of the Devonian system, for example, allows of the existence of only the Lower Devonian series in the British Isles, and the disposition of the Devonian lakes in Wales and Ireland is singularly capricious. Maps of North America are given for each system, usefully discriminating between actual outcrops and conjectural extensions.

The Carboniferous period is divided into a lower Mississippian and an upper Pennsylvanian period; the Cretaceous into Comanchean and Cretaceous proper. This last subdivision, however, raises exactly the same difficulties as the attempt to restrict Silurian to the upper part of the old Silurian system. European readers will gain greatly from the last half of the book. Though they cannot accept it as their only text-book of geology, they will recognise at all points the originality and perception of the authors.

G. A. J. C.

ELECTRIC WAVES IN THEORY AND PRACTICE.

(1) *Electric Waves. An Advanced Treatise on Alternating-current Theory.* By Prof. W. S. Franklin. Pp. x+315. (New York: The Macmillan Co.; London: Macmillan and Co., Ltd., 1909.) Price 3 dollars net (10*s.* net).

(2) *Wireless Telegraphy and Wireless Telephony. An Elementary Treatise.* By Prof. A. E. Kennelly. Second edition. Pp. vii+279. (London: T. Fisher Unwin, 1909.) Price 4*s.* net.

(3) *Wireless Telephones and How They Work.* By Dr. J. Erskine-Murray. Pp. iii+68. (London: Crosby Lockwood and Son, 1910.) Price 1*s.* 6*d.* net.

(4) *Handbook for Wireless Telegraph Operators.* Published for official use. October, 1909. Price 3*d.*

(1) PROF. FRANKLIN'S treatise, although by its title it might be expected to deal more particularly with that class of electric waves used in Hertzian telegraphy, deals with the whole subject of electromagnetic waves, and is more adequately described by its sub-title. Indeed, the subject of wireless telegraphy is given, if anything, less than its fair share of attention on the ground that it is already adequately treated in Fleming's "Principles of Electric Wave Telegraphy." It is to be wished that all authors showed a similar moderation and restraint. The volume opens, after a brief introductory chapter, with two chapters on water waves and wave trains, which serve as a useful introduction to the principal ideas of wave motion. The next four chapters deal

with the general mathematical theory of electromagnetic waves, with special reference to transmission and telephone lines, and in the sixth chapter Hertzian telegraphy is briefly discussed from the practical side. The next two chapters, forming the second part of the volume, deal with harmonic analysis and non-harmonic E.M.F.'s and currents, and bear directly on the problems met with in alternating-current machinery. The mathematics is advanced, and the book is only suitable for advanced students. In an appendix are given eighty-eight problems for the student to work out, and there are a number of very excellent diagrams.

(2) Prof. Kennelly describes his book as an elementary treatise; it covers both the theoretical and practical side of wireless telegraphy and telephony, and is admirably suited for the reader with only very slight technical knowledge. The exposition of the theoretical side is clear, and the description of practical methods, though short, is sufficient to give a general idea of the present position of the art. The only objection which we have to raise against the book is on account of the diagrams, which are numerous but far from clear. Those in the earlier part of the book especially are on so small a scale that they are practically unintelligible; this is the more to be regretted as the type and paper are excellent, and there is no apparent reason why the diagrams should not be equally well reproduced.

(3) Dr. Erskine-Murray's little book is a popular exposition of the methods and present position of wireless telephony. Dr. Erskine-Murray combines a thorough knowledge of his subject with the power of clear and simple explanation, and we know of no better book for those of the general public who are anxious to know how wireless telephony now stands. We are rather doubtful whether the somewhat rosy view of the future taken in the last chapter is likely to be realised, although the advances already made make one chary of expressing too strong a doubt.

(4) No stronger evidence of the assured position of wireless telegraphy as a commercial means of communication could be afforded than the publication of this little Government handbook. The book itself does not call for much comment, since it contains only instructions and regulations for operators on board ship or in coast stations, but that such regulations should be called for is a more convincing proof that wireless telegraphy has settled down to the steady enjoyment of its own kingdom than any number of treatises or popular booklets. The position of wireless telephony to-day is much the same as that of wireless telegraphy ten years ago. Will 1920 see the issue of a Government handbook for wireless telephone operators?

OUR BOOK SHELF.

The Liverpool Geological Society. A Retrospect of Fifty Years' Existence and Work. By W. Hewitt. Pp. 117. (Liverpool: C. Tinling and Co., Ltd., 1910.)

THE Liverpool Geological Society, which was established on December 13, 1859, has signalised its jubilee by the publication of this volume, which includes an account of the history of the society and its geological labours, a list of papers printed in the Proceedings, and biographical notices of some past members. The society originated from a meeting held at the residence of G. H. Morton, who was its real founder, and for about forty years the chief moving spirit among the members. A capital portrait of him is given. Well known as the author of a volume "On the Geology of the Country around Liverpool," and of a series of important papers on the stratigraphy and palæontology of the Carboniferous rocks of Flintshire, he was one of the most distinguished of provincial geologists. By regarding the country within fifteen miles of Liverpool as their proper sphere of study, the society took the Carboniferous limestone series of Flintshire as their foundation-rocks, together with the succeeding Millstone Grit, Permian, Trias, Pleistocene, and Recent deposits.

On all these formations the members of the society have done excellent work. Undoubted Permian strata, including a bed of magnesian limestone with Schizodus, were described by Mr. E. Dickson at Skillaw Clough, near Parbold. The researches of the late T. Mellard Reade on the Triassic rocks, the Glacial Drifts, and the recent physical changes in the Lancashire district are well known. His portrait is included; also that of Dr. Charles Ricketts, another enthusiastic worker who dealt with many local physical problems. There is one other portrait, that of Joseph Lomas, who had done much in investigating the fauna, flora, and origin of the Trias. Unfortunately, a railway accident in Algeria terminated the life of this zealous and genial worker at the early age of forty-eight. Photographic plates are given of the famous footprints of Cheirotherium from the Keuper Sandstone of Storeton, in Cheshire, described by Morton; and of the gypsum boulder from the Glacial Drift of Great Crosby, described by Mellard Reade. The volume has been carefully prepared, and is a valuable and interesting record of the work of Liverpool geologists.

Catalogue of the Lepidoptera Phalaenae of the British Museum. Vol. ix. Catalogue of the Noctuidæ in the Collection of the British Museum. By Sir George F. Hampson, Bart. Pp. xv+552; plates cxxxvii-cxlvii. (London: Printed by Order of the Trustees British Museum [Natural History]; Longmans and Co.; B. Quaritch; Dulau and Co., Ltd., 1910.) Catalogue 15*s.*; plates, 12*s.*

WE have again to congratulate the authorities of the British Museum and the indefatigable author on the appearance, within less than a year, of another volume of this highly important descriptive catalogue of moths. It is the sixth which has been devoted to the Noctuidæ, and is the third and last volume dealing with the great subfamily Acronyctinæ, of which 385 genera and 2288 species (a large proportion new) are described, and a great number illustrated in the three volumes devoted to the subfamily.

It may be useful to note that at the commencement of his work Sir George gave a table of fifty-two families of Lepidoptera, of which seven (families 33–39 inclusive) are butterflies, placed between family 32, Castiniadæ, and family 40, Euschemonidæ, the remaining forty-five families being moths. Of these, the first three, the Syntomidæ, Arctiadæ, and Agaristidæ, are described in the three first volumes of the work; while of the fifteen subfamilies into which the Noctuidæ are divided at the commencement of vol. iv., only the first four subfamilies have yet been dealt with. It therefore follows that the nine volumes which have hitherto appeared cannot be expected to represent a quarter, and perhaps not even a tenth, of the whole work, although

many of the families of moths and the subfamilies of Noctuidæ still to be monographed are undoubtedly much less numerous in species than those already described.

When we consider how very few species of insects were known to entomologists a century, or half, or even a quarter of a century ago, the enormous increase in our knowledge of this subject within the last few years is simply marvellous, even to those who have witnessed, and to some extent kept touch with, its progress from day to day.

Report on the Poultry Industry in Belgium. By Edward Brown. Pp. viii+112. (London: National Poultry Organization Society, Ltd., 1910.) Price 1s. net.

In 1906 and 1907 Mr. Brown visited America, Denmark, and Sweden to inquire into the methods followed in the poultry industry, and during last year he visited Belgium with a similar object. Probably in no country in the world is intense production more general than in Belgium, one consequence being that it supplies its own poultry and egg requirements, and is not dependent, like England, on imports from foreign countries; indeed, it has a surplus for export.

Although in some respects the conditions in Belgium resemble those obtaining in England, there is the fundamental difference that the Belgian farmer specialises in small animals, like poultry, rabbits, even in pigeons and cage-birds as a hobby, whilst the English farmer has gone in for larger stock. Poultry-farming pure and simple is not common. But everywhere Mr. Brown found that poultry figured as an adjunct to the farm, particularly on the small holdings. In some cases, indeed, land did not come under cultivation until it had been run over for some years by fowls, and fertilised by their droppings. Thus the Campine district, which extends from Malines east and north to the Dutch frontier, was at one time merely a sandy plain covered with fir trees. About thirty years ago the peasants began to raise chickens for sale to the fatteners; the industry spread, and now the trees are gone and the whole district is farmed. It would be interesting to know how many tons of purchased food were consumed per acre in effecting this change. Egg-production is stated to be the main object, and the birds are looked after by the women and children; the methods are, however, essentially simple, no more elaborate appliance being used than is absolutely essential.

The report contains a number of useful details, and concludes with a number of recommendations. The small holder in particular is urged to devote some, though not all, of his attention to poultry, and it is suggested that poultry-keeping should be encouraged on land at present waste. Various methods of management are also recommended.

Halley's Comet: its History, with that of other noted Comets, and other Astronomical Phenomena, Superstitions, &c. By Rev. John Brown. Pp. 52; illustrated. (London: Elliot Stock, 1910.) Price 1s. net.

As a useful collection of facts and references concerning Halley's comet this small volume will take a place in the mass of comet literature now appearing so profusely. It contains nothing startlingly novel, being, to a great extent, a compilation of interesting oddments gathered, with due acknowledgments, from various sources. In many places extraneous material is introduced, rendering the book perhaps more interesting, but less suitable as a precise account of what it presumes to deal with. The four illustrations are rather crude and of no especial interest.

LETTERS TO THE EDITOR.

[*The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts intended for this or any other part of* NATURE. *No notice is taken of anonymous communications.*]

The Orientation of Crystals of Ice in a Flux of Heat.

It was found by Forbes many years ago that the thermal conductivity of ice was better along the principal axis than at right angles to it. Straneo, in 1897, does not come to any definite conclusion in deciding that such is the case. It is well known, however, that the formation of surface ice by conduction always shows the principal axis of the crystals to be normal to the freezing plane, or, in other words, in the direction of the flux of heat from the underwater. Since ice is a better conductor of heat than water, it is to be expected that if any difference exists in the conductivity in the two directions, the ice crystal would form in such a way as to dissipate the heat more readily.

During the process of the formation of an ice mantle in a rather large Bunsen ice calorimeter, my assistant, Mr. F. H. Day, directed my attention to a rather interesting case, which, I think, proves the better conduction along the axis of the crystal. The bulb of the calorimeter was about two-thirds immersed in a freezing-point mixture. This particular calorimeter was unusually difficult to start, and always refused to freeze when ether was rapidly evaporated in it, or when a saline ice mixture was introduced. In consequence, our custom has been to add some liquid air or solid carbon dioxide, as most convenient at the time. In this case we used solid carbon dioxide. The undercooling must have been considerable around the inner glass tube, and a sharp temperature gradient resulted between the lower part of the glass and the walls of the calorimeter. Heat was flowing in from the freezing-point mixture, but near the surface the heat flowed in more rapidly around the exposed portion of the bulb. The ice formed as usual, but on withdrawing the calorimeter for inspection we found, growing out from the solid mantle of ice, long needles and thin plates, which were perfectly orientated along the lines of the flow of heat. The crystals near the top of the mantle were directed at an angle upwards, while those at the base were found normal to the mantle surface. Between these positions the crystals grew at a corresponding inclination to the mantle surface. This, I think, conclusively shows the path of best conductivity in the ice crystal to be along the principal axis.

H. T. Barnes.

McGill University, April 19.

Zeeman Effect of the Yellow Mercury Line λ 5770.

It is well known that the separation of the mercury line λ 5770 in a magnetic field into a triplet is abnormal, inasmuch as the value of the ratio e/m of vibrating electrons is much greater than that obtained from experiments on kathode rays or from measurements of the Zeeman effect on other lines of mercury and of other elements. Lohmann first noticed that the line is separated into a nonet in strong fields, but did not investigate its type. By using an echelon spectroscope of resolving power 430,000 for $\lambda = 0{\cdot}5\mu$, I found that the distribution of lines in the nonet can be accurately examined by using a vacuum tube of special construction. From a field of 18,000 gauss upward, the lines composing the nonet were distinctly observed with my instrument. They are distributed in three groups of three lines each, closely arranged at equal intervals, and each group occupies the position of the normal triplet. No dissymmetry with respect to the middle line was noticed. Several measurements in fields between 18,000 and 28,000 showed that the separation of lines in each group is proportional to the field strength, so that in weak fields each group appears as a single line. The lines of the middle group are equally bright, but the intensity of the remaining two groups of lines diminishes as we proceed outwards, just as is the case with the mercury line 5461, which is also divided into

a nonet. Runge's law is applicable to 5770; the type of the nonet is such that the lines form aliquot parts of $a=e/m.H/4\pi$, and the difference in the number of vibrations of these lines can be represented by

$$0, \pm\frac{a}{8}, \pm\frac{8}{8}a, \pm\frac{9}{8}a, \pm\frac{10}{8}a.$$

Considered as a triplet, which corresponds to lines 0, $\pm\frac{9}{8}a$, Gmelin found that $e/m=2{\cdot}02\times10^7$; v. Baeyer and Gehrcke obtained $2{\cdot}06\times10^7$, which is also the number I have arrived at from the same standpoint. Considered as a nonet, however, we have to multiply the above number by $\frac{8}{9}$, so that the corrected result turns out to be:—

Gmelin	$1{\cdot}80\times10^7$
Gehrcke and v. Baeyer	$1{\cdot}83\times10^7$
Nagaoka	$1{\cdot}83\times10^7$

This is in close agreement with the same constant obtained from measurements on the nonet of the mercury line 5461, for which $e/m=1{\cdot}80\times10^7$.

The above examination of the line 5770 shows how the different types of a class of nonets are derived from normal triplets.

Starting from the normal triplet A, we get nonets of types B, C, and D by doubling the intervals of component

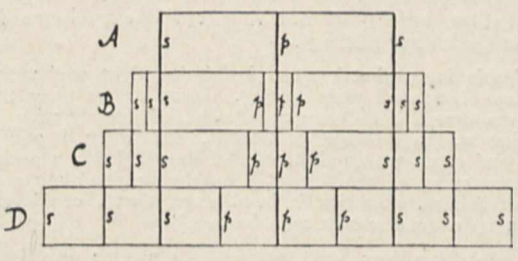


FIG. 1.

lines of each group, as shown in Fig. 1. Considered as aliquot parts of a, they are represented by

B. $0, \pm\frac{a}{8}, \pm\frac{8}{8}a, \pm\frac{9}{8}a, \pm\frac{10}{8}a.$

C. $0, \pm\frac{a}{4}, \pm\frac{4}{4}a, \pm\frac{5}{4}a, \pm\frac{6}{4}a.$

D. $0, \pm\frac{a}{2}, \pm\frac{2}{2}a, \pm\frac{3}{2}a, \pm\frac{4}{2}a,$

with direction of electric force as shown in the figure, p indicating that it is parallel, and s at right angles, to the direction of the field. B is represented by the line 5770, C by the neon lines 6678 and 6305, and D by the mercury line 5461. Probably there is also a type

$$0, \pm\frac{a}{16}, \pm\frac{16}{16}a, \pm\frac{17}{16}a, \pm\frac{18}{16}a,$$

intermediate between A and B. Of the different lines which I have examined, the copper line 5105 seems to belong to this type, but as it requires high resolving power I have not been able to clear up this point. It appears to me quite probable that triplets, which show broadening of lines and no asymmetry in high fields, and give values of e/m greater than $1{\cdot}87\times10^7$, belong to some of the intermediate types.

H. NAGAOKA.

Physical Institute, University of Tokyo, March 29.

The Fertilising Influence of Sunlight.

IN NATURE of February 17 is a communication from Mr. and Mrs. Howard pointing out that the probable explanation of the advantage of leaving land rough ploughed during the hot weather in India is that the biological changes which occurred under the conditions of Messrs. Russell and Hutchinson's experiments occur here also.

The following temperature record, which is one of the highest I have, will be of interest in this relation:—

Date, May 28, 1906.

Maximum shade temperature	107° F. ...	42° C.
Maximum temperature of soil 3 in. deep	109 ...	43
,, ,, ,, 6 ,,	109 ...	43
,, ,, ,, 9 ,,	104 ...	40
,, ,, ,, 12 ,,	100 ...	38
,, ,, ,, 24 ,,	93 ...	34

Other records of soil temperature in Behar are published in "An Account of the Research Work in Indigo at Dalsing Serai, 1903–4," by Bloxam, Leake and Finlow (Appendix ii.). Temperatures approximating to 50° C. at 1 inch from the surface were recorded.

The hot-weather temperature here (Behar) is not so high as in some other parts. Jacobabad "enjoys" one which runs up to 127° F. on occasions, and the whole of the western part of the Punjab (an area equal to about twice that of the British Isles) is liable to maximum air temperatures of 110°–115° F. (43°–46° C.), so that the surface soil in that part may be assumed to attain an average temperature some 10° F. (5° C.) higher than here at Pusa; but it is certain that, however uncomfortably hot India is, its soils never attain a temperature anything approaching 100° C.

Dr. Russell mentions (NATURE, March 3) that biological changes at temperatures below 100° C. are being studied, so that we shall doubtless learn shortly in how far they assimilate under these conditions to the effect at 100° C. In any case, it must not be forgotten that there cannot be much difference in temperature between roughly ploughed land and unploughed land which has carried a cold-weather crop; in both the amount of moisture in the first 6 inches will be nominal, and the thermal capacity of each must be much about the same. The roughly ploughed soil will include more air, and I should expect the rise of temperature at 6 inches to be rather greater in unploughed land. Hence if this agricultural practice is found to be accompanied by important biological changes, this must be due to some cause other than mere temperature.

Regarding the effect of *sunlight*, this can only affect the outside surface; in unploughed land this is better defined than in broken-up land, and during the ploughing operation more soil is exposed (temporarily) to the sun than in the former case, but the ploughing here referred to is commonly *one* ploughing, not a "multiple stirring" such as occurs in the preparation of the seed bed.

Finally, it is perhaps unnecessary to mention that this rough ploughing results in other advantages than those mentioned. One is that the soil absorbs more of the first monsoon rain than unploughed land, and can be prepared for monsoon crops much more quickly.

Pusa, April 13. J. WALTER LEATHER.

Observations of Halley's Comet.

I SAW Halley's comet through field-glasses on Sunday morning, April 24, at 3.40. It was then about 10° above the horizon, 20° to the left of Venus, and slightly under it. It was very distinct from 4.0 to 4.20. At its best, 4.15, I could just distinguish the head by the naked eye, but only for a minute.

The tail appeared broad and short, only about twice the moon's apparent diameter in length, with its axis at 40° to the horizon. The tail began to grow indistinct at 4.30, but the head was visible to 4.45.

The sky was not ideal, Pegasus not distinct, Cassiopeia only partially seen, but Venus was very distinct and bright.

I saw the comet again yesterday—Monday, April 25—from 4.0 to 4.15. The sky was not at all clear. The comet was in a line with Venus, and still about 20° to the left. I could not see it with the naked eye.

This morning, April 26, comet was clearly seen from 3.45 to 4.30. The tail appeared longer and more elegant in appearance. It was perhaps 5° above Venus, and less than 20° to the left. The head was easily seen at intervals by the naked eye, but the tail showed only a trace, and that only once.

The measurements are only by the eye, but are, I think, fairly correct.

C. LEACH.

Malta, April 26.

Anomalous Reading of Hygrometer.

MR. RICHARDSON'S explanation in NATURE of April 28 of the anomalous readings referred to does not seem very satisfactory, because, owing to the presence of dust in the atmosphere, the air is never supersaturated; indeed, it is seldom even saturated, owing to the presence of some particles having an affinity for water vapour. But even supposing there had been supersaturated air at the time, then the "dry bulb" would also form a condensing surface and would have been heated as well as the wet bulb. Fortunately, the observer of the anomalous reading noted that the temperature was rapidly falling at the time, and the bad conducting covering of muslin would quite account for the wet bulb falling slower, and so reading higher than the dry. J. A.

