THURSDAY, MAY 26, 1910.

THE LAST DAYS OF CHARLES II.

The Last Days of Charles II. By Dr. Raymond Crawfurd. Pp. 80. (Oxford: Clarendon Press, 1909.) Price 5*s.* net.

CHARLES II. died at midday on Friday, February 6, 1685, at the age of fifty-three. His last illness seemed to his courtiers to begin on the morning of Monday, February 2, with an attack of convulsions. He was bled, and became conscious and able to speak; on Thursday had more convulsions, with intervals of consciousness, and on Friday morning, after an attack of breathlessness, gradually became insensible, and so died without further convulsion. His body was examined after death; the blood-vessels of the brain were found distended, there was an excess of serum in the cerebral ventricles, the heart was large and firm, and, except an old pleural adhesion on the left side and a general engorgement of the liver, spleen, and kidneys, there were no other signs of disease. From these facts, as set forth in detail in contemporary evidence, Dr. Crawfurd arrives at the conclusion "that his death was due to chronic granular kidney (a form of Bright's disease) with uræmic convulsions."

Dr. Crawfurd's interesting book begins with an account of the authorities. These are the memoirs of Thomas, Lord Ailesbury, who was in waiting upon the king; the despatches of Barillon, the French Ambassador; those of the Dutch Ambassador; the diary and letters of Philip, Earl of Chesterfield; a letter to Mr. Roper, a fellow of the College of St. John the Evangelist; the life of James II., based on his memoirs; the narrative of Father Hudleston, the priest who was brought in to the dying king; and the account of the illness written by Sir Charles Scarburgh, the learned royal physician. Scarburgh had received one of the highest honours which a physician could attain in that century, the friendship of Harvey, and his account of the progress of the illness and of each consultation, of the treatment and of the autopsy are unexceptionable evidence. Of equal value as regards truthfulness, though looking at what passed in an entirely different way, is the simple narrative of Father Richard Hudleston, a Benedictine to whom, by some slip of memory, Lord Macaulay has attributed a want of education which the narrative alone is sufficient to disprove. The accounts of Lord Ailesbury, Lord Chesterfield, and James II., and of Barillon, who were all present, supply further and, in the main, trustworthy details. The letter of the Rev. Francis Roper is less important, but shows the feeling of the time.

The king had excellent medical advice. Edmund King, who took the first step in treatment, was a man of great experience in all parts of his profession and had a scientific mind; Dr. Richard Lower was one of the first discoverers of the nature of dropsy; Dr. Frazier had been attached to the king, and attended him in poverty and exile as well as in prosperity; Dr. Walter Charleton had lived a long life among the learned; Dr. Martin Lyster had a mind attentive to every part of science, and a most tender heart; Sir Thomas Witherby was the president of the College of Physicians. The greatest of English physicians thought so well of Dr. Thomas Short that he dedicated to him his treatise on gout and dropsy. Dr. Edmund Dickenson was a man of great general learning who had spent much time in chemical studies. Dr. Edward Browne had been trained from boyhood in literature, philosophy, and medical observation by his celebrated father, Sir Thomas Browne. Sydenham, in his account of the irregular smallpox, speaks of Millington as his friend and as a learned and candid physician, and Garth says of him—

"At your approach the baffled tyrant Death
Breaks his keen shaft and grinds his clashing teeth."

Barwick was devoted to the royal family, and was a very competent physician. Thus the king had the good fortune to be treated by a group of learned men, among whom were several first-rate observers.

At the present day, if the fourteen most distinguished physicians of the College were at the bedside of a patient afflicted by the convulsions which often terminate diabetes, the knowledge which they could bring to bear upon the problem of treatment before them would be but little more than that which their fourteen predecessors possessed of the last illness of Charles II. Since 1685 Blackall and Bright, and many other investigators, have made clear the whole morbid anatomy, and something of the pathology and treatment, of chronic granular kidney and uræmic convulsions, and thus Dr. Crawfurd is able to give good reasons for his opinion of the cause of the king's death. His hypothesis explains satisfactorily the king's intervals of consciousness, and is further confirmed by the entire absence in the accounts of the eye-witnesses of any evidence of paralysis such as would almost certainly have been noticeable had cerebral hæmorrhage been the cause of death.

Dr. Crawfurd shows that the facial paralysis imagined by Sir Henry Halford to be represented in the wax figure of Charles II. at Westminster is not present. He is, perhaps, not quite just to the attainments of Wellwood as shown by his "Banquet of Xenophon" and other writings, and by the general opinion of his contemporaries. He is also unintentionally unjust to one of the physicians who signed the prescriptions given in the account of Scarburgh, which he has printed in full. This is Dr. Christian Harel, manager of the Royal Laboratory, whose acquaintance Charles probably made at Aix-la-Chapelle, and who was a man of great perseverance and some ability. His name is erroneously transcribed C. Farwell, E. Farrell, C. Farel, and C. Farell. He afterwards became physician to Queen Mary.