THE LONDON TO MANCHESTER FLIGHT.

THE success of M. Paulhan in reaching Manchester from London by aëroplane, and thus gaining the *Daily Mail* prize of 10,000*l.*, for which Mr. Grahame-White had made such a valiant struggle, is the second case in which an English aviator has been within measurable reach of a success which has actually been achieved by a Frenchman. Last summer it was Latham who attempted and failed to cross the Channel, and Blériot who carried off the palm.

The success of the present effort affords a striking measure of the rapid progress that has been made within the last three years in extending the performances of aëroplanes. When first the offer of the prize for the Manchester flight was announced it certainly looked as if a more useful purpose would be served by offering a prize to anyone who could fly at all. It is hardly likely that if the only inducements offered to aviators had been prizes for such long distance flights as the present one, the same amount of attention would have been devoted to short flights; but numerous private individuals, notably in France, filled up the gap by offering a large number of smaller prizes for more modest achievements, and, as soon as a flight of a hundred yards had been performed, the main difficulty of performing a flight of a hundred miles was overcome. All that remained necessary was experience, and such increase in the carrying capacity of aëroplanes as was necessary to provide an adequate supply of energy for the journey.

Owing to the fact that both aviators used Farman biplanes, the results do not teach us anything regarding the relative merits of different types of machine; and it would be premature to draw any inferences regarding the relative merits of "monoplanes" and "biplanes," in view of Blériot's monoplane success last summer. The Farman biplane, like most other aëroplanes, is probably longitudinally stable and laterally unstable, and in a short trial which Mr. Grahame-White made early in the afternoon before starting, the machine is described as swaying from side to side dangerously. In this respect, both competitors had the same difficulties to contend against, and in view of the fact that Mr. Grahame-White is a proficient flyer both on the Farman biplane and on the Blériot monoplane, and that he made a good sixty-five-minutes flight on the Farman machine, it is probable that under reasonable weather conditions the contest would have resulted in a tie. Mr. Grahame-White's failure was certainly attributable to the bad weather. He only started from London at 6.29 p.m. on learning that Paulhan had started an hour before, and thus he was only able to get that night to Roade, about the time when M. Paulhan descended at Lichfield, fifty-seven miles in front.

On the following morning chances were again against the English competitor, for, after struggling against the wind, he was "twisted from side to side and progress seemed impossible, so he decided reluctantly to come down"; four minutes after Paulhan had again started and only ten miles behind him. If the result proves anything, it is that the French aviator was either more skilled in checking the lateral oscillations of his machine in a high wind, or that his greater experience of meteorological conditions enabled him to seize opportunities which Mr. Grahame-White missed. Possibly, too, the difference of altitude may have affected the conditions, for, according to all chronicles, M. Paulhan seems to have flown higher than Mr. Grahame-White. At any rate, Mr. Grahame-White was at a disadvantage, for he started off without waiting for a meal on the first day, after hearing of M. Paulhan's start, and was probably less fit for his task the next morning. Whatever the explanation, however, it is abundantly shown that the time has not yet come when aëroplanes can be generally used for touring or for regular purposes of transport, but that much practical experience and fair weather are still required before a successful flight can be relied on. It is, indeed, a matter of congratulation that the landings were all effected in safety, and that neither Mr. Grahame-White nor M. Paulhan had any misfortunes of a serious character. At the same time, M. Paulhan is reported to have stated that he would not repeat the experience for double the prize, adding:—

> "People fancy that because I did the flight well within the time it was all plain sailing. I can assure them that from the time I left Crewe the strain and anxiety with my machine was a tremendous burden, and when I put on speed and came within sight of Manchester I felt a perfect rag, wondering all the time if I could ever reach my goal. I don't believe, now that it is all over, that I could have kept it up a quarter of a mile further."

M. Paulhan has well earned his prize; but it is sincerely to be hoped that those who have money to give away in the future, and wish to promote the development of aviation, will devote it to competitions which are less strenuous tests of physical endurance, and more rigorous tests of the development of real advances in the construction of aëroplanes. The Aërial League's appeals in this direction have not met with too generous a response from the British public.

The use of the Gnome motor in these flights clearly demonstrates that the rotating-cylinder type of engine has a future before it. It obviates the vibrations necessarily associated with reciprocating engines, and affords a simple means of cooling the cylinders. The principle is old enough, and mathematicians have long puzzled over how to apply it, but the practical difficulties appear not to have been overcome until quite recently.

The flight has not been without its lessons regarding the means of finding one's way in the air. In this case the London and North-Western line was followed, the course being indicated by whitening the sleepers in places, and the possible halting places also being clearly marked.

If one success has thus been scored in April, the *Deutsche Zeitschrift für Luftschiffahrt*, on the other hand, describes April as the black month for aërial navigation, and April 3 as the *Dies irae*. In the issue for April 20 are portraits of Prof. Abegg, Dr. Delbruck, and Herr Benduhn, victims of the accidents to the balloons *Schlesien* and *Pommern*, both of which sailed on that day; next we have Dr. Alberti's accident with a Blériot machine in Munich, Le Blon's death at St. Sebastian, Molon's misfortune at Cannes, Grade's accident at Leipzig—all chronicled or figured in this single number of the journal. In view of this series of misfortunes, we again express the hope

that future friends of aviation will discover means for advancing its development that will not tempt men to repeat such dangerous adventures as were inevitably associated with the London to Manchester flight, and that M. Paulhan's success will not stimulate a number of less experienced followers to attempt to emulate his achievement. G. H. BRYAN.

THE FIGHT AGAINST SLEEPING SICKNESS.[1]

(1) THE report of the German Sleeping Sickness Commission is an attractive work in which even those who are not specially concerned with the problems of sleeping sickness may find much to interest them. In addition to a great mass of detail bearing on the etiology, diagnosis, treatment, and prevention of a disease which is at present the most important economic problem of European administrations in Africa, the work contains many facts and observations of interest to the naturalist and the anthropologist, and is illustrated by numerous exquisite photographs. A certain number of the illustrations have, as might be expected in a work of this kind, a melancholy interest, representing the ravages of the disease as shown by sufferers from it, or even more significantly by deserted homesteads; but others give a vivid idea of the scenery of the shores of the Victoria Nyanza and of the dwellings, habits, and appearance of the natives of that region.

After a brief introduction and an account of the general course of the expedition, by Dr. Koch, there follow sections on the etiology of sleeping sickness, by Dr. Koch; on diagnosis and on clinical observations, by Prof. Beck; on the treatment of the disease, by Prof. Beck and Prof. Kleine; and on preventive measures, by all three authors. In an appendix are to be found meteorological observations made during the expedition, and a history of 180 cases of sleeping sickness that came under observation and treatment, with their temperature charts.

The section on etiology is divided into two parts, dealing respectively with *Trypanosoma gambiense* and *Glossina palpalis*. Trypanosomes were found not infrequently in the blood of persons whose glands did not show the characteristic swellings and who presented no symptoms of disease. The number of trypanosomes in the blood of infected persons was always small, and appeared to be subject to periodic variations. In the lymphatic glands trypanosomes were more numerous than in the blood. It is stated that the trypanosomes in the blood were always uniform in appearance, and showed no differentiation of form; but all preparations seem to have been made by methods which, though suitable for clinical diagnosis, were quite inadequate for accurate study of structural details.

Many animals were examined with the object of discovering a vertebrate host other than man for *Trypanosoma gambiense*. Of mammals, only in a single monkey were trypanosomes found, similar in type to *T. gambiense*; those found in birds, on the other hand, were of a distinct type. In reptiles, trypanosomes were found in tortoises and crocodiles. The trypanosome of the crocodile is described as large, and similar in appearance to the European *T. rotatorium* of frogs. In view of the erroneous statements that have been so often made, attributing to Dr. Koch the discovery of a connection between sleeping sickness and crocodiles (see NATURE, February 18, 1909, p. 458), attention should be directed to his clear statement that "in any case there is no connection between this crocodile-trypanosome and *Trypanosoma gambiense*."

With regard to the transmission of *T. gambiense*, Dr. Koch believes it to be effected by *Glossina palpalis* alone. Nearly three thousand tsetse-flies of this species were examined, and 189 of them were found to contain trypanosomes, of which four types are distinguished and described with the aid of coloured figures drawn from stained preparations. Three of these types of "wild" trypanosomes are considered to be distinct from *T. gambiense*, with which species, however, "Type IV." is identified; it was found five times in tsetses caught on the Sese Islands. "Type I.," the commonest of the four types in occurrence, is identified with the trypanosome of the crocodile. Attempts were made to infect tsetse-flies with *T. gambiense* by feeding them on infected animals, but in all cases the trypanosomes died out in a few days in the alimentary tract of the Glossina. The infection of the tsetse-fly can only be brought about, it is suggested, under certain definite but as yet unknown conditions. The more recent work of Prof. Kleine and Sir David Bruce will doubtless, when completed, make clear the nature of these conditions and solve a problem which has baffled previous investigators.

A number of observations upon the habits of *Glossina palpalis* are set forth. Dr. Koch is of opinion that crocodile-blood is the principal food of this fly, but that other animals also contribute to its nourishment, especially the hippopotamus. Experiments were made on the effects of clearing the vegetation in spots haunted by the fly, with results confirmatory of the experience of others, that this is an effective method of banishing the fly.

At the beginning of the section dealing with etiology in this report, Dr. Koch points out that the more important facts bearing upon this subject have already been made known by the work of others, and that consequently the investigations of the German Commission can only pretend to fill some gaps and contribute towards "completion of the etiology." It is doubtless for this reason that Dr. Koch so seldom mentions the results of other investigators in his account of his own observations, and often writes in a manner which might lead those unacquainted with previous work on the subject to think that his observations were new. As a matter of fact, the only discovery which can be claimed by Dr. Koch and his collaborators as entirely original, so far as the etiology of sleeping sickness is concerned, is that of the occurrence of trypanosomes in the salivary glands of the tsetse-fly. This important discovery, which was first announced in a preliminary communication to a German medical periodical in 1907, had not been made previously by any investigator, and was received at first with some scepticism, but has since been confirmed by Prof. Kleine and Sir David Bruce.

Prof. Beck's section on the diagnosis of sleeping sickness deals in turn with gland-puncture, lumbar puncture, and blood-investigation. The last of these methods is considered the surest when carried out in a manner which was employed by the Commission, and is described in detail; it is stated to have often given positive results when other indications were negative, especially in those cases in which the glands had become normal under treatment.

[1] (1) Bericht über die Tätigkeit der zur Erforschung der Schlafkrankheit im Jahre 1906-7 nach Ostafrika entsandten Kommission. Erstattet von Dr. R. Koch, Prof. Dr. M. Beck, and Prof. Dr. F. Kleine. Pp. vi + 320; 5 plates. (Berlin: Julius Springer, 1909.) Price 16.40 marks.

(2) Bibliography of Trypanosomiasis. Compiled by C. A. Thimm. Pp. iv+228. (London: Sleeping Sickness Bureau, Royal Society, 1909.) Price 4s.; to be obtained from the Bureau.

(3) Sleeping Sickness Bureau, Bulletin No. 13. Vol. ii., January. (London: Royal Society, 1910.)

(4) Report on the Measures adopted for the Suppression of Sleeping Sickness in Uganda. By Sir Hesketh Bell, K.C.M.G. Colonial Reports.—Miscellaneous, No. 65, December, 1909. Pp. 27, 1 map.

With regard to the treatment of sleeping sickness, Prof. Beck deals with the use and effects of atoxyl, and Prof. Kleine with those of other drugs, of which a variety were tried, but with results inferior to those yielded by atoxyl. For combating sleeping sickness Dr. Koch lays stress on the importance of discovering the infected persons in the earliest stages of the disease, both because curative treatment has then most chance of success, and also in order to prevent them from spreading the infection. The treatment should be carried out in concentration camps situated in places free from tsetse-flies. Healthy populations should be hindered from access to the lake-shore except at places cleared of the vegetation which shelters the tsetses, and the collection of rubber should be forbidden so long as there is danger of infection in the forests on the shore. The tsetse-flies should be kept in check by clearing vegetation in their haunts and by destroying the crocodiles, their principal food supply; this object is to be effected by encouraging the destruction of the nests and eggs of these reptiles. In view of the voracity of tsetse-flies and the readiness with which they suck the blood of any vertebrate animal, it may well be doubted whether the extirpation of crocodiles, though very desirable for many reasons, if practicable, would have the desired effect of diminishing the numbers of the flies to any appreciable extent.

(2) The bibliography of trypanosomiasis issued by the Sleeping Sickness Bureau is a labour-saving publication that will be most useful to those occupied with any problems, whether medical or scientific, relating to trypanosomes and their hosts, vertebrate or invertebrate. It aims at being complete up to March 31, 1909, and contains references, alphabetically arranged, to about 1900 original memoirs, articles, and treatises, catalogued under the authors' names, and numbered in order. In addition to these numbered references, the titles of journals that contain literature on trypanosomes or tsetse-flies are inserted without numbers, followed by a list of the articles or memoirs they contain, so that it is possible to look up the title of a journal in the catalogue and find what papers on trypanosomes or tsetses have been published in it. It is stated that a subject-index is in course of preparation, to be issued as a supplementary pamphlet, indicating the numbers in the bibliography to be consulted for the various subjects.

(3) The thirteenth Bulletin of the Sleeping Sickness Bureau begins a second volume of this most useful publication. Amongst other subjects, the present number deals with the transmission of trypanosomes, the treatment of trypanosome-infections, methods of destroying tsetse-flies, and the alleged occurrence of "ultra-microscopical" forms of trypanosomes. An interesting account is given of a method of destroying tsetse-flies, discovered by Mr. Maldonado, manager of an estate on the island of Principe, who observed that these flies attacked the backs of labourers stooping at their work in the fields; he caused the labourers to wear on their backs black cloths coated on the outer surface with a glutinous substance. In this way 133,778 tsetse-flies were trapped on one plantation during some twenty months. This method may be found useful, it is suggested, for keeping down *Glossina palpalis* in places where clearing is impracticable. A very useful feature of the Bulletin is a section entitled "Sleeping Sickness News," in which information is given concerning recent developments of the disease and measures taken to check it.

(4) Sir Hesketh Bell gives a historical account of the progress of discovery and research, and a summary of the results gained, with regard to sleeping sickness. He then describes the administrative measures taken in Uganda to combat the disease. These measures may be summarised as follows:—(1) The removal of infected persons into fly-free areas, that is to say, more than two miles away from the lake-shore, in order that they shall not render the tsetse-flies infective and capable of transmitting the disease to healthy persons; for this purpose segregation camps have been started in which those afflicted with the disease are put under medical treatment; (2) the removal of healthy persons from areas infested by tsetse-flies, until such time as the flies may be supposed to have lost their infectivity; (3) the extirpation or banishment of the fly, by clearing the forest on the foreshore of Lake Victoria, in those places, such as ferries or ports of main trade-routes, from which it is not practicable to remove the population. The task of keeping the foreshore clear is stated to have been aided greatly by planting the cleared areas with citronella-grass, which grows rapidly, and is also of commercial value, yielding a considerable amount of valuable oil.

These measures, when first planned, were based on the belief that the tsetse-fly only transmitted the disease mechanically and did not remain infective for a longer period than forty-eight hours, a belief founded on the experimental results of scientific investigations which had at that time demonstrated clearly the existence of so-called "direct" or "mechanical" infection, but had failed to obtain evidence for the occurrence of deferred or "cyclical" transmission. Consequently it was thought that the flies would lose their infectivity very quickly when they could no longer suck the blood of diseased persons. The recent researches of Kleine and Bruce, however, have shown that the trypanosome of sleeping sickness goes through a developmental cycle in the tsetse-fly, and that when once the trypanosome has established itself, the fly remains infective, apparently for the rest of its life, without again feeding on the blood of an infected person. It follows from this discovery that the period for which healthy persons must be removed from the fly-belts, in order to ensure that the infection has died out in the flies, is much longer than was thought, and cannot at present be stated definitely. There are two further possibilities to be borne in mind, neither of which have as yet been proved, though often suspected, to exist, and which greatly complicate the problem of the transmission and spread of the disease. One is that an infected tsetse-fly may transmit the infection to its offspring; the other, that some vertebrate animal other than man may harbour the trypanosome of sleeping sickness in its blood, and so be a "reservoir-host" which keeps up the infection in the flies. It must also be remembered that to keep the natives, probably much against their inclinations in many cases, more than two miles from the shore along the immense coast-line of the Victoria Nyanza must be a task of considerable difficulty and of uncertain result. The natives concerned are evicted from the homes which they and their ancestors have inhabited for untold generations, and, moreover, they are for the most part extremely sceptical as to the agency of the tsetse-fly in the transmission of the disease. It is therefore extremely probable that in spite of administrative prohibitions, leakage, so to speak, sometimes occurs, and natives evade the regulations against frequenting the danger zone. In a recent communication to the Royal Society (*vide* Proceedings, 1909) Bruce and his collaborators state that they have found tsetse-flies still infective that were caught in localities from which the natives had been removed, and conclude that the tsetse-flies "can retain their

infectivity for a period of at least two years after the native population has been removed." Whether this very discouraging result is to be explained by longevity of the flies, by hereditary transmission of the trypanosomes in the flies, by the existence of "reservoir" hosts, or by leakage and transgression of official orders, cannot be decided positively at present. Time alone can show if the measures adopted will be efficacious in stamping out the disease and the result will be awaited anxiously by all who have the interests of our African colonies at heart.

E. A. M.

DEVELOPMENT OF UNIVERSITY (AND OTHER) EDUCATION IN INDIA.

THE recent publication of the "Fifth Quinquennial Review of the Progress of Education in India, 1902–7," by Mr. H. W. Orange, C.I.E.,[1] Director General of Education in India, indicates clearly that very considerable and satisfactory progress is being made in India in all branches of education, and that the university standards in particular are being raised and made more real and effective. The review deals with the period 1902–7, and it is probable that during no previous five years has there ever been such rapid and sound progress.

The best indication of the increased amount of attention which education is securing will be found in the expenditure, which is mainly met from public funds. Thus in 1902 the total expenditure on education in India was 401 lakhs of rupees, while in 1907 it had advanced to 559 lakhs, or an increase of nearly 40 per cent. This increased expenditure has been accompanied by a very large increase in the number of pupils in all stages and branches of education. Thus there were nearly 1200 more pupils studying university courses, nearly 77,000 more secondary school pupils, and about 860,000 more primary school pupils under instruction in the year 1907 than there were five years previously. In certain cases much more progress was made in the five years, 1902–7, than had been made in the previous fifteen years. This is specially the case in the matter of training of teachers, in female education, in the special education of Mohammedans, and in the primary standards for boys generally, of whom, of course, the great majority are Hindus. These are all very healthy signs, and perhaps the first and second named may be considered as of almost vital importance to the satisfactory progress of Indian education and of India as a nation.

These great improvements have been mainly brought about by the fact that, under Lord Curzon's government as Viceroy, a general inquiry was held which extended to all kinds and grades of educational institutions, from the universities to the primary schools. This inquiry brought under examination the methods, organisation, tendencies, and results of Indian education as a whole, and resulted in the meeting of various committees, conferences, and commissions. As the result of these, certain general lines of policy were laid down by the Imperial Government, and these have since been continuously applied by the various local governments and authorities in meeting the local educational needs of the various provinces.

In the case of university education in India, a good deal of leeway had and still has to be made up. In many cases standards of teaching had become antiquated, and were also unsuitable. In previous years a great many art colleges had been started by persons wishing to help forward the great cause of education, and these had been affiliated to the various universities. Many of these were known to be insufficiently staffed and very imperfectly equipped generally, the main cause for such conditions being the exceedingly slender financial resources of these institutions. This has been due to their having no endowments and to the exceedingly small fees charged to the students, an annual fee of two to three pounds being commonly paid by a student for education up to B.A. and M.A. standards. Added to this, many colleges were endeavouring to teach a great variety of subjects instead of confining their attention to one or more simple courses, which could have been efficiently carried through with the means at their disposal. As a result of these conditions, a considerable proportion of the students sent up for examination had only received an imperfect training, and this state of affairs having gone on for a considerable period, it had almost insensibly reacted on the standards of the examinations themselves, which had become much lower than was desirable.

To remedy this state of affairs, after certain preliminary inquiries a University Commission was appointed which exhaustively examined into university education in all parts of India, and this reported in June, 1902. As a result a new Act was passed early in 1904 which reconstituted the five existing universities. Under the previous Acts of Incorporation the work of the universities was confined practically solely to the examination of students, while the new Act declared that the universities were "incorporated for the purpose (among others) of making provision for the instruction of students, with power to appoint university professors and lecturers, to hold and manage educational endowments, to erect, equip, and maintain university laboratories and museums, to make regulations relating to the maintenance and conduct of students, and to do all acts which . . . . lead to the promotion of study and research."

This contrast shows the different aspect in which Indian universities are now being regarded, and these provisions will probably gradually exercise a powerful influence, though from their nature their effect can only come slowly, but even now, in certain branches of study, university courses of lectures are being delivered.

Certain other provisions also appear in the new Act which even in the short time which has elapsed since it was passed are having important and far-reaching effects.

The senates were reconstituted, and steps were taken to make them more representative of those actually engaged in teaching in the affiliated colleges than had hitherto been the case, and appointments to the Senate were limited to five years instead of for life. These new senates are now working much more efficiently that was formerly the case. Under the Act also, new sets of regulations had to be prepared for all branches of study, and the Government of India was given the power, after consulting the Senate, to make such additions and alterations as might be considered necessary. Speaking generally of the new regulations, they are a very great improvement on the old ones, for they require a much higher standard of study, and also that such study shall be practical rather than of a theoretical nature. Indeed, in all the science subjects practical work is made an essential part of the course of study, whereas formerly theoretical book-work frequently sufficed to carry a student successfully through some of the science examinations.

Perhaps, however, the clauses of the Act which are having the most immediate and tangible effect are those dealing with the affiliation of colleges to the

[1] Published in Calcutta by the Superintendent of Government Printing in India, 1909.

various universities. Formerly, if a college was once affiliated, the university had practically no control of any kind over it, and though it might be known that a college was doing very inferior work, no effective remedial action could be taken. Under the new Act the connection between the college and university is much closer and more effective than it has hitherto been. The conditions which a college must fulfil in order to receive and retain the privileges of affiliation are prescribed in some detail in the Act, and in order that the university may be satisfied as to the fulfilment of these conditions, systematic and periodic inspection of colleges by university inspectors is established, and this is coupled with the power of calling upon a college so visited to amend within a specified period any points over the wide range of requirements laid down by the Act. These inspections took place almost immediately after the passing of the University Act, and it is not too much to say that the condition of affairs disclosed showed abundantly the absolute necessity of the action taken to secure the passing of the new Act. Some colleges, indeed, have already had, or will have, to disappear if they do not rise to the required standard within a reasonable time. In other colleges where defects were found, due mainly, perhaps, to want of funds, arrangements are being made to remedy them, and these efforts are being supplemented by annual grants of money made by Government, which grants are administered by the universities.

Another direction in which radical changes are taking place under the new Act and its consequent regulations is in the matter of the residence of students. Formerly, in many cases, these conditions were deplorable, but gradually a much better state of things is being evolved, and here again the change is largely due to improvements made with money given for building hostels, &c., by Government and by other donors.

That educational activity is increasing is also shown by the fact that at Allahabad in January of this year, the foundation stone of some important new university buildings was laid by Sir John Hewett, the Lieut.-Governor of the United Provinces, who is also Chancellor of the Allahabad University, and by a demand which is now coming from Burma for a new university to be established there, in addition to the existing universities at Calcutta, Bombay, Madras, Allahabad, and the Punjab. As time goes on, indeed, there will probably be room, not only for the Burma University, but for others at such places as Nagpore, in the Central Provinces, and perhaps at Aligarh, which is now the centre of a large and exceedingly well-managed Mohammedan college.

Such are the main lines on which the improvements in university education in India are being conducted, but the effect of the new University Act does not end here, and it has also had an important bearing on the schools for secondary education. In most Indian universities, students usually can only go up for the matriculation examination if they have studied at a high school recognised by the university. The standard set by the university matriculation, therefore, largely influences the secondary schools. Formerly these standards were low, and in many ways unsatisfactory, while the schools which had been "recognised" were many of them most inferior in every way, specially in teaching and discipline, and they could not possibly impart sound education or develop character. Now the standards for the matriculation examination have been revised and generally raised, while also the conditions under which the secondary schools receive recognition have been formulated under the various university regulations, and unless a school is shown by inspection to be satisfactory in respect of constitution, management, and financial stability, premises and equipment, staff, instruction, and discipline, it cannot be recognised by the university, and hence cannot send up its pupils for examination. Inspection, therefore, has to be made of schools as well as of colleges, and this is rapidly raising the tone of the education given.

Hence the new University Act of 1904 is having a very marked and beneficial effect on all forms of college and high-school education, and India appears to be entering on a more prosperous era in the matter of higher education in all its branches than has hitherto been possible.

THE NUTRITIVE VALUE OF BLACK BREAD.

DURING the last General Election much was heard about the hard lot of the German workmen and peasants who are compelled to eat black bread, and much political capital was made of it. It may therefore be interesting to inquire how much of a hardship this is from the point of view of nutritiousness and also of tastiness. The so-called black bread is made of rye, and has the property of keeping moist for a much longer time than wheaten bread, although if kept too long it is apt to turn sour. It is quite a mistake to suppose that it is nasty; in New York, where wheaten bread is the staple article of diet, the German bakeries almost always also sell black bread, even in the best quarters of the town, and it is said that black bread is always to be found on the Emperor's table. So those who habitually buy white bread by no means entirely discard the use of black bread, though it does not appear to have found very much favour except with those of German extraction.

From the various analyses which have been published, the amount of nitrogenous material contained in the different cereals does not differ greatly nor constantly; but wheat has its nitrogenous matter partly in the form of gluten, a sticky material almost wanting in the other cereals. So far, then, as nitrogenous constituents are concerned, everything turns upon whether gluten is more nutritious than the other nitrogenous bodies. There is no reason to suppose that it is, but its adhesive properties are valuable in causing the dough, when permeated by carbonic acid gas, as a result of fermentation, to rise into a more porous, spongy mass. The nitrogenous material contained in the flour of all cereals when it is made into dough commences to decompose, and in this state acts as a ferment, breaking up a portion of the starch into dextrin and glucose, whilst some part of the starch undergoes a further fermentation into alcohol and carbonic acid gas. In this state the dough is called "leaven," and small portions of it are capable of setting up the same action in much larger masses of dough.

This is the old way of preparing bread, and is still employed in the making of black bread; in the making of finer breads it is not wholly discarded, although yeast is used for the initiation of the process. If this change goes far the bread loses in whiteness, and the addition of alum as an adulterant is made with the view of checking the fermentation. It is not generally known that the comparatively dark colour of whole-meal bread is not due to the particles of bran which it contains, but to the fermentative changes having gone further. This is due to the husk containing another nitrogenous body, which also acts as an active ferment. In fact, in white bread a large proportion of the starch remains unchanged.

But whole-meal bread is well known to have a

higher nutritive value than white bread, probably partly on account of this conversion of the starch, which is a process indispensable to its digestion if it has not happened before it is eaten; and, of course, the whole-meal bread is richer in inorganic salts by the retention of the husk.

And it must not be supposed that rye bread is of necessity "black"; a bread that is lighter in colour than our brown bread can be made from rye flour, the depth of colour being dependent upon the treatment.

So far, then, there is not the smallest reason to suppose that black bread is inferior as a nutritive food to white bread, but rather the contrary.

Passing from the consideration of the nitrogenous (vegetable fibrin) constituents, rye contains as much or more starch and fatty matter as wheat. It contains more lime, about the same amount of magnesia, a good deal more silica, and slightly less phosphoric acid.

As the phosphates of lime and magnesia are needed for the calcification of bones and teeth, there is little to choose in this respect between a whole-meal wheaten bread and rye bread, both being superior to white bread. Formerly it was supposed that teeth of poor quality were actually deficient in lime salts, but this has been found not to be the case. Good teeth, whatever may be their chemical difference, and this has not been ascertained as yet, are unquestionably associated with good general nutrition in the growing person, and, of course, an adequate supply of lime and magnesia is essential to their formation. It should be added that the differences between samples of the same cereals are considerable, being apparently dependent upon the season, soil, and other conditions, so that in many cases the analyses show discrepant results.

But a consideration of the chemistry of the different breads gives no support to the idea that black bread is an inferior article of diet, and the German peasant is not to be pitied for having to use it. In texture it is moister, a little more sticky and doughy, does not get stale so soon, and it might not be wholly to the taste of those accustomed to wheaten bread, at all events at first. It is good food, nevertheless, and those accustomed to it often actually prefer it.

During the Crimean war the Russian prisoners in the hands of the French did not thrive, but after, on the advice of a Russian surgeon, they were given the black bread to which they were accustomed they did much better.

The political orator is not too particular about his facts so long as he thinks they will serve his turn, and the allegations made about black bread have been, to say the least, wanting in scientific accuracy, and so may be classed with much else that is heard from electioneering platforms as calculated, whether with intent or from ignorance, to convey a perfectly false impression.

COMMANDER PEARY'S EXPEDITION TO THE NORTH POLE.

NO geographical goal has been so long and ardently desired as the North Pole. The glamour of the Dark Continent, the mystery of the South Polar lands, the lure of Potosi and Golconda, have never touched the popular imagination like the attraction of the North Pole. The whale and seal hunters of the seventeenth and eighteenth centuries developed the art of Arctic travel; while the Eskimo, the polar fauna, and the heroism of the knights of the frozen seas, kept an undue share of popular geographical interest "North where the bergs careen." The commercial hopes that led to the search for the North-West Passage and the Franklin tragedy for a while made the Arctic Archipelago the centre of popular interest, but the North Pole, as a fixed spot, as definite as the winning post of a race, has kept its own as the goal most prized by sporting geographers.

It has at length been won, and the lecture by Commander Peary to the Royal Geographical Society, in the Albert Hall last night, told the story of the winning. The quest has been Commander Peary's one interest for twenty-four years; he has led four expeditions to reach the pole, after his remarkable exploration of the North Greenland ice-cap had given him the necessary experience, and had yielded him geographical results of perhaps greater scientific value than those of his last and most famous journey. He has carried through his work in an appropriately serious spirit. He has not regarded his quest as a mere matter of geographical athletics, but as a mission so important that he has been tempted to regard the Eskimo as placed by Providence in their inhospitable home on purpose to help him to his goal.

Commander Peary's lecture was a simple statement of the narrative of the expedition, and it gave no details as to the determination of the high latitudes, which geographers at this stage would have preferred to the short appendices giving the soundings and preliminary notes on the temperatures and tides. The expedition was apparently successful because a large force was able to start early in the season. Like Russia, according to Czar Nicholas, the pole has been protected by its ally, "General February"; but on this occasion the expedition began its journey from winter quarters in the middle of February. The party consisted of seven members, accompanied by seventeen Eskimos, 133 dogs, and nineteen sledges. With so large a staff a light advance party could be used to prepare the trail and successive divisions sent back from different stages, so that the final dash for the pole could be made by a party well equipped and comparatively fresh.

Commander Peary says that he and his comrades increased in fitness and training every day of the northern march. At a camp determined by Captain Bartlett as at 87° 48′ N., that gallant officer and the last supporting party returned, leaving Peary, his negro servant Henson, and three Eskimo, with forty of the best dogs and five sledges. On April 1 Peary continued northward, hoping to reach the pole by five marches of twenty-five geographical miles each. At the end of the fifth march a temporary break in the clouds at "approximately local noon, Columbia meridian," enabled Peary to determine the position as 89° 57′. A few hours later, with a light sledge carrying only instruments, drawn by a double team of dogs, he went on for another ten miles, and, as the sky cleared, he took observations, which showed that he had gone beyond the pole. After returning to camp he went eastward for eight miles, and both then and after his second return to camp he secured more observations, which confirmed his faith that he had reached and crossed the pole. Five miles from the pole he found a crack, and through a hole in it bored with a pickaxe he took a sounding of 1500 fathoms, and found no bottom. The expedition returned south by forced marches, and it reached Cape Columbia in such fine trim that it crossed to Cape Hecla, and thence to the ship, in two marches of forty-five miles each.

The only definite scientific contributions announced are the soundings, which indicated a depth of only 310 fathoms at 85° 23′; the depth had increased to more than 700 fathoms at ten miles further north, while at 87° 15′ the result was 1260 fathoms, with no

bottom. Further soundings were prevented by the loss of the wire, which broke on two occasions, detachable sinkers not having been employed.

The expedition gives convincing proof that the sea extends over the North Pole, confirming the view of the eighteenth-century whalers, who claimed to have occasionally found such open seas that they were able to attain high latitudes. So many British whalers claimed to have reached 82° and 83° in open water that it is difficult to disbelieve them all; and as the Greenland Sea was then being scoured by whalers, it is quite probable that they were occasionally able to attain these latitudes. The view that the sea extended to the pole was then partly based on the evidence of Dutch ships, that are said to have reached latitudes of 86°, 88°, and 89°; but the evidence for these latitudes was found unconvincing when it was discussed by Barrington in 1774.

Considering the exceptional interest in the achievement, and the impossibility of leaving any permanent record at the pole, Commander Peary's observations when published will, no doubt, be scanned critically, though in no hostile spirit. As Captain Bartlett accompanied him to 87° 48′—about 150 statute miles from the pole—and Peary thence made five long marches northward, there seems no reason why so expert an ice traveller, prepared to make the supreme effort of his life, should not have reached either the pole or sufficiently near it for all practical purposes.

As the great goal of Arctic enterprise has been won, we may now hope Arctic research will be continued in a more scientific spirit. There is much work still to be done. Geographically, the area now of most interest is that to the north-west of the Arctic Archipelago, and as Peary has shown that a large expedition can journey for four hundred miles out from land and back again, the search for the furthest islands of that group is possible by sledge journeys. The contour of the Arctic Ocean has still to be determined, and this work can hardly be done by sledge journeys, which can give but meagre results, compared with the work in a floating laboratory drifting, like the *Fram*, across the polar seas. Such work is slow, but the risks are probably not excessive. The Arctic death-rate has been far lower than the African, and, with the opportunities of life on a well-found ship, much of the biological and other scientific work might be done during the voyage. The reaching of the pole should change the methods but not lessen the interest of Arctic work.

Report and Conclusions on Peary's Arctic Work.

A full report of the speech delivered by the Hon. J. Hampton Moore, of Pennsylvania, in the U.S. House of Representatives on March 22, with reference to Commander Peary's work in Arctic regions and his attainment of the North Pole, has lately been issued. The subjoined extracts from this report will serve to supplement the information which Commander Peary was able to give in his lecture last night, and to substantiate his claims to distinguished eminence as a polar explorer.

Memorandum of Peary's Northern Voyages.

1886. May to November; about seven months: Penetrated 100 miles on the inland ice of Greenland east of Disco Bay, about 70° N. latitude; altitude, 7500 feet.

1891–2. June, 1891, to September, 1892; about sixteen months: Right leg broken on voyage north. Five-hundred-mile march out and same distance back, across northern part of Greenland, discovering Independence Bay on the north-eastern coast.

1893–5. July, 1893, to September, 1895; about twenty-seven months: Entire party except Peary and two men returned at end of first year. Spring of 1895 Peary repeated the march across northern end of Greenland, and gained some miles beyond his farthest of 1892. Discovered the great Cape York meteorites, and brought the two smaller ones back with him.

1896. July–October; about three months: Unsuccessful attempt to bring home largest of the Cape York meteorites.

1897. July–October; about three months: Brought home largest of the Cape York meteorites—the Ahnigito, the largest in the world—weighing about 90 tons.

1898–1902. July, 1898, to October, 1902; about four years, three and a half months: During this time made four separate attempts to get north, resulting in the rounding of the northern end of Greenland and the attainment of the latitude of 83·59° north of the extreme northern point of Greenland; also the attainment of the latitude of 84·17° north of the northern point of Grant Land. All the instruments, records, private papers of the Lady Franklin expedition at Fort Conger brought home.

1905–6. July, 1905, to November, 1906; about seventeen months: Highest north, 87° 6′, attained in this journey.

1908–9. July, 1908, to September, 1909; about fifteen months: Attainment of the Pole.

Summary.—Eight voyages, six attempts to reach the Pole, and some twelve years spent inside the Arctic Circle.

	Degrees N. Lat.		Degrees N. Lat.
1886	69·00	1900	83·59
1892	81·35	1902	84·17
1895	81·40	1906	87·60
1899	81·50	1909	90·00

Peary's ability as a commander is thoroughly demonstrated by the success of his various expeditions. Twice his ship was driven through the ice to the highest point ever reached in the western hemisphere, and to a point higher than any ship has ever attained under her own steam. Many other ships attempted this same voyage; four of them accomplished part of it, and two were lost. As to his work being civil and distinct from naval, it may be observed that Peary's bringing of the *Roosevelt* home in the autumn of 1906, fighting her way through the heavy Arctic ice, from Cape Union to Littleton Island, and thence down along the savage Baffin Land and Labrador coasts, encountering storm after storm, with rudder and sternposts torn away, propellers crippled, and pumps going constantly, has been characterised as one of the ablest, most resourceful, and courageous affairs of its kind in the annals of Arctic exploration. Indeed, it was the wonder of everyone who saw the ship when it was taken out on the dry dock.

With regard to the expedition that was successful, the expedition of 1908–9, resulting in the discovery of the Pole, he fitted out this expedition at his own expense and that of his friends, and was then granted leave of absence by the Navy Department, taking with him instructions which gave him an unqualified official connection with the Government.

Upon Commander Peary's return, the Navy Department asked the Coast and Geodetic Survey to furnish the results of the late expeditions carried on by him under the auspices of the Peary Arctic Club.

In reply to this request, Commander Peary sent a profile of soundings taken by the expedition, and tidal and meteorological records.

The following table shows the soundings from Cape Columbia to the Pole:—

Sounding by—	Latitude	Fathoms	Remarks.
	° ′		
	83 7	0	
Marvin	83 10	98	Edge of glacial fringe.
Marvin and MacMillan	83 25	96	
Bartlett	83 53	110	Edge of continental shelf.
Marvin	84 29	825	
Do...	84 39	580	
Do...	85 23	310	
Do...	85 33	700	No bottom.
Bartlett	87 15	1,260	Do.
Peary	89 55	1,500	Do.

Peary's Notes on Soundings.

The sounding equipment of the expedition consisted of two reels of specially made piano-wire of 1000 fathoms each, and three approximately 20-lb. leads, with clam-shell device for grasping samples of the bottom. These reels were arranged to be fitted quickly to the upstanders of a

sledge when making a sounding, and had handles for reeling in the wire and lead.

One of these reels and leads were carried by Bartlett with his advance party, and the other reel and two leads by the main party.

Portions of the wire and the two leads were lost at various times in hauling up, owing, probably, to kinks in the wire.

When the sounding at 85° 33′ was made, 700 fathoms only were left of the sounding wire of the main party, and Bartlett, with the other thousand fathoms, was in advance and inaccessible.

In hauling up the wire from this sounding it parted again, and some 200 fathoms, together with two pickaxe heads and a steel sledge shoe, which had been used to carry it down, were lost.

When Marvin turned back the Captain's 1000 fathoms and the remaining 500 fathoms of the other reel were combined.

When Bartlett made the sounding at 87° 15′ I gave him explicit instructions to use the utmost caution in regard to the wire, in order not to lose any more of it, as I wanted it all for a sounding at the Pole should I succeed in getting there.

Acting upon these instructions, Bartlett ran out 1260 fathoms and then stopped, on account of a small kink in the wire, which he feared would part when the wire was hauled up.

When I made my sounding about five miles from the Pole the wire parted, as had been feared, and the last lead and nearly all of the wire was lost.

The above facts are noted to explain the irregularity of these soundings, which did not get bottom.

The sounding of 310 fathoms at 85° 23′ naturally impressed me at once as surprising, and when Marvin reported the result to me, immediately after taking the sounding, I at once asked him if he was sure that he had the bottom, and he replied that he was, as the fact of this pronounced shoaling from 825 fathoms to 310 impressed him at once, and he made sure that his depth was correct.

Again, when the sounding of 700 fathoms and no bottom was made about ten miles farther north, we both spoke of the peculiar fact of this outlying ridge with deeper channel intervening between it and the continental shelf, and Marvin again said that he was sure of his 310 fathoms reading.

Had it not been for the loss of the last lead and practically all of the wire while making the soundings at the Pole, I should, on the return, have interpolated other soundings.

The profile indicates that a line of 5-mile interval soundings from Cape Columbia to the eighty-sixth parallel might develop a particularly interesting profile of the bottom of the Arctic Ocean.