MECHANICAL LITERATURE OF THE NINETEENTH CENTURY.

Royal Society of London. Catalogue of Scientific Papers, 1800–1900. Subject Index, Vol. ii., Mechanics. Pp. lxxiii+355. (Cambridge: University Press, 1909.) Price 15*s.* net.

THIS second volume of the Royal Society's subject index illustrates the difficulties, as well as the merits, of the undertaking. The vagueness of the

boundary between mechanics and mathematics, on the one side, and between mechanics and physics on the other, must have given some trouble, but this kind of problem seems to have been dealt with fairly satisfactorily. The difficulties of internal classification, on the other hand, are most perplexing and baffling. One constant source of difficulty is that the mere title of a paper often gives a wholly inadequate, or even a misleading, notion as to its real scope; the same paper may, moreover, contain matters which in any complete system of classification would fall under quite distinct headings. As regards papers published since 1883, the editors have attempted to deal with this point, and we are told that in all such cases the contents have been examined by experts. It is unfortunate that the same process could not be extended backwards so as to cover the whole century, but the labour involved would have been enormous, and the result at the best imperfect.

The schedules adopted as the basis of classification are those of the International Scientific Catalogue, but a number of subheadings have been introduced. These are printed in a somewhat aggressive type, and distract attention perhaps as much as they assist it; indeed, we have found that some little practice is necessary before the volume can be used with effect. It is possible to set oneself some rather interesting problems in hunting up known papers; we may suggest, for instance, a search for references to Hamilton's memoirs on varying action, Kirchhoff's theory of the vibrations of a circular plate, or his experimental method of determining elastic constants, and Hertz's paper on the pressure of elastic solids in contact. These are, of course, all in the book, but they may take some finding.

It would be ungracious to dwell further on imperfections which must occur on almost any practicable system. It is pleasant to turn to points which can be commended without reserve. The list of serials which have been used for the purposes of the work, and the indication of the more important British libraries where these are to be found, will save much trouble to scientific workers. Very welcome, also, as well as important from the point of view of scientific history, are the references to biographical articles; these seem to be especially full and complete. The lists of general treatises, tables, public addresses, and books on apparatus strike us, on the other hand, as somewhat meagre. Possibly they are merely receptacles for a few odd items for which place could not be found elsewhere.

When all is said, an index to the mechanical literature of the whole nineteenth century, drawn up on a consistent plan, cannot fail to be an enormous boon to students and investigators. These are once more under a deep obligation to the Cambridge University Press, which has undertaken the complete risk of printing and publishing the work. We would endorse the closing words of the preface, which express a hope that the scientific world generally will "use their best endeavours that this public-spirited action shall not result in financial loss."

SHELL-FISH INDUSTRIES.

Shell Fish Industries. By Prof. J. L. Kellogg. Pp. xvi + 361. (New York: Henry Holt and Co., 1910.) Price 1.75 dollars net.

IN this work Prof. Kellogg gives a very interesting account of the shell-fish industries of the United States, and also a very valuable summary of our present knowledge of the morphology and life-histories of the edible molluscs which form the material of those fisheries. The keynote of the book is the insistence on that waste of great natural resources, and indifference to the needs of the future which have characterised American exploitation. Past generations may have believed that the natural wealth of the continent was inexhaustible, but the present one, by mercilessly clearing up what remains, has established a record of waste which is probably without parallel in the history of peoples. The picture of wastefulness and lawlessness presented by the account of the great Chesapeake oyster fishery given in this book will seem almost incredible to European readers—even to those who know how State control of the sea-fisheries has generally given origin to a mass of futile and vexatious legislation. We read of insufficient surveys resulting only in insecure titles; of conflicting laws; of the utilisation of political machinery to secure immunity from State interference; and of an entirely inefficient fishery police. The earlier oyster-dredgers are described as being commanded by "as merciless a band of pirates . . . as ever ruled a deck on the high seas," and manned by "vagrants, thieves, and murderers," or by newly arrived and ignorant foreigners. The crews of these vessels suffered "abject slavery" and "unspeakable cruelties." They formed "one of the most depraved bodies of workmen to be found in the country." The Baltimore vessels "established a record of crime and cruelty such as has rarely been equalled." The fishery was entirely the exploitation of originally very rich natural beds, and it is not surprising that depletion of these has taken place to such an extent that many areas are now barren.