Tidal Records.

The tidal records consist of practically unbroken series of hourly readings of the height of the tide, taken day and night, at the following places and between the dates specified :—

Station.	Period of observation.	Length of record.
		Days.
Cape Sheridan .	November 12, 1908, to June 30, 1909 (total loss of record, 31 hours) ...	231
Cape Columbia	November 16, 1908, to December 14, 1908	29
Cape Bryant ...	January 16, 1909, to February 13, 1909	28
Fort Conger ...	June 10, 1909, to June 25, 1909 (total loss of record, 5 hours)	10

The observations were taken day and night, and besides the regular hourly readings numerous additional readings were generally taken near the times of the high and the low waters.

Commander Peary's observations leave little to be desired in regard to tidal observations between Cape Morris Jesup and Cape Columbia; but there are long stretches of the Arctic coast where nothing is available. This is especially true of the Russian coast and the western and northern portions of the Arctic archipelago.

The results obtained from Commander Peary's records show that the tides along the northern coasts of Grant Land and Greenland are quite different in many respects from what had been heretofore supposed. For example, his records prove that the tide occurs three hours earlier at Cape Columbia than at Cape Sheridan, and not later, as had been generally assumed.

As already intimated, the full significance of these observations in respect to Arctic geography cannot be seen at this time.

The meteorological records consist of thermograms covering about 180 days, and barograms covering about 260 days.

National Geographic Society's Investigation.

At a meeting of the board of managers of the National Geographic Society, Wednesday morning, October 20, the records and observations and proof of Commander Robert E. Peary that he reached the Pole April 6, 1909, were submitted to the society.

The records and observations were immediately referred to the committee on research, with the direction that the chairman appoint a subcommittee of experts, of which he shall be a member, to examine said records and report on them to the board. Mr. Henry Gannett, chairman of the committee on research, immediately appointed as the other members of the committee Rear-Admiral Colby M. Chester, United States Navy, and O. H. Tittmann, superintendent of the United States Coast and Geodetic Survey.

In due course the board of managers of the National Geographic Society, at a meeting held at Hubbard Memorial Hall, Washington, D.C., November 4, 1909, received the following report :—

The subcommittee to which was referred the task of examining the records of Commander Peary in evidence of his having reached the North Pole beg to report that they have completed their task.

Commander Peary has submitted to this subcommittee his original journal and records of observations, together with all his instruments and apparatus and certain of the most important of the scientific results of his expedition. These have been carefully examined by your subcommittee, and they are unanimously of the opinion that Commander Peary reached the North Pole on April 6, 1909.

They also feel warranted in stating that the organisation, planning, and management of the expedition, its complete success, and its scientific results reflect the greatest credit on the ability of Commander Robert E. Peary, and render him worthy of the highest honours that the National Geographic Society can bestow upon him.

HENRY GANNETT.
C. M. CHESTER.
O. H. TITTMANN.

The foregoing report was unanimously approved.

Immediately after this action the following resolutions were unanimously adopted :—

"Whereas Commander Robert E. Peary has reached the North Pole, the goal sought for centuries; and

"Whereas this is the greatest geographical achievement that this society can have opportunity to honour: Therefore

"*Resolved*, That a special medal be awarded to Commander Peary."

Time Records on Dash to Pole.

Referring to the time occupied by Peary in his last dash to the Pole, Mr. Gilbert H. Grosvenor, director and editor of the National Geographic Society, says :—

"In view of the recent published statement by a Member of Congress doubting the distances travelled by Peary on his last northern sledge journey, I have gone to some trouble to obtain correct figures from the narrative of Peary's last and previous expeditions.

"Anyone who cares to take the time and trouble can verify these figures, and will find the following results :—

"Peary's average distance per march from Cape Columbia to where Bartlett turned back was 12·8 miles. Had it not been for the north wind two days, setting them back, this average would have been 13⅜ miles. Between two observations taken by Marvin the average of three marches was 16⅔ miles. Several of the marches were 20 miles.

"His average, from the time Bartlett left him, to the Pole was 26 miles. His average on his return was 25·6 miles.

"For comparison with the above figures, as showing that these averages are not at all excessive, the following facts can be taken from the narrative of the last expedition and previous ones:—

"Peary's last two marches on the return, from Cape Columbia to the *Roosevelt*, were 45 miles each. On this and previous expeditions the journey from Cape Hecla to the *Roosevelt*, a distance of 45 to 50 miles, was made in one march. The distance from Cape Columbia to Hecla was also made on other occasions in one march. The march from the *Roosevelt* to Porter Bay, a distance of 35 miles, was repeatedly made in eight, ten, and twelve hours. MacMillan and Borup, returning from Cape Morris Jesup to the *Roosevelt*, made the distance of 250 miles or more in eight marches, an average of over 31 miles a march. Peary, in one of his earlier expeditions, made the distance from Cape Wilkes to Cape D'Urville, a distance of 65 to 70 miles, in one march. He repeatedly made the march from Cape D'Urville to Cape Fraser, a distance of 40 miles, in one march, and in the winter of 1899–1900 travelled from Etah to a point in Robertson Bay, 60 miles distant, in less than twelve hours.

"On his return from Independence Bay to Bowdoin Bay, Peary averaged 20 miles a day for twenty-five successive marches; 210 miles in seven successive marches (an average of 30 miles a day), making the last march of 40 miles, all these with dogs not driven by Eskimo drivers.

"On more than one occasion in the fall of 1900 Peary's parties went from Lake Hazen to Fort Conger, both by the Bellows route and by the Black Vale route, distances either way of 50 miles overland, in one march. This after the sun had set for the winter.

"In February, 1899, before the sun returned, Peary (with both feet frozen six weeks before) sledged from Conger to Cape D'Urville, a distance of over 200 miles, in eleven marches, in an average temperature of 53½° below zero, an average of about 20 miles. In March of 1902 he went from Cape Sabine to Fort Conger, a distance of 250 miles to 300 miles, as travelled, in twelve marches, an average of 21 to 25 miles, and later covered the same distance again in eleven marches, an average of 22 to 27 miles.

"In the history of polar exploration no one has had so much and such long-continued training in ice work as Peary; his speed is the result of long years of practice, resulting in great physical endurance and skill in the use of the sledge."

NOTES.

ELSEWHERE in this issue Prof. Bryan deals with some aspects of the remarkable aëroplane flight from London to Manchester accomplished by M. Paulhan on April 27–28, thereby winning the prize of 10,000*l.* offered by the *Daily Mail* to the aviator who would make this cross-country flight within twenty-four hours. M. Paulhan left London (Hendon) at 5.22 p.m. on April 27, and descended at Lichfield—117 miles distant—at 8.10 p.m., that is, 2h. 48m. later. He left Lichfield at 4.10 a.m. on the following day, and arrived at Manchester at 5.30 a.m., the distance being 69 miles. The total distance covered with the one stop was thus 186 miles. The prize was presented to M. Paulhan at a luncheon given in his honour on Saturday, and a 100-guinea cup was handed to Mr. Grahame-White in recognition of his plucky endeavour to secure the prize for England. At the banquet, the editor of the *Daily Mail*, in expressing regret for the absence of Lord Northcliffe on account of illness, reminded the assembly that it was owing to Lord Northcliffe's personal initiative that the substantial prize won by M. Paulhan was offered for competition. He stated also that, in view of the great importance of aviation to Great Britain, the *Daily Mail* will immediately offer a further sum of 10,000*l.* for a flight of which the conditions will be announced shortly. Mr. Grahame-White, in acknowledging the toast of his health, said that it is his intention to expend the proceeds of the Royal Aëro Club's testimonial to himself upon the necessary organisation for an aëroplane flight from London to Paris "which I have made up my mind to attempt with the least possible delay." Though we have no sympathy with mere record-breaking, such flights as those accomplished across country by M. Paulhan and Mr. Grahame-White, and others now contemplated, provide practical demonstrations of aëroplane performances which will make the British people realise more than anything else the possibilities of aërial navigation. At present the man in the machine counts for everything; and an aëroplane which Prof. Bryan considers to be laterally unstable is so skilfully managed that it rises superior to its imperfections. It is indeed a sign of progress in the management of aëroplanes that, without a trial flight, and about nine hours after his machine arrived at Hendon, M. Paulhan should make a flight of 117 miles across country without a stop. No doubt much yet remains to be done before the best type of construction of aëroplanes can be determined; nevertheless, the flight last week will go down in history as a notable achievement.

IT is announced that Mr. P. H. Cowell, F.R.S., chief assistant in the Royal Observatory, Greenwich, has been appointed superintendent of the Nautical Almanac, in succession to Dr. A. M. W. Downing, who has retired.

WE have received with regret the announcement of the death, on April 28, of Prof. E. J. L. M. van Beneden, professor of zoology and comparative anatomy in the University of Liége, at sixty-four years of age.

A CONVERSAZIONE, with short lectures and lantern demonstrations, will be held by the Entomological Society in the rooms of the Civil Service Commission, Burlington Gardens, W., on the evening of Friday, May 27. Fellows of the society and others interested requiring further particulars are invited to address all inquiries to the honorary secretary, conversazione committee, 11 Chandos Street, Cavendish Square, W.

THE valuable collections of native African art made by Mr. E. Torday in the southern Belgian Congo are now being classified and arranged by the authorities of the British Museum. The most remarkable specimens in the collection are the wooden portrait statues of past rulers, which throw a new light on savage art in Africa. Next in importance are a splendid carved throne of the paramount chiefs, wooden caskets and cups, and specimens of remarkable textiles resembling velvet, made from the fibre of the upper skin of the palm leaf (*raphia*). This collection was happily made before the almost complete disappearance of native art work due to the importation of cheap European productions.

THE council of the Institution of Civil Engineers has made the following awards for papers during the session 1909–10:—a Telford gold medal to Mr. C. M. Jacobs (New York); a Watt gold medal to Mr. J. D. Watson (Birmingham); a George Stephenson gold medal to Mr. D. A. Matheson (Glasgow); Telford premiums to Messrs. F. C. Buscarlet (Sunderland), A. Hunter (Glasgow), I. C. Barling (Tynemouth), J. Dalziel and J. Sayers (Derby), and J. Shaw (Birkenhead); and the Manby premium to the late Mr. C. W. Hodson (London). The thanks of the council have been conveyed to their colleague, Dr. C. A. Harrison, for the paper contributed by him.

AT the annual general meeting of the Institution of Civil Engineers, held on Tuesday, April 26, the result of the ballot for the election of officers was declared as follows:—*President*, Mr. Alexander Siemens; *vice-presidents*, Dr. W. C. Unwin, Mr. R. Elliott-Cooper, Mr. A. G. Lyster, and Mr. C. A. Brereton; *others members of council*, Mr. J. A. F. Aspinall (Liverpool), Mr. B. Hall Blyth (Edinburgh), Mr. J. A. Brodie (Liverpool), Mr. W. B. Bryan, Colonel R. E. B. Crompton, C.B., Mr. Wm. Davidson (Australasia), Mr. E. B. Ellington, Mr. Maurice Fitzmaurice, C.M.G., Mr. J. P. Griffith (Ireland), Sir Robert A. Hadfield (Sheffield), Dr. C. A. Harrison (Newcastle-on-Tyne), Mr. W. Hunter, Mr. G. R. Jebb (Birmingham), Mr. H. E. Jones, Sir Wm. Thomas Lewis, Bart., K.C.V.O. (Aberdare), Mr. H. D. Lumsden (Canada), Sir Thomas Matthews, Hon. C. A. Parsons, C.B. (Wylam-on-Tyne), Mr. A. Ross, Mr. J. W. Shores, C.M.G. (South Africa), Mr. F. J. E. Spring, C.I.E. (India), Mr. J. Strain (Glasgow), Sir Frederick R. Upcott, K.C.V.O., C.S.I., Sir Philip Watts, K.C.B., Mr. W. B. Worthington (Derby), and Mr. A. F. Yarrow (Glasgow).

SCIENTIFIC work in America will benefit largely by the will of the late Prof. Alexander Agassiz. The American Academy of Arts and Sciences receives 10,000*l.*, and the National Academy of Sciences an equal sum. A bequest of 5000*l.* goes to the City of Newport, Rhode Island, for the support of the Coles Laboratory and for use in the maintenance of manual training in the city schools. The principal beneficiary is Harvard University. Prof. Agassiz has left to that institution a valuable collection of books and instruments, as well as a legacy of 20,000*l.* for the general uses of its Museum of Comparative Zoology. Another sum of 20,000*l.* is left to the president and fellows of Harvard for the publication of memoirs of Prof. Agassiz's own expeditions. In addition, a bequest of 2400*l.*, which is to provide a life income to two servants, is to revert to Harvard on the death of these servants and their wives, and the bulk of the estate, now to be divided among the three sons of the deceased, is also to become the property of the University should the family become extinct.

DR. C. B. PLOWRIGHT, whose death was announced in last week's NATURE, belonged to the school of mycologists founded by the Rev. M. J. Berkeley, one of the pioneers of modern mycology and the founder of plant pathology. Of this school only three members now remain, one of whom is the veteran Dr. M. C. Cooke. Among the members that assembled annually for the fungus foray, held under the auspices of the celebrated Woolhope Club, Dr. Plowright was always noted for his advanced ideas and his endeavours to elevate mycology from the old Friesian rut in which at the time it was firmly imbedded. His espousal of the heterœcismal theory of the rusts was the cause of much good-natured banter; nevertheless, Dr. Plowright commenced experiments and infections, which were continued for many years, and resulted in the production of the classic work entitled "A Monograph of the British Uredineæ and Ustilagineæ." A second publication of importance was "A Monograph of the British Hypomyces." In addition, more than one hundred papers bearing on systematic mycology and plant pathology have appeared under his name in various publications. He was a constant visitor to the various fungus forays for many years, and was for some time president of the British Mycological Society. His geniality and readiness to remove difficulties from amateur mycologists will doubtless be remembered by many, who will sincerely regret his removal from amongst them.

THE eleventh session of the International Geological Congress will be held in Stockholm on August 18–25, and the executive committee has prepared a very attractive programme both of meetings and excursions. The special problems of which discussion is invited are the classification of the pre-Cambrian system, post-Glacial climatic changes, the iron ore supplies of the world, the geology of the Polar regions, and the sudden appearance of the Cambrian fauna. The excursions are divided into three groups, those before, during, and after the congress. The most extensive of the preliminary excursions will be one to Spitsbergen under the conduct of Baron de Geer; it will last three weeks, and will be devoted to examination of the very varied glacial and stratigraphical geology of Ice Fiord. The cost of the excursion is 50*l.* Most of the other preliminary excursions are in northern Sweden, and include visits to the great overthrust area of Jämtland under the direction of Prof. Högbom, to the iron ore deposits of Lapland, to Lake Tornea to examine its overthrusting and Pleistocene geology, and to the peat deposits of Närke. There will be short excursions during the congress to localities easily accessible from Stockholm. Subsequently there will be excursions of from three to fifteen days to the chief localities of geological interest in southern Sweden, including the Archæan rocks of the south-western coast, the island of Gotland and other Silurian localities, the iron mines of middle Sweden, and the chief Mesozoic localities of Scania. The second session of the Agro-geological Conference will be held in Stockholm simultaneously, and though the two congresses are independent, geologists are invited to join both. In preparation for the discussion on the iron ore resources of the world, an elaborate collection of reports on the iron ore supplies of most countries has been collected from the geological surveys and mining geologists. It has been edited by the general secretary to the congress, Dr. Gunnar Andersson, and is being issued at a price of 3*l.* It consists of two quarto volumes of 1100 pages, with an atlas of forty-two maps and numerous plates. The work has not yet been issued, but from the list of contributions it is obviously a most valuable and authoritative statement as to the available supplies and distribution of iron ore.

THE weather was fairly normal over the British Islands during April, but the conditions were generally far less settled in the northern and western districts than elsewhere. Rain fell with considerable frequency, and at times the measurements were large, especially in those places where thunderstorms occurred. At Greenwich rain fell on seventeen days, yielding a total of 2·65 inches, which is 1·08 inches more than the average of the past sixty-five years; of this amount 1·50 inches fell on April 16, when a sharp thunderstorm was experienced. The mean temperature at Greenwich was 47·5°, which is 0·6° below the average, and there were only seven days with a temperature of 60° or above. Frost occurred in the screen on two nights, but radiation frosts occurred on sixteen nights, the exposed thermometer registering 15·9° on April 3. The sun was shining for 130 hours, which is seventeen hours less than the normal, and there were three days absolutely without sunshine. There were only three days during the month with the temperature in the sun's rays above 120°. In April last year the duration of bright sunshine was 250 hours, and there were twelve days with the solar radiation temperature above 120°, whilst the mean temperature was 49·6°, and the aggregate rainfall 1·64 inches.

IN vol. xxiv. of the *Queensland Geographical Journal* Mr. R. H. Mathews describes certain sacred stones used in burial and other rites by the aborigines of Australia.

One variety, known as Kopai balls, are made of burnt gypsum reduced to powder and moulded into a kind of concrete with ashes and sand. These are placed on the grave, and the spirit is supposed to come out and lick them, becoming in this way conciliated and friendly to the survivors. Another type of stone used in their secret rites is ground down into a blunt point at one end, and marks are cut on the surface with a sharp stone, shell, or piece of bone. The object of these markings is obscure, but they certainly convey some religious or symbolical meaning.

THE Peabody Museum, Harvard University, continues in vol. iv., part iii., of its Proceedings for the current year the studies of the Maya Codices, of which two instalments have already appeared, with an attempt by Drs. Tozzer and Allen to identify the conventualised animal forms which appear in these remarkable documents. A detailed examination shows that only a small part of the animal life of the country occupied by the Maya-speaking peoples is represented, and while some drawings are fairly accurate, there is much difficulty in identifying other species which the artists intended to represent. Only those forms of animal life are depicted which possessed a mythological significance or were used as offerings to the numerous deities of the Pantheon. The whole scheme is thus purely religious, and the reproduction of this large series of animal figures will throw much light on the obscure religious system of this remarkable race.

MESSRS. DULAU AND CO. have issued in the series of "Eugenics Laboratory Memoirs" a memoir, by Mr. David Heron, Galton research fellow, on the influence of defective physique and unfavourable home environment on the intelligence of school children. The memoir is based on a limited survey of children in schools under the London County Council, carried on under the direction of the medical officer of the Education Committee, and the characters noted include the sex, age, height, weight, and condition of the teeth of the child, and, for certain schools, the state of nutrition, the condition of the clothing, the degree of cleanliness, the power of hearing, the condition of the cervical glands and of the tonsils, and adenoids. The methods used by Mr. Heron are in several respects novel and noteworthy, and the data based on the measured characters are of interest; but the memoir should serve its most useful purpose in indicating the absolute necessity for clear definition when qualitative characters are to be noted; the classification of the data in the present survey seems in several cases, owing to variations in the personal equation of the observers, to have been so unsatisfactory that little confidence can be placed in the results. So far as they go, these indicate but very slight correlation between intelligence and the other characters observed; but this result is in conflict with that given by the investigations of Dr. Francis Warner in 1888–91 and 1892–4, to which the author does not refer. Dr. Warner's surveys show a high correlation between dulness and malnutrition, and between dulness and development defects, and these conclusions seem the more probable.

ACCORDING to the report for 1909, the Rugby School Natural History Society continues to maintain its record for good work, some of the papers being of a high character, while the illustrations of foreign Lepidoptera are beyond praise. Whether the system of annually making trips for the purpose of obtaining large series of the local Lepidoptera, illustrative of variation, and including as many varieties as can be obtained, is altogether desirable, we will leave our readers to decide for themselves.

"RECORDS OF THE WESTERN AUSTRALIAN MUSEUM AND ART GALLERY" is the title of a new scientific journal started by the director of the museum at Perth, Western Australia. The first number is mainly devoted to an account of the so-called Mammoth Cave (a decidedly bad name for Australia), on the Margaret River, and its contained mammalian remains. Some of the latter are described by Mr. Glauert, and referred in part to existing and in part to extinct species of marsupials and monotremes.

WE have received copies of the two volumes of the *Actes de la Société Helvétique des Sciences Naturelles* for the ninety-second session, 1909. Among the contents of the first volume is a summary of Dr. Fritz Sarasin's "Geschichte der Tierwelt von Ceylon," the full text of which we have received for review in another and later serial. In another article Dr. M. Bikli gives an illustrated account of the physiography and plant-life of Greenland, a country the name of which the author believes to be derived from the contrast between the barren coastline and the green carpet frequently clothing the slopes of the more inland fjords. A special feature of the country is, indeed, the abundant dwarf vegetation clothing almost all the elevated ground except the mountains, this being illustrated by a photograph taken a short distance inland on Disco Island, while other photographs show how this plant-growth has in the course of years covered boulders and slabs of rocks. A particularly interesting picture shows the rounded shores and islands of a typical glacier-landscape at the mouth of one of the fjords.

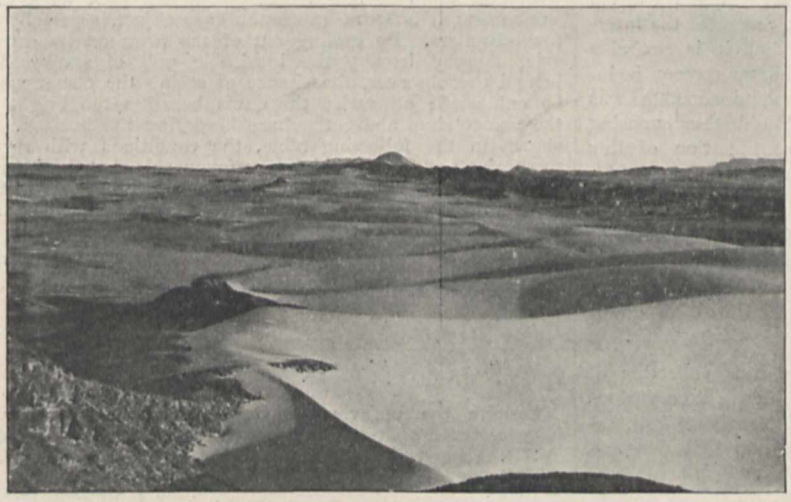
DISCUSSING the action of light upon the green parts of plants in *Naturwissenschaftliche Wochenschrift* (April 3). Dr. Th. Löhr directs attention to the investigations of Senn upon the changes in form and position of the chromatophores. According to this observer, the green colouring matter occurs in the shape of drops or grains, the grana, invested by a distinct protoplasmic layer and lying in the general stroma of protoplasm. Under favourable conditions of light the chromatophores are polygonal, but when subjected to strong or weak light they contract to a globular form. Reference is also made to the hypothesis advanced by Stahl that the colour of the chromatophores is regulated so as to avoid absorption of heat rays and undue transpiration. The latter part of the article deals with the conclusions of Wiesner regarding the light requirements of plants, and Haberlandt's explanation of light perceptivity.

THE second "Masters lecture" on the production of horticultural varieties was delivered by Prof. H. de Vries before the Royal Horticultural Society, and occupies the first place in the Journal (vol. xxxv., part iii.). He recognises varieties of two types, those which are constant at their first appearance and others which are continually sporting; the latter can only be fixed by "working up." As an example of his method, he relates his experience in trying to obtain the wholly peloric variety of *Linaria vulgaris*. For eight years he cultivated the ordinary species, treating it in various ways and excluding always the possibility of crossing with allied forms; during this period, inflorescences with occasional peloric (hemi-peloria) flowers were produced, and eventually plants producing all peloric flowers appeared in the cultures. He notes that seed was obtained from some of these wholly peloric flowers. In his book he states that the seed came only partially true, but by further cultivation and selection he reduced the "reverts" to a small percentage.

IT has not been the custom to issue an annual report on insect pests in the West Indies, but a summary is pub-

lished in No. 201 of the *Agricultural News* of the more serious occurrences of pests during 1909. In only one district, a comparatively small area in Barbados, was any trouble experienced from the sugar-cane root-borer (*Diaprepes abbreviatus*); the larger moth-borer (*Castnia licus*) was, however, reported from British Guiana. The cotton-worm (*Aletia argillacea*), which was very abundant during the season 1908–9, has given very little trouble during the present season, nor have any other cotton pests been reported. Scale insects continue to attack limes, but no severe outbreak has occurred during the year; parasitic fungi are known to occur on these insects, and probably aid in keeping them in check. The scarabee, or jacobs, of the sweet potato (*Cryptorhynchus batatae*) has proved serious in Barbados, and cannot yet be controlled; new methods of treatment are therefore being devised. Another insect about which further information is required is a small moth, the larva of which lives in the heads of ripening sorghum, and causes much damage.

THE sand-dunes of the Libyan Desert have been studied by Mr. H. J. Ll. Beadnell during a residence of three years in Kharga oasis, some 300 miles south of Cairo (*Geographical Journal*, vol. xxxv., April, p. 379). Even where superposed on irregular sands, the dunes show a remarkable linear grouping from north to south. The dunes of Abu Moharik thus start west of Cairo, and thence form a belt 6 or 7 kilometres wide and 650 kilometres in length. The author traces the sand to the rocks of post-Middle-Eocene age that border the Mediterranean, and not to the Nubian Sandstone of the southern region. Between these two regions lies the tableland of Eocene limestone, grains from which may supply more than 7 per cent. of calcium carbonate to the dunes piled up in the oasis of Kharga. The growth and movement of crescentic dunes or barchans have been especially observed. By saturating the concave side of a barchan with water, it became possible to cut a section in it, showing a bedded structure formed by sand carried over from the windward side. Mr. Beadnell urges that this justifies the older view of the formation of the steep convex face, as against that of excavation by scour suggested by Dr. Cornish. Dr. Cornish, however, in the discussion on the paper, attributes the stratification to sliding following upon scour. Steep as the inner face seems to the eye, Mr. Beadnell shows that its slope cannot exceed 33°. The average rate of progression of dunes in the Libyan Desert, from north to south, is now for the first time measured over two years, and proves to be 15 or 16 metres a year. The finest material from the northern sandstones is probably recovered in the district of alluvial loams south of Kharga oasis.



A Belt of Dunes in Kharga Oasis, looking south or downstream. From the *Geographical Journal.*

IN connection with Prof. Silvanus P. Thompson's recent experiments on the physiological effects of an alternating magnetic field on the human body, Mr. A. A. C. Swinton, in a letter which appears in the *Electrician* for April 22, directs attention to several simpler methods of producing the same effects which have been known and used by medical men for some years. If the current from an ordinary magneto machine be passed from the hand to a wet sponge held on the temple behind the eye, a faint flicker will be seen, which increases in frequency as the speed of the machine is increased. If the current is sent through the head in other directions a metallic taste is produced in the mouth. By making the arms and body into the secondary of a coil of many turns carrying a high-frequency current, a small incandescent lamp the terminals of which are in contact with the two hands may be made to light up.

FROM a paper by Dr. L. A. Bauer in the March number of *Terrestrial Magnetism and Atmospheric Electricity*, it appears that a more detailed examination of the records of the magnetic storm which accompanied the eruption of Mont Pelée on May 8, 1902, has led him to the conclusion that the storm was not instantaneous over the whole earth, but that it originated about 14° west of Mont Pelée and travelled eastward with a velocity of about 7000 miles per minute round the entire globe. This result raised in Dr. Bauer's mind the further question whether magnetic storms in general are instantaneous over the whole earth, and an examination of the records of the disturbances of January 26, 1903, and of the seventeen cases tabulated by Mr. Ellis in his Royal Society paper, has led him to the further result that magnetic storms are not instantaneous over the whole earth, but in general travel to the east, occasionally to the west, with a speed of about 7000 miles per minute, which may be reduced considerably in the case of some of the larger and more complex disturbances.

MR. ARTHUR MORLEY contributes a useful article on the strength of materials under combined stresses in *Engineering* for April 29. Undoubtedly recent experiments on combined stresses have furnished interesting information on the behaviour of materials under static loads, but some hasty applications of this information are very unfortunate. A static determination of the tenacity of a material is easily made, and may serve as a useful index of quality, but it is well known that a simple stress of about one-quarter to one-third of this amount will be sufficient to cause fracture if frequently reversed in direction. What the conditions of failure may be under combined stresses which fluctuate are, in the absence of experimental evidence, at present unknown; but a safe load may as well be proportional to the static tenacity as to the static shear stress at elastic failure, and it is much too soon to speak of the entire revision of formulæ and practice affected by accepted theories, or to hope that controversy concerning the design of crank-shafts is ended. Rather it would be correct to say that only the fringe of the question has been touched.

A PAPER on the effects of sewage and sewage gases on Portland cement concrete was read at the Concrete Institute on April 21 by Mr. Sidney H. Chambers, surveyor to the Hampton Urban District Council, and appears in the *Builder* for April 30. Mr. Chambers has had special opportunities for studying this problem during the past five or six years, and has come to the conclusion that the gases in solution in sewage, and those expelled from it, arising from its decomposition, do act injuriously upon Portland cement concrete, even when the concrete is constituted of sound and good materials. However, little danger from erosion need be feared provided one or other of the following factors be absent:—(*a*) a high degree of putrescence of the sewage; (*b*) a moistened surface, which held or absorbed the putrid gases; (*c*) the presence of a free air supply. In one chamber under the author's observation, as the level of the liquid fell it left the concrete wetted with a liquid containing sulphuretted hydrogen in solution. This wet surface was then exposed to the action of the air supply, which oxidised the sulphuretted hydrogen with the production of sulphur and sulphuric acid, and led to the decomposition of the concrete, the lime being converted finally into sulphate of lime. The exact nature of the intermediate compounds cannot be stated, but it is probable that the active agent is sulphurous acid, as cement is insoluble in sulphuric acid. The decomposed concrete was washed away at the next rising of the liquid, thus exposing a fresh surface to the action. The continuation of this cycle led to the formation of grooves at the varying liquid-level.

MESSRS. SWAN SONNENSCHEIN AND CO. will publish in the course of the next fortnight a volume to be entitled "The Signs and Symbols of Primordial Man," in which Dr. Albert Churchward explains the evolution of religious doctrines from the eschatology of the ancient Egyptians.

A CLEARANCE catalogue of a miscellaneous collection of books, including works on America, Africa, &c., various domestic animals, and general natural history and literature, has just been issued by Messrs. John Wheldon and Co., Great Queen Street, Kingsway, W.C. The same firm announces the publication of a work, to be issued in twenty-five quarterly parts, on "South American Ornithology: a Manual of the Birds of Continental South America, from the Isthmus of Panama to the Straits of Magellan," edited by Mr. H. Kirke Swann.

MM. GAUTHIER-VILLARS, of Paris, have issued in their "Savants du Jour" series a monograph, by M. Ernest Lebon, dealing with Prof. Gaston Darboux and his work. The book opens with a biography of the distinguished mathematician and a list of the many distinctions conferred upon him. The remaining six sections are concerned with Prof. Darboux's contributions to mathematical science, and contain several appreciations of them by French men of science. It may be noted that Prof. Darboux's writings number 419. The volume, which costs 7 francs, contains an excellent portrait of Prof. Darboux.

WE have received from Messrs. Newton and Co. an advance proof of the first portion of their new catalogue concerned with "Apps-Newton Induction Coils, X-Ray, High-frequency, Static, and other Electrical Apparatus for Medical Work." An introductory section, which precedes the price-list, provides the general medical practitioner with the information needed to enable a beginning to be made in the use of electrical methods in his practice. The catalogue serves, incidentally, to show with what powerful aids recent developments in electrical science have provided present-day physicians and surgeons. The contents of the list, arranged as they are so as to make reference easy, will prove of great interest, not only to medical men, but also to electricians.

MESSRS. KEGAN PAUL, TRENCH, TRÜBNER AND CO., LTD., have published an eighteenth edition of the late Mr. Winwood Reade's "The Martyrdom of Man." Reade, who died in 1875, in his thirty-sixth year, said of this book of his that in commencing it he intended "to prove that Negroland or Inner Africa is not cut off from the main-stream of events as writers of philosophical history have always maintained, but that it is connected, by means of Islam, with the lands of the East, and also that it has, by means of the slave trade, powerfully influenced the moral history of Europe, and the political history of the United States. But I was gradually led from the history of Africa into writing the history of the world."

OUR ASTRONOMICAL COLUMN.

HALLEY'S COMET.—Attempts to observe Halley's comet, with binoculars or naked eye, during the past week have shown that it is by no means an easy object, especially for town-dwellers. By getting out of the town on its eastern side, thereby leaving the inevitable pall of smoky haze behind the observer, the chance of seeing the comet would be enhanced; otherwise the dawn becomes too bright ere the comet rises above the haze bordering the horizon. As shown in the following table, the conditions with regard to sunrise are now slightly more favourable, but the interval between comet-rise and sunrise again begins to decrease after May 6, and, on this account, observations will become increasingly difficult:—

	Comet rises a.m.	Sun rises a.m.
May 6	2.20	4.26
,, 9	2.19	4.21
,, 12	2.18	4.16
,, 15	2.37	4.11
,, 18	3.30	4.7

Despite the unfavourable conditions, several observers have reported seeing the comet with binoculars. Thus Mr. W. B. Tripp writes that he saw it plainly, from Isleworth, with a binocular field-glass, from 3.0 to 3.30 a.m. on May 3; to the naked eye it was a very faint object south of γ Pegasi. In addition to a bright nucleus, there appeared to be an appreciable, though short, tail, of which Mr. Tripp sends a rough sketch. Other naked-eye observations have also been recorded. Sir Robert Ball, telegraphing to the *Times* on May 3, said:—"Halley's comet was observed at Cambridge at 3 this morning. The stellar nucleus was between the second and third magnitude, and the tail was 20 minutes long."

The rapid approach to the earth should make observations easier, the distances, in millions of miles, for the next few days being as follows:—May 6, 56; May 10, 41; May 14, 27; May 18, 16; May 20, 14·3. After May 20 the comet will recede from us at about the same rate as it is now approaching us, attaining a distance of about 42 million miles on May 30.

Some interesting articles dealing with comets in general, and Halley's in particular, appear in No. 1926 of *La Nature* (April 23), which is wholly devoted to the subject. M. Jean Mascart discourses on the historical importance of Halley's comet; M. Rudaux discusses the nature of comets and their orbits, referring to many famous examples; and M. Touchet contributes a description of comet 1910*a*. All the articles are profusely illustrated with interesting diagrams and photographs.

Another interesting article, in which Dr. H. N. Russell discusses the conditions of the present apparition, is published in the *Scientific American* for April 16. He points out that the present apparition is a favourable one, and discusses the phenomena which may be observed. One of the illustrations is a reproduction of Prof. Frost's objective-prism spectrum of January 14, in which the cyanogen band is an outstanding feature. Dr. Russell makes some

interesting speculations as to the density of the comet, and suggests that golf balls, sown at the rate of two or three per cubic mile, would probably represent fairly well the degree of rarefaction obtaining in the head at the time its cross-section was 12,500 miles.

In No. 4404 of the *Astronomische Nachrichten* Herr J. Holetschek discusses the length of the comet's tail at different apparitions, *apropos* of the question whether the tail, on May 19, will extend far enough to envelop the earth. In 1759, when the earth passed through the plane of the comet's orbit on May 14, the tail exhibited large fluctuations in apparent length; on May 5 it was recorded as nearly 47° long, but on May 14 the recorded length was but 19°. Herr Holetschek gives the following values for the length at various apparitions, the first being a mean value, the second the largest value recorded; the unit is the earth's distance from the sun:—1456, 0·20, 0·39; 1531, 0·14, 0·17; 1607, 0·06, 0·12; 1682, 0·10, 0·22; 1759, 0·08, ??; 1835, 0·08, 0·17; in each case the first value is probably the length of the most brilliant, easily seen, part of the tail. For the tail to reach to the earth on May 20 its length must be 0·15 on this scale. Some amount of discussion has appeared in the daily Press as to the probability of its attaining the requisite length, and, to a representative of the *Daily Mail*, Mr. Crommelin suggested that the chances are about even; but there is no method of determining the probable length at any particular time, for comets' tails are so very uncertain in their behaviour.

THE VELOCITY OF THE SOLAR SYSTEM IN SPACE.—The results of a new determination of the velocity of the solar system in space are published by Prof. Stroobant as an extract from the *Bulletin de l'Académie roy. de Belgique* (No. 1, pp. 39–51, 1910). After discussing previous solutions of the problem, he takes Newcomb's later value for the apex (A=277·5°=18h. 30m.; D+35°), and, from the more recent determinations of radial velocities of stars, calculates the displacement of the sun in that direction.

From the discussion of the velocities of forty-nine stars situated near the assumed apex, Prof. Stroobant derives 18·75 km. as the velocity of translation of our system, and from fifteen stars surrounding the anti-apex he derives 21·55 km. per sec. Combining these results, he finds that, in regard to stars visible to the naked eye, the solar system is travelling towards the assumed apex with a velocity of 19·40 km. per second. This value is a little less than that (19·89±1·52 km.) derived by Campbell taking the apex obtained by himself, and is much greater than that (16·7 km.) found by Kapteyn; it represents an annual displacement of 4·10 astronomical units. Prof. Stroobant tabulates the stars discussed by him, giving their positions, magnitudes, spectral types, &c., and shows that stars of different types give different values for the velocity of the solar system; thus twenty stars of the Orion type give a mean value of 22·5 km., and appear to constitute an individual system in the stellar universe.

STAR COLOURS.—In a paper which appears in No. 3, vol. xxxi., of the *Astrophysical Journal* (April, p. 234), Prof. Louis Bell discusses the reputed colours of the *comes* in double stars in relation to the known facts concerning the colours of stars and their spectra.

It is a fact, established by many investigations, that among the reported colours of double stars there are bizarre tints which are not met with among isolated stars. That this is not due to any physical connection between the *comes* is shown by the fact that it appears as strongly in the case of optical doubles as in the case of binary systems. The suggestion that these tints are merely subjective effects of contrast is generally countered by the statement that they are not always complementary, but Prof. Bell shows that this statement is not conclusive.

From a discussion of the spectra of a number of doubles, and from a number of experiments on artificial stars, he shows, fairly conclusively, that the reported tints are produced physiologically, and have no determined objective existence. As an example of the evidence deduced from the study of spectral type, he mentions 59 Serpentis, where the primary type i. is yellow and the secondary type ii. is blue; a type ii. star of a bright blue colour is unknown among isolated stars, and logically improbable. His experiments show that with artificial stars of unequal magnitudes, such as are found among double stars, "dazzle tints" and "fatigue" effects probably account for the curious associations of colours met with in the records of the colours of multiple stars and star-clusters.

THE FORMATION OF SATURN'S RING SYSTEM.—In No. 4403 of the *Astronomische Nachrichten* Prof. Lowell discusses the causes which have produced the present conformation of Saturn's system of rings. He points out that commensurability of period between perturbing and perturbed masses is a greater factor in determining their loci than is the more direct effect of attraction, and shows that in the case of Saturn's system the rings have their present conformations in accordance with this principle. Thus Prof. Lowell shows that, despite its smaller mass, Mimas has been the chief fashioner of the rings, aided by Enceladus and Tethys, in this order. Not only do the older divisions of the rings show this commensurability of period with the satellites, but newly discovered divisions occur at such distances as would give commensurability the greatest effect.

THE WATER PROBLEM.

THE discussion on the constitution of water which took place under the auspices of the Faraday Society on April 26 was remarkable for the presence of two distinguished foreign visitors, Prof. Walden, of Riga, and Prof. Guye, of Geneva, the former having travelled specially from Riga in order to be present, whilst the latter was able to arrange a necessary visit to London in such a way as to enable him to present his paper in person. Contributions to the discussion were also received from Mr. Sutherland, of Melbourne, and from Prof. Nernst.

Prof. Walker, of Edinburgh, occupied the chair, and in opening the discussion remarked on the extreme complexity of the problem of ascertaining the real nature of this commonest of all solvents, and on the great progress that had been made in recent years in the accumulation of quantitative data for its solution.

Prof. Walden's paper, "Is Water an Electrolyte?" included a number of observations that had been made in order to determine whether water, when dissolved in a medium possessing powerful ionising properties, might not itself become an electrolyte. To secure an adequate answer to this question, it was considered necessary to make use (amongst others) of media of which the specific inductive capacity was greater than that of water. The liquids selected were hydrogen cyanide, HCN; formamide, $H.CO.NH_2$; nitrosodimethylamine, $(CH_3)_2N.NO$; formic acid, H.CO.OH; and sulphuric acid, the first two solvents being characterised by a specific inductive capacity greater than 84, the value for water. In passing, it may be noted that Prof. Walden's discovery of the use of formamide as a solvent represents a "find" of extraordinary importance which, even if it stood alone, would form an adequate recompense for the labour involved in his masterly survey of the wide field of organic liquids; this solvent appears to reproduce nearly all the valuable qualities of water, including its convenient freezing point and boiling point and its powerful ionising properties, but will mix freely with important groups of compounds which do not dissolve to any marked extent in water.