The natural reaction to such a condition of affairs is scientific investigation, competent and honest surveying, and the study of methods of cultivation. This side of the question is illustrated by an account of the great oyster fisheries in Long Island Sound and adjacent waters. Here State control has suppressed disorder, and has established security of tenure in the case of the partition of the sea-bottom among the holders. Methods of cultivation—seeding, culling, deposition of cultch, and destruction of starfish and other oyster enemies—have made the sea vastly more prolific than in natural conditions; and so we find an output of enormous proportions, and steam dredging vessels without parallel elsewhere among fishing nations. The same line of development is already indicated in the case of other American shell-fisheries.

The parts of the book dealing with these matters—the history of the industry and the methods of cultivation—will prove most interesting to general readers and to those who study fishery questions, but the purely scientific chapters in Prof. Kellogg's book are

also of great value. The first three chapters, and some later ones, give a good account of the life-histories of the oyster, the clams (Mya and Venus), and the scallops (Pecten). One chapter deals with the ciliary mechanisms in some of these animals, and, being based on original observations, contains much that will probably be new to most zoologists. There is also an interesting chapter on bivalve molluscs in relation to human disease. Prof. Kellogg's book may confidently be recommended to all biologists interested in the economic side of their science. J. J.

THE FAUNA OF CEYLON.

Über die Geschichte der Tierwelt von Ceylon. By F. Sarasin. Zool. Jährbucher, suppl. 12, part i. Pp. 160. (Jena: G. Fischer, 1910.) Price 7 marks.

SINCE this elaborate piece of work embodies the results of the biological investigations undertaken by the Messrs. Sarasin in Ceylon during a protracted period, it has good claim to rank as the most authoritative attempt to explain the origin and relationships of the fauna of that island yet published. It is, however, really more than this, as it embraces a survey of the relationships and probable migrations of the faunas of south-eastern Asia generally, and their connection with that of Africa. Very valuable are the details given with regard to the geographical range of the various genera of mammals, reptiles, molluscs, planarians, and worms constituting the Ceylon fauna. Ceylon, which long formed a portion of "Gondwanaland," and is thus of great antiquity, appears to have been isolated from the Indian mainland during the whole or the greater portion of the Pleistocene period.

From this antiquity—in which the island presents a striking contrast to Celebes—the fauna of Ceylon displays unmistakable evidence of a very mixed origin, both as regards space and time. Not fewer than three epochs of connection between the Oriental region and Africa have left their impress on the Ceylonese fauna, one of these periods of union being pre-Cenomanien, while a second was Siwalik. Special emphasis is laid by the author on the part played during the Eocene in the evolution of the fauna of Ceylon by the irruption of the Deccan traps, which for a considerable period formed an impassable belt, dividing the peninsula into a southern area, including Ceylon, and a northern area. Even after the cessation of volcanic activity, communication between these two areas was greatly restricted, consisting of one track on the western and another on the eastern side of the peninsula, and even then practicable only to animals capable of withstanding a considerable amount of drought. The Siwalik connection the author considers took place by way of Baluchistan, Persia, Arabia, and Syria, or possibly to the south of Arabia by way of Socotra; and the author agrees with Dr. Arldt that the connecting area was originally clothed with forest, and that the affinity of the faunas of the African forest-zone, the Malay countries, and southern India and Ceylon may be accounted for by the subsequent deforestation of the tract, and the retreat of the animals to districts where suitable conditions still remained.

Dr. Sarasin likewise admits a former connection between Ceylon and eastern Africa and Madagascar; but considers that a chain of islands will explain the facts of the case, and that recourse to a continental "Lemuria" is quite unnecessary. He likewise accepts a connection with the Malay islands, probably by way of the northern part of the Bay of Bengal, and has also something to say with regard to the South American affinities of the Indo-African fauna. In Ceylon itself the older forms of life, such as planarians, worms, and molluscs, have a very different distributional history from those of the later mammals, and thereby present another contrast to Celebes, where the advent of all was synchronous. A valuable digest of the previous literature concludes this excellent piece of work. R. L.

THE PHILOSOPHY OF EXPERIENCE.

The Principles of Pragmatism: a Philosophical Interpretation of Experience. By H. Heath Bawden. (Boston and New York: Houghton Mifflin Co., 1910.) Price 1.50 dollars net.

THIS is an altogether admirable exposition of the views which are usually associated with the names of Peirce, James, and Dewey in America, and Schiller in England. It does not claim to construct a system, but only to show how we may establish the basal conceptions of a new philosophy of experience.

Pragmatism is the reaction from a speculative philosophy which was out of touch with the affairs of men. The practical man follows with interest the development of a working hypothesis in science, but is impatient of speculations on the infinite and eternal. He values thinking, but he insists that thought shall keep close to experience. He has no use for empty abstractions. The metaphysician has spun a universe out of his own inner consciousness, and tries to make the facts fit his system. The pragmatist seeks the cooperation of the man of science in constructing a philosophy which shall be accurate in method and shall fit the facts.