Hydrogen cyanide, which with its high specific inductive capacity and great fluidity provides ideal conditions for electrolysis, was found when used as a solvent for water to give molecular conductivities of the order of 0·000 as contrasted with 300 for a salt such as potassium iodide; the low molecular conductivity of the water dissolved in hydrogen cyanide finds a parallel, however, in the low conductivity of hydrogen cyanide dissolved in water. Formamide, with a similar specific inductive capacity, but much smaller fluidity, gave for the molecular conductivity of water values (about 0·016) slightly higher than in the case of hydrogen cyanide. In the case of formic and sulphuric acids the specific inductive capacity is lower than that of water, sulphuric acid being further handicapped by its extraordinary viscosity, but both solvents gave increased values for the molecular conductivity of water, namely, about 0·17 in formic acid, but rising in the case of sulphuric acid as high as 74. From these observations it is clear that the conductivity attributed to the water does not

depend on the *physical* qualities of the solvent, but on some *chemical* relationship between solvent and solute. It was suggested by the author that water, acting as an amphoteric electrolyte, could form a salt when mixed either with a strong acid or with a strong base, and that the high conductivity of mixtures of sulphuric acid and water, and the slight conductivity of mixtures of formic acid and water, were due neither to free acid nor to free water, but to the presence of an oxonium sulphate or formate in the liquid. The absence of conducting power in mixtures of water with hydrogen cyanide or formamide was attributed to the weakness of their acidic and basic qualities and the impossibility of combining them with water to form a salt-like electrolyte.

Prof. Guye, in a paper "On the nature of molecular associations in the special case of water," referred to a new formula by which the coefficient of association of a liquid might be deduced from its molecular surface energy, and showed that in the case of water at the boiling point it gave the factor 1·96—a value considerably lower than that (2·66) deduced by Ramsay and Shields, but agreeing closely with a value (1·98) deduced by Walden by another method. He also described the results of a calculation whereby the degree of association of liquid water could be calculated from the degree of association of steam on the assumption that the law of mass-action held good in both cases, and that the value of the constant remained the same throughout. Taking the figure 1·089 given by Bose for the association-factor of steam, the value 1·99 deduced for water was shown to agree satisfactorily with those derived by the other methods referred to above.

The values given by Prof. Guye for the coefficient of association of water at 100° were, in the subsequent discussion, referred to by Mr. Bousfield, who pointed out that (if correct) they would render untenable Sutherland's theory that liquid water is a binary mixture of trihydrol and dihydrol, since even at 100° it would be necessary to assume the presence of considerable amounts of monohydrol in order to reduce the (average) association-factor below 2.

The paper by Mr. W. R. Bousfield and Dr. T. M. Lowry, on "Liquid Water a Ternary Mixture. Solution-volumes in Aqueous Solutions," was an extension to other solutes of some curious observations made five years previously in the case of aqueous solutions of caustic soda. The solution-volumes of the soda were found to vary largely with the concentration and with the temperature, the most remarkable feature of the variations being the occurrence of a maximum of solution-volume at about 60° C. in liquids of all concentrations. The gradual conversion of the ordinary, slightly concave, expansion curve into a strongly convex curve had now been traced through a series of solutes—chloral hydrate, sugar, acetic acid, silver nitrate, potassium, sodium, calcium and lithium chlorides. The curves for caustic soda were shown to be intermediate between those for sodium and calcium chlorides, and to form one member of a series of progressively changing types. The drooping of the ends of the curves was shown to depend on the occurrence during the preparation of the solutions of a contraction resulting from the formation of hydrates. Such a contraction indicates that water is increased in density by combining with a solute; in order to give definiteness to this conception, the suggestion was made that the density of combined water is similar to that of its denser constituent (dihydrol) in the free state, and that the contraction on dissolution is due mainly to the conversion into hydrate of *lighter* constituents present in the liquid. As this contraction in the case of lithium chloride solutions increases both above and below 40°, it follows that a lighter form of water is produced, not only by cooling, but also by heating it. The presence of three constituents in the liquid (ice, water and steam, or trihydrol, dihydrol and monohydrol) is indeed absolutely necessary in order to account for the complex changes of volume that have been observed in water and in the solutions prepared from it.

Mr. Sutherland's paper "On the constitution of water" had been circulated before the meeting, and owing to lack of time was taken as read. His suggestion that the hexagonal symmetry of ice crystals may be taken as evidence in favour of the "trihydrol" formula will now receive more serious consideration than would have been the case a few years ago; although his method of deducing the relative sizes of the atoms differs from that made use of by Barlow and Pope, and his method of "packing" is not the "closest" possible, there is no doubt that the general scheme of the arrangement is sound, and that the argument from crystal structure to chemical constitution may now be accepted as both legitimate and useful. Unlike the previous authors, Mr. Sutherland considers that monohydrol does not exist in liquid water, but is present in all salts containing water of crystallisation. He attributes to it a density (1·31 in the solid and 1·26 in the liquid state) considerably greater than that of dihydrol (1·13 and 1·09) or of trihydrol (0·92 and 0·88), and in an appendix gives values for a number of its other physical properties.

Prof. Nernst's paper on the specific heat of ice, water and steam was read by Dr. Wilsmore. The survey covered the whole field from −200° to the highest temperatures, but attention was directed specially to minima in the specific heat of water vapour under moderate pressures and of liquid water at moderate temperatures; both minima were attributed to the dissociation of complex molecules. The question of specific heats was also dealt with in a note on the specific heat of water of crystallisation by Mr. F. P. Sexton, of Truro, which was read by Dr. J. A. Harker. In the case of copper sulphate the first four molecules of combined water were found to have a specific heat 0·499, whilst the fifth molecule gave the value 0·508. Mr. Bousfield pointed out that the value 0·5 also held good for the combined water in solutions of potassium chloride, the heat capacities of which could be calculated correctly by assuming them to be mixtures of free water, hydrate-water, and salt. Dr. Senter pointed out that the values now given agreed well with the view, in support of which much evidence was available, that in compounds such as copper sulphate four molecules of water were definitely associated with the metallic atom, the remainder being perhaps attached to the molecule as a whole.

Early in the evening Mr. H. B. Baker showed a remarkable experiment on the influence of purification in retarding the action of water on sodium amalgam, the underlying idea being that if water could by purification be rendered non-conducting it might also be rendered chemically inactive. Similar experiments on the inactivity of highly purified nitric acid were described by Mr. Veley.

A complimentary dinner, the first in the history of the Faraday Society, was given in honour of its foreign guests, Profs. Walden and Guye, on Wednesday, April 27, under the chairmanship of the president, Mr. James Swinburne, F.R.S. The English guests included Sir William Ramsay, Sir William Tilden, Sir Joseph Larmor, Prof. H. B. Dixon, Prof. Divers, and Dr. Chree. In responding to the toast of the guests of the evening, Prof. Walden referred to the scientific relationship between Russia and Great Britain, remarking, incidentally, that the first Russian chemist was an Englishman, sent by Queen Elizabeth to Russia in the sixteenth century. Prof. Guye dwelt on the debt which chemists all over the world owed to Faraday, and gave an interesting account of Faraday's visit to Geneva when he accompanied Sir Humphry Davy on his tour through Europe. T. M. L.

RECENT ADDITIONS TO IDEAS REGARDING THE INTERNAL STRUCTURE OF THE EARTH.[1]

BEYOND the superficial observations made by geologists, not extending more than about one two-hundredth of the radius below the surface, even by indirect means, we are dependent on mathematicians for our ideas regarding the physical state of the earth's interior; these ideas are based on extrapolation from physical constants obtained in the laboratory, and their variety extends to the number of possible permutations and combinations of the three physical states of matter—solid, liquid, and gaseous. Halley's conception of a core and shell rotating at different speeds has been revived by Sir F. J. Evans (1878) and by the distinguished founder of this series of lectures to explain the secular variations of magnetism. The Laplacian hypothesis, based on Clairault's theorem, is now

[1] Abstract of the Wilde lecture delivered to the Manchester Literary and Philosophical Society on March 22, by Sir Thomas H. Holland, K.C.I.E., F.R.S.

being superseded in many minds by Chamberlin's planetesimal theory, after having inspired petrologists with a vain hope of finding traces of the primeval slaggy crust among the Archæan gneisses. Astronomers prefer a solid globe, but on grounds different from those assumed by Hopkins and at first accepted by Lord Kelvin. Arrhenius concludes in favour of a gaseous core, like that postulated by Ritter, but of larger dimensions than the gaseous core suggested by Dr. Wilde.

Theories regarding the processes of consolidation, the gradient of pressure, and the deep-seated rise in temperature are equally varied. Until this year all agreed in assuming the earth's interior to be hot, but Prof. Schwarz now prefers to think it is cold. So long as radio-active bodies were unknown the apparent reserves of heat-energy offered the world a short life; but its actuarial value has now been increased almost indefinitely by the discovery of radium in embarrassingly large quantities, and Prof. Joly warns us that, instead of peaceful cooling, the present "age" may end in catastrophic heating.

The nearest approach to actual observation regarding the deep-seated parts of the globe is recorded by the seismograph as interpreted by R. D. Oldham, who aptly compares the seismograph with the spectroscope as an instrument for examining inaccessible objects. The first and second phases of long-distance seismographic records, which are due to waves passing through the earth by approximately chordal paths, show a reduction in velocity when there is a sufficient distance between the origin of the shock and the recording instrument for the assumed chordal paths to pass through the inner two-fifths of the earth's core, while the distortional waves are apparently dispersed by refraction when the origin of the earthquake and the recording instrument are separated by about 140°. The records, which are confessedly too few to be regarded as conclusive, suggest that the central core differs in physical characters from the outer three-fifths and the superficial crust. Similarly, the vibrations that pass under the great oceanic depressions indicate elastic conditions differing from those under the continental plateaux, the difference being apparent to a depth of about one-quarter the earth's radius. This last conclusion might be correlated with the variation in the chemical composition in the sub-oceanic crust caused by selective denudation of the kind indicated by Sir John Murray in 1899, and by Chamberlin's theory regarding the origin of the oceanic depressions.

The recent discussions and new data obtained by geodesists and geologists to check Dutton's theory of isostasy have revived interest in the deep-seated parts of the superficial crust. The remarkable work recently done in India by Burrard and Lenox-Conyngham, when correlated with the results of the Geological Survey, are especially important in showing the truth and the limitations of isostasy. Burrard's results indicate that the Himalayan heights are partly compensated by deficiencies of subterranean gravity, and that greater loads are maintained by the rigidity of the geologically stable crust of the peninsula than in the folded parts of the extra-peninsular region. The deficiency of gravity under the outer and sub-Himalaya is, however, equally pronounced in the plains near the southern foot of the range; but at a distance of about 150 miles from the foot of the mountains there is a subterranean band of high gravity parallel to the alluvium-filled Gangetic valley, as well as to the four Himalayan zones—the foot-hills, composed of Tertiary strata; the outer Himalaya, of much older, unfossiliferous sediments; the crystalline range of snow-covered peaks; and the Tibetan highlands of fossiliferous, marine strata.

Soon after Dutton published his theory of isostasy, R. S. Woodward pointed out that, if the highlands continued to rise in consequence of the reduction in their load by erosion, and the depressions continued to sink under the growing weight of accumulating sediment, the process should continue indefinitely, and mountain ranges would thus never be worn down, while new folds in undisturbed areas would never arise; but the geological history of India shows why and how this process may result in "isostatic suicide." For ages before the end of the Mesozoic era the rivers of Gondwanaland, which stretched away as a great continent to the south and west, poured their loads of silt into the Eurasian ocean, of which the southern shore-line approached the line now occupied by the Himalayan snow-covered peaks. With the loading down of the northern littoral of Gondwanaland, the northern part of the continent became stretched, and normal faults were developed with a general east to west trend.

Some of the faults of this kind occurring in the Central Provinces were shown by J. G. Medlicott, so long ago as 1860, to be pre-Gondwana (that is, pre-Carboniferous) in age, others were formed before the Upper Gondwana (Lower Mesozoic) strata were formed, while the latest affected the younger Gondwana beds, and became channels for the Upper Cretaceous basalts. The general trend of the Cretaceous dykes in this part of India, and the prevalence of normal faults further east at about the same latitude, shown in various geological maps published by later members of the Geological Survey, indicate the nature and direction of the tension produced by the unloading of Gondwanaland and the simultaneous depression of the adjoining ocean bed. The process reached its climax towards the end of Cretaceous times, when the basaltic magma below welled out and flooded more than 200,000 square miles to a depth of nearly a mile.

Presumably the tension marked by faults in Central India existed also in areas further north, where the records are now buried under the Gangetic alluvium, and the band of high gravity detected by Burrard's plumb-line and pendulum is probably due to concealed batholiths of basic and ultra-basic magma, which were injected into the region of tension after the manner described by Prof. R. A. Daly.[1] Then followed the production of a geosyncline parallel to the northern shore-line of the old Gondwana continent and parallel to the subsequent folds of the Himalayan range, which are now being thrust over towards the region of deficient gravity between the visible mountain range and the concealed band of basic batholiths.

The data in this area are in substantial agreement with Daly's idea of a persistent sub-crustal gabbroid magma, which, though possibly only in a state of potential fusion under regions of normal pressure-gradient, may become fluid in localities of protracted erosion and gradual rise of the northern shore-line of the old Gondwana continent and agree, in general, with those analysed by Hayford and others in America in showing that isostasy can be detected only when the visible masses over wide areas are concerned; further data of this kind will permit of the determination of the minimum loads that can be maintained by the crust in old stable land surfaces as compared with the apparently smaller loads maintained in recently folded regions. If the sequence of events in India has been correctly traced, it should be possible to indicate areas on the earth which are in danger of basaltic floodings and of later folding movements. In South America, for instance, the north-flowing tributaries of the Amazon and the Araguaya are possibly developing conditions on the old land surface of Brazil similar to those that on Gondwanaland preceded the outburst of the Deccan Trap in Cretaceous times.

THE HULA, OR FOLK-DRAMA OF HAWAII.

THE Hula, or national folk-drama of Hawaii, has already been casually described by the Rev. W. Ellis in his "Polynesian Researches," and has been noticed in the "Travels" of Captain Cook; but it was left to Dr. N. B. Emerson to undertake a detailed investigation of the unwritten literature of the island, and to make a collection of the songs sung in these performances. The results of this study have been published in Bulletin No. 38 of the American Bureau of Ethnology. We may congratulate this institution on having now, for the first time, under the authority of a special Act of Congress, extended its operations beyond the bounds of the American continent.

The Hula is a special form of folk-drama, dealing in a series of impassioned lyrics with many phases of the national mythology and traditions. The poetry is of a highly romantic and sensuous type, including themes connected with human love and life, the processes of nature,

[1] "Abyssal Injection as a Causal Condition and as an Effect of Mountain-building," by R. A. Daly (*Amer. Journ. Sci.*, xxi^{v}., 1906, pp. 207–13).

the mysteries of the spirit world, described by a series of metaphors and personifications. Much of it is of very ancient date, and is hardly intelligible even to the best native scholars at the present day. In studying the translations and analysis of Dr. Emerson, we cannot avoid the suspicion that much is vague and uncertain, and that the interpretations may sometimes ascribe to these apparently meaningless songs a significance which reflects modern romantic conceptions alien to the spirit of the early singers. Throughout the whole drama the themes are essentially religious. The chief deity invoked is Laka, the impersonation of the powers of vegetation, who is addressed in special hymns and worshipped at an altar adorned with leaves and flowers of those plants which are believed to be specially acceptable to the goddess, because they are the forms in which she prefers to manifest herself. With her are invoked the spirits of the wood, which resemble the fairies of Europe, Pele, the goddess of the volcano, and her sister, Kapo, who, like the Mother goddesses in other parts of the world, assumes a dual form—benevolent as a sylvan deity, chthonic or lewd, the latter phase being only occasional.

As Mr. A. Lang has pointed out, the mysteries of Greece

Woman playing on the Nose-flute (Ohe-hano-ihu).

can best be interpreted on the analogy of rites among savage or semi-savage races. The Hula accordingly presents notable resemblances to the Greek Eleusinia and similar celebrations. The performers are carefully selected; they must observe stringent purity tabus, sexual license being prohibited; they are kept in a special enclosure, which they must never leave except with muffled heads, and they must engage in no conversation beyond its limits; above all things, they must avoid contact with a corpse. As the Greek hierophant proclaimed, "Ye mystae, to the sea!" in Hawaii the performers rush into the ocean, going and returning in a state of nudity; there is a pass-word of admission, a prayer at the beginning and end of each performance, and a special supplication for the removal of tabu; a ritual dress, modelled on the primitive fig-leaf. Finally, the central act of the rite is a form of sacrament. A cooked pig is brought into the assembly, and the hierophant, acting as carver, "selects the typical parts—snout, ear-tips, tail, feet, portions of the vital organs, especially the brain (*lolo*). This last it is which gives its name to the ceremony. He sets an equal portion before each novitiate. Each one must eat all that is laid before him. It is a mystical rite, a sacrament; as he eats he consciously partakes of the virtue of the goddess that is transmitted to himself."

The Hula assumes various forms. A special type is assigned to each instrument—the drum, the gourd rattle, the bamboo rattle, a kind of xylophone, pebble castanets, a hollow bamboo beaten on the ground, a jew's harp, and that remarkable instrument the nose-flute. Others include the use of marionettes, or mimetic delineations of animals, as the shark and dog dances.

On the whole, this elaborate study of a primitive folk-drama is interesting from many points of view—as a description of savage music recorded in the recognised notation; as throwing fresh light on the problem of the mysteries; as a new conception of folk-poetry, with its sensuous, enigmatic lyrics. Lastly, it throws novel light on the interpretation of the popular mythology and traditions. If we cannot always accept Dr. Emerson's interpretations of the materials which he has collected, we can admire the industry and insight which appear throughout this volume.

PIGMENTATION AND CANCER.

DOES the absence of skin pigment predispose white men to cancer? This question has been answered in the affirmative in a paper[1] which has attracted some attention. The author, Dr. Watkins-Pitchford, adduces instances of the inverse ratio obtaining between the degree of pigmentation of the skin and of the body cavity, and explains that the external and internal pigmentations protect the tissues from excessive "irradiation" by actinic rays, of which the influence is assumed to be highly inimical to the life of the individual. More weight would have attached to his observations, in whatever bearing they have upon cancer, had the thickness of the body wall been considered in relation to the degree of internal pigmentation and the slight penetrating powers of many of the rays loosely called actinic.

"White man is of all animals the most liable to cancer" forms the postulate from which the author elaborates his views. This is an old dogma which is by no means universally accepted as true, and for certain individual organs is now proven to be false. For example, cancer of the mamma is probably as frequent in Indian hospitals as it is in London, and it is as common in the mouse as it is in the human female. It certainly occurs in the native African negress more frequently than was formerly supposed. However, the author brings this first postulate into line with his second, "the absence of effective pigmentation, or other form of external protection, in white man is the primary cause of his liability to cancer"; the same holds for domesticated animals. The liability to cancer should therefore be found increasing in proportion as pigmentation is decreasing, and the true albino of any species, man included, should display the greatest liability of all. A table is given to illustrate the scale of liability of black, brown, red, yellow, and white races of man by estimations of "probable" cancer death-rates for Zulus, Tamils, Red Indians, Chinese, Italians, English, Dutch, and Swedes. The figures can be definitely stated to be worthless for purposes of comparison. Those for the Chinese in the United States are meant to show the intermediate incidence of cancer in the yellow race; but why not have chosen the Japanese, who have relatively excellent national statistics showing more than 25,000 deaths annually, and who admit that this number is far short of the total, which would represent a death-rate probably not less than in England? The Italian figures presumably represent "brown" man, but the Italian national statistics are among the worst in Europe, and cannot be compared with English statistics. The table merely gives a list of increasingly worthless figures and correspondingly untrustworthy records of the occurrence of cancer. The argument would, however, break down for another reason—by its failure to explain the frequency of cancer in the negroes of America as contrasted with its real or apparent infrequency in Africa.

[1] "Light, Pigmentation and New-growth, being an Essay on the Genesis of Cancer." By Dr. Wilfred Watkins-Pitchford. Pp. 150. Read at the South African Medical Congress, Durban, August 2, 1909.

The general application of an inverse relation between degree of pigmentation and liability to cancer cannot be maintained, and it fails equally when applied to explain the varying incidence of the disease in different anatomical sites of the body. For carcinoma of the breast, the argument is much as follows. The woman of the white variety of mankind stands erect with her mammæ projecting, and fully exposed to direct solar irradiation; she has no pigment or hair to aid her delicate, translucent skin in protecting the glandular epithelium lying immediately beneath the surface. She covers her bosom with a single garment—the flimsiest of white silk blouses. The man, in addition to wearing shirt and underclothing, protects his chest from irradiation by coat and waistcoat of dense cloth and of dark colour. Hence there are 100 cases of cancer of the breast in the woman to one in the man. The differences between the male and female, and between the mammary glands in the two sexes, are not of the subordinate importance assigned to them in determining the onset of cancer. They are of primordial importance, since the difference between the male and female obtains for all species liable to carcinoma mammæ.

The frequency of this form of cancer in the woman requires to be considered, almost certainly, from totally different points of view. Not only do the sites of predilection vary from one class of vertebrate to another, but, if the Mammalia themselves be considered, some species are very liable to cancer of certain organs from which others, even nearly allied, are relatively or altogether exempt, as illustrated, *e.g.*, by the variations in the frequency with which the mamma is attacked. The liability of the woman is merely a peculiarity shared, *e.g.*, with the female of the mouse and dog, whereas in other domesticated mammals, *e.g.* in the cow, cancer of the mamma is practically unknown. Equal degrees of "irradiation" will not harmonise the parallel liability of the woman and the female wild mouse to cancer of the mamma, nor will differences in "irradiation" explain the exemption of the cow and the proneness of the tame albino and the wild grey mouse to this form of the disease.

These specific differences in liability depend in part, at any rate, on something more than external conditions. Under very divergent conditions, as regards habits (exposure to daylight), environment, and food, the incidence of cancer may be parallel, as in the case of the tame and wild mouse. Therefore innate fundamental tendencies of much biological import cannot be dismissed by assuming that cancer occurs in the mamma of dogs because the abdomen is "irradiated" through sitting up when "begging," or in consequence of a too great fondness for lying before an open fire. Nor can the biological significance of the sites of predilection for cancer of the rectum and uterus in mankind be explained by their corresponding with the sites on which a full bladder focusses actinic rays! The assumption that organs which are dark red or brown in colour are less liable to cancer than organs of a lighter colour will not explain why primary carcinoma of the liver is more frequently recorded in cattle than in other domesticated mammals.

A real and grave increase in cancer is asserted to have occurred during the past fifty years, and the attempts to allay tendencies to public panic by soothing assurances to the contrary are stated to be a praiseworthy policy, but intentionally misleading. This is rather a grave charge to bring, without substantiation, against investigators who have as much claim to be taken seriously as has Dr. Watkins-Pitchford in his explanation of the increase he alleges, viz. that there has been a decline in the use of woollen garments during the past fifty years, a change in the colour of the clothing worn, and that black broadcloth and black silk have ceased to be the clothing of respectable society, except the clergy, who enjoy a "privilege of cloth," and with it a low cancer death-rate.

In short, the prevention of cancer is represented as a matter of effective protection against solar irradiation, to which white man, having lost his pigmented skin, exposes himself both blindly and nakedly; but, we pause to ask, How is it, then, that the black-coated mouse is as liable to cancer as is the albino? We wonder if the difference in the recorded frequency of cancer in black and white man is the result of imperfect opportunities for observing the disease in the former, and of the attainment of the cancer-age by a smaller relative number of individuals. We remember that the black man and woman are by no means exempt from cancer, and we regret that the drudgery of putting their opinions to a sufficient test is not undertaken personally by a large army of arm-chair speculators who essay to write on the nature, cause, prevention, and cure of cancer. This punishment should certainly be theirs.

E. F. B.

CHEST DEVELOPMENT IN BOYS IN NEW SOUTH WALES.

THE New South Wales branch of the British Science Guild has just circulated a report in which it states that a special sub-committee investigated a number of points in connection with the physical development of boys in New South Wales, and compared the results with those of other countries. It was found (1) that the average girth of English boys round the chest is roughly 3·6 inches more than that of boys in New South Wales at seventeen years of age; (2) Tasmanian boys have always measured rather more than New South Wales boys round the chest, and at the late age of sixteen or seventeen years they come approximately to the English average; (3) the chest growth of the New South Wales boy is at all ages much less than that of the Washington boy, viz. at nine years nearly 1 inch, at ten years more than 1 inch, between thirteen and fifteen years 1½ inches or more; (4) as a result of this the lung capacity of New South Wales boys averages at all ages much less than that of the American boys, and the deficiency varies from 500 c.c. at nine years of age to 625 c.c. or more at seventeen years.

The committee found it difficult to give a complete estimate of the causes of this devitalising condition, the factors at its disposal being too indeterminate, but the suggestion is offered that the habit of the young Australian of leaning against lamp-posts and door-posts, or the difficulty with which he can be got to walk for an outing so long as there is a conveyance to be had, or his inveterate custom of supporting the games of cricket and football by leaning across a fence or resting his form upon a shaded bench while he bets upon the odds or barracks more or less enthusiastically, have to be considered in this connection.

The executive council of the Guild at Sydney passed the following recommendations:—(1) that the attention of the Government and municipal councils be drawn to the supreme importance of providing areas specially set apart and adapted for the purpose of healthy games, it being understood that such areas should be left bare of trees and flowers, save on borders, and should be provided with running tracks and facilities for cricket, football, lacrosse, basket-ball, and similar games; (2) that as the principle of taxing the unimproved value of land is a direct discouragement to schools to provide such areas, representation should accordingly be made to the Government and to municipal councils to allow some substantial concessions to all *bona fide* schools providing adequate playgrounds, such playgrounds being, like parks, really a guarantee of the people's health.

THE ADMINISTRATION OF ANÆSTHETICS.

THE report recently presented to Parliament concerning deaths resulting from the administration of anæsthetics (Cd. 5111, price 1*d*.) touches upon a matter of grave public interest, in which expert medical opinion and questions of pure science and the common sense of the intelligent "man in the street" alike contribute. We may say at once that the report appears to us to be of high value; it recognises a danger that for many years past has weighed very seriously upon the minds of those who know the danger, namely, of sudden death during the administration of chloroform, and it ends by recommending towards the remedy of this danger that a small standing committee or commission should be appointed to deal with the subject under the control of the Home Office.

The body of the report, although offering, no doubt, points open to criticism by individual authorities, is, on the

whole, unexceptionable as an expression of the resultant opinion received from many different sources. It is recognised at the outset that a "certain number" of deaths are due to preventable causes, and that a "certain number" of deaths are inevitable, which obviously signifies that the actual numbers of preventable and inevitable deaths are quite undetermined. One of the first services to be expected from a standing committee of experts would be information as to the relative proportions between these two classes of deaths. Idiosyncrasy as a factor cannot be eliminated. Anæsthetics, like all other poisonous drugs, act differently on different constitutions. Alcohol in known quantity does not necessarily produce identical effects upon different persons, but, as regards chloroform, ether, and other poisons, before we are entitled to appeal to idiosyncrasy we require to know what quantity of any one of these poisons may have been actually administered. Such information might usefully be acquired at small cost by a standing committee of the Home Office, and made available to the medical profession and to the intelligent laity in a convenient form.

The use of anæsthetics "of longer duration," inclusive, presumably, of chloroform, for the purposes of minor surgery, including dentistry, is considered in paragraphs 9 and 10 of the report. Although evidence was offered on behalf of the Incorporated Society of Extractors and Adaptors of Teeth to the effect that there had been 1,249,167 administrations of general anæsthetics by members of the society with only one fatal accident, the committee is of opinion that the administration of those anæsthetics the effect of which is of prolonged duration should be confined to qualified medical men.

The report is almost precisely on lines recommended by the General Medical Council in that it urges the need of legislation, that it recognises the necessity of limiting the administration of general anæsthetics to *qualified* medical and dental practitioners, and of prohibiting single-handed anæsthetising and operating.

There is no doubt that this report may prove to be the initial point leading to the acquisition of much useful knowledge and to greatly increased safety in the increasing number of cases where, thanks to Lord Lister and to the system of aseptic surgery, operations are possible, and anæsthetics therefore required. In the words of the report, there is need yet for much careful clinical observation, controlled, if necessary, by physiological experiments.

METRIC MEASURES.

THE Decimal Association has recently issued a circular on the progress of the metric system of weights and measures in this country, and also two papers written by Mr. Aldred F. Barker, director of textile industries at the Bradford Technical College, advocating the adoption of the metric system in the textile trade. It appears from the circular that the total number of metric weights and measures verified in the United Kingdom during the year ended March 31, 1909, was 8797. As this was the first year in which the obligation upon local authorities to distinguish between metric and imperial weights and measures in their returns to the Board of Trade was enforced, comparisons of this total with the totals for previous years, as furnished in the returns, would necessarily be misleading; but it is evident that the metric system is making steady headway here. Of the weights and measures verified and stamped in this country during the year in question, 1 in 1280 belonged to that system. Opponents of the metric system have an axiom to the effect that, whatever its merits, its compulsory introduction would be absolutely disastrous to the great textile industry. Mr. Barker's papers form a highly technical refutation of this axiom. He shows that the metric system could be adopted by the industry with a minimum of inconvenience, and that it would afford a more methodical and practical basis for those mysterious lists and tables which are to the textile trade what the Nautical Almanac is to the astronomer.

Mr. L. J. Spencer, of the Mineral Department, British Museum, has contributed to the March number of the *Mineralogical Magazine* an interesting paper on the weight of the "Cullinan" diamond, and on the value of the carat weight. He directs attention to the discordant values given by various authorities for the weight of the "Cullinan" diamond expressed in carats, and points out that the adoption of an international standard carat would be the best means of preventing such discrepancies in estimations of the weights of precious stones. The "metric carat" of 200 milligrams, the adoption of which was advocated by the International Conference on Weights and Measures in 1907 as a universal standard, has met with considerable support abroad, but diamond dealers in this country are not at present disposed to abandon their time-honoured but diverse-valued carat of about 3½ troy or avoirdupois grains, the various equivalents adopted for which by different firms do not appear to cause much inconvenience to the trade. In these circumstances, only the exclusive adoption of the metric carat by all the more important foreign States would render official action possible towards its legal recognition or compulsory adoption in the United Kingdom.

FUNGAL STUDIES.

MR. C. L. MOORE has followed up his studies of the Myxomycetes of Picton County in Nova Scotia, by a short account of some Nova Scotian aquatic fungi referred to the species Saprolegnia, Achyla, Aphanomyces, Leptomitus, and Sapromyces. The paper, which is published in the Transactions of the Nova Scotian Institute of Science (vol. xii., part iii.), contains figures and descriptions of the antheridia and oogonia for most of the species.

An important contribution to the literature on the Mycetozoa is provided by the list of species from Ceylon compiled by Mr. T. Petch, which is published in the Annals of the Royal Botanic Gardens, Peradeniya (vol. iv., part vi.). The list enumerates 102 species, the majority of which are also found in Europe; *Alwisia bombarda* and *Erionema aureum* are two tropical species recorded from the wet country. The commonest species are *Didymium effusum*, *Physarella mirabilis*, and *Hemitrichia clavata*. Physarella may be said to invade the laboratory, where it develops on logs kept for growing other fungi. Mr. Petch notes that there is a greater tendency for the plasmodium to wander than in Europe, which he ascribes to the greater rainfall and humidity. *Stemonitis herbatica*, Physarella, and *Didymium effusum* have been gathered, from the crowns of palm trees, 20 feet from the ground; *Perichaena chrysosperma* frequently ascends to a height of 50 feet on Bombax trees.

Mr. Petch has also prepared a second part of his revisions of Ceylon fungi, which appears in the same number of the Annals. As a result of the examination of fresh specimens, a number of specific names have been reduced to synonyms. It is noted that certain characters generally regarded as specific may sometimes be merely variations due to weather. Thus the white gills of *Lepiota Zeylanica* in showery weather pass through a yellow stage before changing to red, whereas in fine weather the yellow stage is not evident. Again, the stipe of *Lepiota pyrrhaes*, which ordinarily bears an annulus and scales, appears smooth and ringless when grown in a saturated atmosphere. With reference to the genus Auricularia, the author offers several reasons for recognising two species, *Hirneola polytricha* and *Auricularia tremellosa*, both distinct from the common European species *Auricularia auricula judae*.

The October (1909) number (vol. cxviii., part viii.) of the *Sitzungsberichte der Kaiserlichen Akademie der Wissenschaften*, Vienna, is entirely devoted to botany. Prof. von Höhnel contributes a further set of notes on Javanese fungi. He creates a new genus, Treubiomyces, for a fungus (Nectriaceæ) collected on leaves of *Ficus elastica*, which bears rough patches of clustered hyphæ surmounted by long hairs. Another fungus, *Limaculina samoensis*, taken on the same host, is characterised by a perithecium raised on an under layer of hyphæ, the *subiculum*, which bears short round cells and stellate spores. In the same number Dr. P. Fröschel communicates a short paper on the latent period in heliotropic experiments, in which he

confirms the results of Blaauw that the light of a mercury vapour lamp or direct sunlight acting for a period of 1/2000th second is sufficient to produce a stimulus. Mr. F. Kölbl, describing his experiments on the heliotropic sensibility of woody plants, notes that shrubs are more sensitive than trees.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—Honorary degrees will be conferred this term upon Sir Oliver Lodge, F.R.S., principal of the University of Birmingham, and Prof. W. H. Perkin, F.R.S., professor of organic chemistry in the Victoria University of Manchester.

Mr. K. J. J. Mackenzie has been appointed university lecturer in agriculture for five years as from January 1, 1910.

Dr. T. Percy Nunn, vice-principal of the London Day Training College, will give a lecture on psychology and some problems of education on Friday, May 13, at Gonville and Caius College. The lecture will be open to all interested in the subject.

OXFORD.—The Romanes lecture for 1910 will be delivered in the Sheldonian Theatre on Wednesday, May 18, at 2.30 p.m., by the Hon. Theodore Roosevelt, ex-President of the United States of America. The subject chosen by Mr. Roosevelt is "Biological Analogies in History." Lord Curzon of Kedleston, Chancellor of the University, will preside.

The first Halley lecture, established "in honour and memory of Edmund Halley (sometime Savilian professor of geometry in the University and Astronomer Royal) in connection with his important contributions to cometary astronomy and to our knowledge of the magnetism of the earth," will be delivered on Tuesday, May 10, at 5.30 p.m., in the University Museum, by the founder, Dr. Henry Wilde, F.R.S. The title of the lecture is "On Celestial Ejectamenta."

DR. E. J. GODDARD, Linnean Macleay fellow in zoology, Sydney, has been appointed by the council of Stellenbosch College, South Africa, to the chair of zoology and geology in succession to Prof. R. Broom.

THE thirty-seventh annual dinner of old students of the Royal School of Mines will be held on Thursday, May 26, at the Hotel Cecil. The chair will be taken by Sir Thomas H. Holland, K.C.I.E., F.R.S.

A COURSE of eight lectures on "The Chief Animal and Vegetable Pigments" will be delivered in the Physiological Institute (University College) of the University of London on Fridays during May and June, commencing on Friday, May 6, by Dr. S. B. Schryver. The lectures are open to all students of the University, and also to all qualified medical men and other persons who are specially admitted.

IN an article in the current number of the *Oxford and Cambridge Review*, Mr. John C. V. Bevan, formerly Rhodes scholar and fellow of University College, Oxford, combats a statement which has been circulated that there is no return to the countries which send Rhodes scholars to Oxford. It appears that, of eighty-two Americans, eighty-one have returned home, while one has accepted a university appointment in England. Of fifteen Germans, fourteen have returned to the Fatherland, and one has gone to America. Seventy-eight colonials have completed their tenure as Rhodes scholars; fifty-one have already returned to their colonies; twelve are completing a further course of study before they return; three have obtained appointments in India; two in colonies other than their own; two in foreign countries; one is temporarily engaged in parochial work in this country; four have accepted teaching posts in English universities, but are hoping to secure professorial appointments in their own colonies; three only have decided definitely to settle in England.

A REPORT as to the disposal of the balance of the grant to university colleges of 100,000*l.* for 1909–10, and as to changes in the list of participating colleges, has been sent to the Treasury by the advisory committee on the grants. The report, together with Treasury Minutes thereon, has been printed and circulated as a Parliamentary Paper (110). The committee has already recommended the payment to the recognised colleges of general grants for the year 1909–10 on the same basis as in the two preceding years, and it now recommends the payment of further grants to thirteen colleges, varying in amount from 2000*l.* to Victoria University, Manchester, to 500*l.* to University College, Reading. The committee has had under consideration whether any new colleges should be added to the list of those which participate in the Treasury grants. Special attention has been given to the claims of Hartley College, Southampton; Royal Albert Memorial College, Exeter; East London College; and Birkbeck College, London. The committee recommends in regard to Hartley College, Southampton, that it shall not remain permanently on the list of university colleges in receipt of Treasury grants, and that its grant, reduced to 1500*l.*, shall be continued for the year ending March 31, 1911, but no longer. The committee has felt unable to recommend the award of a Treasury grant to the Royal Albert Memorial College, Exeter, and Birkbeck College. It recommends, however, that the East London College be awarded a grant subject to conditions set forth in the report, and will consider at what amount the grant for the quinquennium beginning with the year 1910–11 shall be fixed. The Treasury has concurred in the committee's recommendations, and will give effect to them.

Two fellowships, to be known as the "A.K. Travelling Fellowships," are to be established in the British Isles by M. Albert Kahn, of Paris, for the purpose of providing selected persons with *bourses de voyage* to enable them to travel in foreign countries. Each fellowship is to be of the value of 660*l.* This sum is to be expended by each fellow as to 600*l.* in defraying his travelling expenses, and as to 60*l.* in the purchase of books and souvenirs. The only condition which each fellow is required to fulfil is that he shall, at the expiration of his fellowship, prepare a report containing his impression of the countries he has visited. It is the desire of the founder that these travels shall be used as an opportunity of acquiring knowledge and experience which will be of use to the fellows in their future careers as teachers, scholars, or investigators. M. Kahn has arranged that his intentions shall be carried out by a board of trustees, consisting, in the first instance, of the Lord Chancellor, the Lord Chief Justice, the Speaker of the House of Commons, the principal of the University of London, Lord Avebury as nominee of the founder, and a sixth person to be elected by the other trustees. From an article in the *Times* it appears that the trust is to be associated permanently with the University of London, and this has been carried into effect by the principal of that University being appointed as one of the trustees. He will also act as the honorary secretary to the trust, and the office through which the trust will be administered will be in the University building. The trustees have been instructed to invite nominations from the Vice-Chancellor or other executive head of each of the universities in the United Kingdom, from the president of the Royal Society, and from the president of the British Academy, although they are not required to confine their election to the persons so nominated.

LAST September Dr. A. D. Waller, F.R.S., delivered an address to the University of California, and the substance of it is published in the current issue of *Science Progress* as an article entitled "The University of London and an Imperial Institute of Science." Dr. Waller directed attention to the immediate future of the University and to some of the first principles that determine the healthy university in the healthy community. Incidentally, he pointed out that it is upon the combination between teaching and research, and not upon their separation, that the intellectual welfare of a community and of an individual depends. The best guide to any district of knowledge is the man who has been there himself as an explorer or as a pioneer. Discussing university research fellowships, he maintains that no condition of life is more enviable than that of a keen-brained man during the best ten years of intellectual life, from, say, the age of twenty-five to that of thirty-five, in receipt of a salary of 200*l.* for teaching during half the week and of a fellowship of 200*l.* for "researching" during the other half. Under such conditions of life the return

in teaching power will repay the outlay in money, and that from among the workers thus supported the exceptional man will be far more likely to emerge than is the case now. The practical measures by which it is possible to give effect to this dual principle in London are such as would at the same time constitute an intercollegiate bond of union formed by the university between its colleges, schools, and institutions through its faculties and boards of studies. The formation of this bond of union should consist in the foundation of an Imperial Institute of Science and Learning, of which the present Imperial Institute building should be the home and headquarters, and its *personnel* select panels of university research fellows. Such panels should consist of professors, recognised and probationary teachers, and other distinguished persons in London, in the United Kingdom, and in His Majesty's Dominions beyond the Seas, selected and nominated by boards of the faculties appointed by the university.

SOCIETIES AND ACADEMIES.

LONDON.

Royal Society, April 28.—Sir Archibald Geikie, K.C.B., president, in the chair.—R. B. **Sangster**: The rotatory character of some terrestrial magnetic disturbances at Greenwich and on their diurnal distribution. The paper commences with an investigation of the changes in direction of the line of total magnetic force at Greenwich on 1903 October 12d. 18h. to 23h., when a considerable magnetic disturbance was in evidence. Measurements of the published registers of all three force components were made at equivalent time intervals of about five minutes, whence is obtained a diagram showing the variation of the force component perpendicular to the line of total force. The diagram shows there was an almost wholly rotatory motion of the transverse disturbance vector, the trace consisting of six distinct convolutions varying greatly in size, but consistent in anticlockwise progression. Several other disturbances during epoch 1900–7 are examined in detail, and it is shown that a right- or left-handed rotatory character in the motion of the disturbance vector was of fairly frequent occurrence, while change from left to right not uncommonly occurred about midnight. It was also found that the same direction of rotation often persisted for several hours, and tables of the diurnal distribution of right- and left-hand rotatory disturbance are furnished to show that those of right-hand character were entirely absent during the hours 4 p.m. to 9 p.m., while, meantime, the left-handed rotations were very prevalent, and reached a notable maximum at 8 p.m. Other points in the diurnal distribution are noted, including the more decided effect resulting from a seasonal grouping of the seventy disturbed days dealt with.—D. Orson **Wood**: The liberation of helium from minerals by the action of heat. Experiments were made to determine how the volume of helium liberated from radio-active minerals by the action of heat depends on the temperature, and on the time for which that temperature is maintained, in particular with the view of the future use of heat to release all the helium contained in minerals not easily treated by chemical methods. The minerals experimented on were monazite and thorianite, the one comparatively poor and the other very rich in helium. The ground minerals were heated, *in vacuo*, in tubes of Jena glass or quartz, by an electric heater consisting of a single coil of nickel wire, to temperatures up to 1200° C., which were measured by a Pt resistance thermometer or a Pt Pt-Rh thermocouple. The gas released was purified by drawing it through KOH and P_2O_5 tubes, and finally by Na–K electrodes. The volume was measured in a modified McLeod gauge (described by Prof. Strutt, Proceedings, vol. lxxx.) specially constructed for the measurement of volumes over a large range—1 c.c. to 1 c.mm. Curves are given to show the volume of helium liberated with time at constant temperatures (250°–1000° C.), and also the percentage of the total content obtainable after prolonged heating at the different temperatures. The way in which the gas must be supposed to be retained within the mineral to accord with the results obtained is discussed, and it is concluded (1) that heat may be used for the complete liberation of the gas if a sufficiently high temperature (about 900° C.) is reached, and (2) that the results are in agreement with the supposition that a small proportion of the gas is diffused through the mineral and that the remainder is concentrated in very minute cavities within it.—Prof. Swale **Vincent**: The chromophil tissues and the adrenal medulla. The author gives an account of the gross anatomy and histology of the chromophil tissues in mammals, and especially in the dog. Descriptions and drawings of the groups of cells in the sympathetic ganglia and of the chromophil bodies in other regions are furnished, and comparisons are made between their structure and that of the adrenal medulla. An extract of the abdominal chromophil body of the dog has precisely the same powerful effect upon the blood pressure as an extract made from the medulla of the adrenal. There seems no reason why one cannot admit the hypothesis that all the chromophil cells have an internal secretion, though this process is more completely elaborated in the larger chromophil bodies and in the adrenal medulla.

Royal Anthropological Institute, April 12.—Sir Herbert Risley, K.C.I.E., president, in the chair.—S. Hazzledine **Warren**: Charcoal burning in Epping Forest. The industry was carried on near Chingford in 1908 and 1909, but has since been given up. The structure of the burners' hut was quite on prehistoric lines. The technical terms used by the burners are also survivals, many of them being Anglo-Saxon or French.—N. F. **Robarts** and H. C. **Collyer**: Additional notes on the British camp at Wallington. The authors described the excavations made when buildings were being erected on the site of the camp, no vestige of which was apparent until the ditch of the camp was cut through in the course of digging foundations, the whole area having at some time been levelled for cultivation. Numerous objects were exhibited which had been recovered from the ditch, including stone implements, mealing stones, loom weights, spindle whorls, and large quantities of pottery, including drinking cups and cooking pots, some of which contained charred grain. Some traces of bronze were found, including a bronze fibula, pointing to the date of the camp having been of early Iron age, possibly about 50 B.C. Some of the stone implements were considered to be of foreign manufacture, and although most of the pottery was very coarse, and probably made locally, a portion of it was evidently imported from Gaul. Particular attention was directed to some perforated tiles, which had apparently been used as "grids," one actually having been found lying near a cooking pot upon a hearth at the bottom of the ditch. Similar tiles had not previously been found in Great Britain. An amber bead showed probable intercourse with Scandinavia. In the ditch itself there was no trace of Roman or Romano-British pottery, although a small quantity of such ware was found in the humus which lay above the original land surface, and which had been washed or carried down by the plough from the higher ground. The authors considered that the camp had been destroyed or abandoned about the time of the Roman entry into London. The camp, which covered several acres, had apparently held a considerable population, which practised weaving and the potter's art, cultivated grain, and possessed, or at all events consumed, the ox and horse, the bones of which were associated with those of boar and wolf or dog.

Royal Meteorological Society, April 20.—Mr. H. Mellish, president, in the chair.—R. G. K. **Lempfert** and R. **Corless**: Line squalls and associated phenomena. A line squall is usually associated with the displacement of an air current moving from south-west by a colder current from north-west. The authors investigated the phenomena associated with several well-marked line squalls, and showed by maps with isochronous lines the direction of front and the rate of advance of the various storms across the country.

Linnean Society, April 21.—Dr. D. H. Scott, F.R.S., president, in the chair.—Miss M. G. **Sykes**: The anatomy of *Welwitschia mirabilis* in the seedling and adult stages. The development of the ridges bearing inflorescences has been studied. On the whole, the investigation has served further to confirm the impression of the aberrant nature of the plant; it may, indeed, be described as an "adult seedling."—Prof. P. **Stein**: Die von Mr. Hugh Scott im

Juli 1908–März 1909 auf den Seychellen gesammelten Anthomyidæ, mit den Gattungen Rhinia und Idiella.—Dr. Malcolm **Burr**: The Dermaptera of the Seychelles.—Dr. J. J. **Tesch**: The Pteropoda and Heteropoda collected by the Percy Sladen Trust Expedition in the Indian Ocean.—Dr. G. **Enderlein**: Die pilzmücken Fauna der Seychellen.

Mathematical Society, April 28.—Sir W. D. Niven, president, in the chair.—Dr. W. F. **Sheppard**: The accuracy of interpolation by finite differences (second paper).—G. H. **Hardy**: Theorems connected with Maclaurin's test for the convergence of series.—Lieut.-Colonel A. **Cunningham**: Two notes on the theory of numbers, (i) the factorisation of $2^{77}+1$; (2) the indivisibility of $2^{p}-2$ by p^{2}, p being prime.

PARIS.

Academy of Sciences, April 18.—M. Émile Picard in the the chair.—The perpetual secretary announced the death of Julius Kühn, correspondant for the section of rural economy.—Arthur R. **Hinks**: The solar parallax deduced from micrometric observations of Eros made in 1900 and 1901. The final result of the micrometric observations is $\pi=8{\cdot}806''\pm0{\cdot}004''$. The results obtained by the method of passages are less exact.—M. **Giacobini**: Halley's comet. The comet was observed on April 17 at the Paris Observatory. Its present magnitude is between 2 and 2·5. The head of the comet is a circular nebulosity $30''$ to $35''$ in diameter, with a strong central nucleus, and no tail could be distinguished.—M. **Tzitzéica**: A new class of surfaces.—A. **Blondel**: The linear functional equation.—A. **Petot**: The mode of action of driving wheels.—C. E. **Guye** and H. **Schapper**: The internal friction of metals at low temperatures. The metals examined were copper, zinc, gold, nickel, palladium, and platinum, and the temperatures ranged from +100° C. to −195° C.—M. **Menneret**: The movements of a liquid in a tube. The damping of the oscillations of a liquid column in a **U**-tube follows two laws, according to the nature of the damping. Similar results are found in the uniform flow of a liquid in a rectilinear tube.—L. **Bloch**: Ionisation by the pulverisation of liquids.—MM. **de Broglie** and **Brizard**: Ionisation by bubbling and chemical reactions.—Louis **Dunoyer**: Concerning the formation of the kathode rays. In the production of the kathode rays the nature of the kathode is usually regarded as unimportant. An experiment is described in which the ordinary conditions of working are followed, and in which the nature of the kathode directly affects the phenomena obtained.—H. **Baubigny**: The constitution of the dithionates and sulphites. Dithionic acid is regarded as $HO_3.S—SO_3.H$, and sulphurous acid as $H.SO_3.H$, the evidence on which these formulæ are based being given.—E. **Fourneau**: The alkaloid of *Pseudocinchona africana* and its saponification by alkalies. The alkaloid of Pseudocinchona resembles yohimbine, and a comparative study of the two bases has therefore been made.—Marcel **Guerbet**: The constitution of the alcohols resulting from the condensation of the secondary alcohols, with their sodium derivatives. The oxidation products of the condensation product from capryl alcohol have been examined, and lead to the view that the alcohol is

$$CH_3.(CH_2)_5.CH(CH_3).CH_2.CH(OH).(CH_2)_5.CH_3.$$

—A. **Berg**: The action of silver oxide upon elaterine. The chief product of the reaction is a quinone, named elateridoquinone, acetic acid being also formed.—E. **Léger**: Aloinose, a sugar from aloin.—Léon **Brunel**: Cyclohexanetriols and their derivatives.—L. **Blaringhem** and Paul **Viguier**: A new species of shepherd's purse (*Capsella Viguieri*) produced by mutation.—Silvanus P. **Thompson**: The physiological effects produced by an alternating magnetic field. On placing the head inside a bobbin carrying an alternating current (field 1400 C.G.S. units) and closing the eyes, the effect of a feeble vacillating light is produced, the period of the fluctuation not being well defined.—A. **d'Arsonval**: Remarks on the preceding note by Silvanus P. Thompson. The phenomena noted have been known to physiologists since 1893.—Ch. **Dhéré** and M. **Gorgolewski**: A method of preparing a serum very free from electrolytes by electrical dialysis. By electrical dialysis the conductivity of the serum was reduced to one-twelfth of its original amount. The purified serum was very readily precipitated by the addition of small amounts of alcohol; the temperature of coagulation was much lower for the purified product.—E. **Bataillon**: Complete embryogenesis produced in Amphibia by the puncture of the virgin egg. The eggs of *Rana fusca* were punctured with a short stylet of glass, manganin, or platinum, the size of the hole being from 0·03 to 0·08 mm. Segmentation started in the treated eggs as rapidly as in eggs impregnated in the ordinary way. A dozen free larvæ resulted from nine sets of operations.—J. **Bridré** and L. **Nègre**: The nature of the parasite of epizootic lymphangitis. The experiments described favour the hypothesis of the blastomycelian nature of the parasite.—E. **Lesné**, R. **Debré**, and G. **Simon**: The presence of virulent germs in the atmosphere of hospital wards. Diphtheria bacilli were proved to be present in the air of the diphtheria wards.—F. **Garrigou**: A rapid and certain method for recognising in a mineral water the presence of metalloids and metals.

April 25.—M. Émile Picard in the chair.—H. **Deslandres**: The distribution of the filaments in the upper layer of the solar atmosphere. The observations taken at the Meudon Observatory now include photographs of the upper layer for twenty rotations with the calcium line and fourteen with hydrogen. The observations are discussed in detail, and four diagrams given showing the filaments on May 20, June 15, November 27, 1909, and April 11, 1910. The observations may throw light on the distribution and special variations of the protuberances, at the present time not regarded as connected with any other solar phenomena.—A. **Haller** and A. **Lassieur**: Study of by-products from cocoa-nut oil. The composition of essence of cocoa. In the purification of commercial cocoa-nut oil by treatment with superheated steam a distillate is obtained smelling strongly of oil of rue. From this mixture a ketone, $C_{11}H_{22}O$, has been isolated. The oxime and semicarbazone are described, and the oxidation products studied. The ketone was shown to be normal methylnonyl ketone. Methylheptylketone was also obtained from the fractions of the crude oil.—C. Eg. **Bertrand** and F. **Cornaille**: The characteristics of the botryopteridian leaf trace.—Ch. **André**: The effect produced on hailstorms by the hail cannon. A statistical study of the effect of hail cannon. Comparing the damage done by hail over the years 1901 to 1908, and the number of hail cannon installed during that time, the conclusion is drawn that no practical service is rendered by the cannon.—P. **Lowell**: A new method of planetary photography employed at the Lowell Observatory at Flagstaff, Arizona. The method was devised by Lampland, and improved by E. C. Slipher. A special screen is used in association with suitable plates, so that the yellow rays near the D lines are the only ones to act on the plate. Details of the results obtained with Jupiter and Saturn are given.—C. **Russyan**: The integration of a system of partial differential equations of the first order by the generalised method of Jacobi.—Joseph **Marty**: The existence of singular solutions for certain equations of Fredholm.—Michel **Fekete**: The series of Dirichlet.—M. **Ouivet**: An application of birational transformations.—H. **Vergne**: The canonical changes of variables.—B. **Galitzine**: The precision of apparatus serving to study the vibration of buildings. In the immediate neighbourhood of a Diesel motor the vertical vibrations predominate, but in a building some distance away both the vertical and horizontal movements are of the same order of magnitude. The vibrations are greater in the higher storeys of a building than in the lower.—U. **Schoop**: A new principle of depositing metals. The fused metal is turned into a fine dust and projected on to the surface to be covered by means of an indifferent gas, hydrogen or nitrogen, under high pressure. A sort of metallic fog is produced, which, in spite of the high temperature of the fused metal, has usually a temperature of between 10° C. and 60° C. Tin, lead, copper, and aluminium alloy, all of which are very fluid when fused, can be deposited on wood, glass, metal, and other surfaces, the thickness of the deposit being completely under control.—C. **Chéneveau**: A simple arrangement for measuring a magnetic field. A differential manometer containing a paramagnetic liquid (an aqueous solution containing 30 per cent. of manganese sulphate) and a diamagnetic liquid of approximately the same density not miscible with the first

(a mixture of benzene and carbon tetrachloride) is placed in the magnetic field the strength of which is to be measured. The boundary meniscus of the two fluids is displaced in the field and is brought back to the original position fixed by a cross-wire in a microscope by the compression of an air bulb. The pressure required to do this is measured on a separate differential manometer. A field of 2800 units gave a reading in the manometer of 65 mm. —P. **Vaillant**: A law of Stefan relating to evaporation. —H. **Ollivier**: The spontaneous re-magnetisation of iron. —P. **Pascal**: The measurement of the magnetic susceptibilities of solid bodies. The solid is placed in a thin glass tube in the magnetic field suspended from the arm of a sensitive balance. By replacing the solid by water a formula is derived giving the magnetic susceptibility independent of the nature and dimensions of the apparatus. —M. **Pariselle**: The ethyl ether of allylcarbinol. This substance has been obtained by the interaction of allylmagnesium bromide and monochlor-methyl-ethyl ether. The products obtained by the addition of bromine and hypochlorous acid have been studied.—Mlle. Pauline **Lucas**: The action of organomagnesium derivatives on the trialkylacetophenones.—Marcel **Delépine**: The essence from *Crithmum maritimum*.—J. **Bertheaume**: The chlorplatinates and periodides of dimethylamine and trimethylamine: their use for the separation of these bases. Determinations of the solubilities of the chlorplatinates of these two bases showed that the differences were too slight to be used as a basis of separation. The method of separation proposed by Weiss, based on the differences of solubility of the periodides, proved to be equally unsatisfactory. —H. **Agulhon**: The influence of the reaction of the medium on the formation of melanines by diastatic oxidation.—J. **Chevalier**: Variation in the amount of sparteine in the plant according to the period of its vegetation.—Léon **Marret**: The presence of Alpine plants at low altitudes in the central Valais.—J. **Beauverie**: The Ambrosia of *Tomicus dispar*.—H. **Colin** and J. **de Rufz**: The absorption of barium by plants. The barium absorbed by plants was found to be localised in the roots.—Gabriel **Vallet**: The sterilisation of large quantities of water by means of the ultra-violet rays. A water polluted with coli bacilli was exposed to ultra-violet light produced by the expenditure of 0·4 kilowatt-hour in a quartz mercury vapour lamp. The water was passed at the rate of 10 cubic metres per hour, and the conditions for complete sterilisation are laid down.—E. **Sauvage**: The abdominal part of the great sympathetic in Saurians.—A. **Ricco**: The eruption of Etna of March 28, 1910.—L. **Joleaud**: The evolution of Quaternary hydrography in the Constantine region, Algeria.—Albert **Nodon**: Researches on the ionisation of the hot spring of the thermal waters of Hammam-Salahin, near Biskra.

DIARY OF SOCIETIES.

THURSDAY, MAY 5.

ROYAL SOCIETY, at 4.30.—The Development of Trypanosomes in Tsetse Flies: Col. Sir D. Bruce, C.B., F.R.S., Captains A. E. Hamerton and H. R. Bateman, R.A.M.C., and Captain F. P. Mackie, I.M.S.—On the Weight of Precipitate obtainable in Precipitin Interactions: Dr. H. G. Chapman.—The Absorption of Gases by Charcoal: Miss I. F. Homfray.

ROYAL INSTITUTION, at 3.—Blackfeet Indians in North America: Walter McClintock.

RÖNTGEN SOCIETY, at 8.15.—Quantitative Measurements of the Conversion of Kathode Rays into Röntgen Rays by Antikathodes of Different Metals: J. H. Gardiner.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—A Telephone Relay: S. G. Brown.

LINNEAN SOCIETY, at 8.—Eight Months' Entomological Collecting in the Seychelles Islands: Hugh Scott.—The Anatomy of *Tipula maxima*: J. M. Brown.

FRIDAY, MAY 6.

ROYAL INSTITUTION, at 9.—Auto-inoculation: Sir Almroth E. Wright, F.R.S.

GEOLOGISTS' ASSOCIATION, at 8.—The History of the Study of Fossils: Dr. A. Smith Woodward, F.R.S.

SATURDAY, MAY 7.

ROYAL INSTITUTION, at 3.—The World of Plants before the Appearance of Flowers: Dr. D. H. Scott, F.R.S.

MONDAY, MAY 9.

ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—The Land of the Incas: Sir Clements R. Markham, K.C.B., F.R.S.

VICTORIA INSTITUTE, at 4.30.—Annual Address. Halley's Comet: Dr. A. C. D. Crommelin.

TUESDAY, MAY 10.

ROYAL INSTITUTION, at 3.—The Mechanism of the Human Voice: Prof. F. W. Mott, F.R.S.

WEDNESDAY, MAY 11.

ROYAL SOCIETY OF ARTS, at 8.—The Restoration and Discoveries at the Guildhall, London: S. Perks.

GEOLOGICAL SOCIETY, at 8.—Dedolomitization in the Marble of Port Shepstone, Natal: Dr. F. H. Hatch and R. H. Rastall.—Recumbent Folds in the Highland Schists: E. B. Bailey.

THURSDAY, MAY 12.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: The Influence of Bacterial Endotoxins on Phagocytosis (Preliminary Report): Leonard S. Dudgeon, P. N. Panton, and H. A. F. Wilson.—The Origin of Osmotic Effects. III. The Function of Hormones in Stimulating Enzymic Change in relation to Narcosis and the Phenomena of Degenerative and Regenerative Change in Living Structures: Prof. H. E. Armstrong, F.R.S., and E. Frankland Armstrong.—On the Direction of Motion of an Electron ejected from an Atom by Ultra-violet Light: Dr. R. D. Kleeman.

ROYAL INSTITUTION, at 3.—Blackfeet Indians in North America: Walter McClintock.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Street Lighting by Modern Electric Lamps: H. T. Harrison.

MATHEMATICAL SOCIETY, at 5.30.

FRIDAY, MAY 13.

ROYAL INSTITUTION, at 9.—Radio-activity as a Kinetic Theory of a Fourth State of Matter: Prof. W. H. Bragg, F.R.S.

ROYAL ASTRONOMICAL SOCIETY, at 5.

MALACOLOGICAL SOCIETY, at 8.—Mollusca of the *Porcupine* Expedition, Part IV.: E. A. Sykes.—The Genus Cremnobates, Swainson: C. Hedley and H. Suter.—Notes on Polyplacophora, chiefly Australasian, Part II.: T. Iredale.—Notes on and additions to the Terrestrial Molluscan Fauna of Southern Abyssinia: H. B. Preston.

SATURDAY, MAY 14.

ROYAL INSTITUTION, at 3.—The World of Plants before the Appearance of Flowers: Dr. D. H. Scott, F.R.S.

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