Philosophy must start, not with a great First Cause or absolute, but with concrete, workaday human life. It must try to understand experience here and now, and from that as a basis proceed to work outward to the metaphysical problems. All the problems of origin and destiny need to be re-stated in terms of present experience. Such a procedure, if it does not much reduce the number of mysteries which lie about us, will at least save us from multiplying them unnecessarily.

The question of immortality, for instance, turns on the nature of individuality. In spite of all the arguments—theological, intuitional, revelational, ethical, and what not—most persons find their faith in a future life scarcely more than a wish. Why? Because the self for whose immortality they hope is an unreal abstraction.

"The self is conceived as a particularistic entity, with barriers to other selves. While, in society, indi-

viduals are recognised to be functions of each other, at death they are supposed to shrivel into isolated and alien units."

The only future that is possible is an immortality of function. An organism is nothing but a centre or focus through which the world-energy operates. When the organism is lost in what we call death, the function may well enough go on in terms of more subtle forms of energetic activity (*cf.* Prof. James's little book, "Human Immortality").

Perhaps, if a criticism may be ventured, modern "psychology-without-a-soul" has become *too much* afraid of being metaphysical. A function must be a function of something. If there is an act, there must be an actor who is, in a way, greater and more real than the act. A soul-entity, then, is justified. It is as reasonable to posit it as to posit a surviving "function."

But the volume is full of deep and careful thinking, and is suggestive and stimulating even in its more questionable doctrines. The analysis of consciousness, and the chapters on the test of truth and on mind and matter, are particularly good.

SOME GERMAN MATHEMATICAL TREATISES.

(1) *Einführung in die Vektoranalysis, mit Anwendungen auf die mathematische Physik.* By Prof. Richard Gans. Zweite Auflage. Pp. x+126. (Leipzig: B. G. Teubner, 1909.) Price 3.60 marks.

(2) *Die Vektoranalysis und ihre Anwendung in der theoretischen Physik.* By Dr. W. v. Ignatowsky. Teil I. Die Vektoranalysis, pp. vii+112. Teil II. Anwendung der Vektoranalysis in der theoretischen Physik. Pp. iv+123. (Leipzig: B. G. Teubner, 1909–10.) Price 6 marks.

(3) *Vorlesungen zur Einführung in die Mechanik raumerfüllender Massen.* By Prof. Alexander Brill. Pp. x+236. (Leipzig: B. G. Teubner, 1909.) Price 8 marks.

(4) *Funktionentafeln mit Formeln und Kurven.* By Prof. Eugen Jahnke and Fritz Emde. Pp. xii+176. (Leipzig: B. G. Teubner, 1909.) Price 6 marks.

(5) *Die Zentrifugalkraft.* By Prof. Friedrich Poske. Pp. 80. (Berlin: Julius Springer, 1909.) Price 3 marks.

(6) *Interpolationsrechnung.* By Prof. T. N. Thiele. Pp. xiii+173. (Leipzig: B. G. Teubner, 1909.) Price 10 marks.

(1) THE simplified system of vector analysis promoted by Gibbs and Heaviside has met with such general acceptance in Germany that treatises and memoirs on subjects of mathematical physics are now often hardly intelligible to readers who do not possess some familiarity with the notations and processes of the calculus in question. A demand has thus arisen for elementary expositions limited to what is absolutely necessary for physical purposes. The first book on our list, now in its second edition, is written mainly with a view to the electrical applications. It deals in a clear and simple fashion with the fundamental operations, and then passes on to the discussion of vector-fields. An interesting chapter on "tensors," which have a bearing on the theories of stress and of quadratic moments, is added. The work closes with a few elementary applications to hydrodynamics and electromagnetism. It may be commended as giving in a very brief compass almost all that is of importance to the physical student.

(2) This work consists of two parts. In the first of these vector analysis is developed from its foundations as an independent discipline, without any reference to Cartesian or other special geometrical coordinates. The author claims some degree of novelty for his methods of exposition, we think with justice. In particular the intrinsic nature of Hamilton's operator ∇, whether as applied to a scalar quantity, or by scalar multiplication to a vector, or by vector multiplication to a vector, is here explained with great insight and (we believe) originality. The passages in question may be recommended to the notice of those who have felt the inadequacy of the usual Cartesian treatment of the matter. The theorems of Green and Gauss naturally present themselves for discussion, and, as in the preceding work, a chapter is added on tensors. The second volume contains a number of applications to elasticity, hydrodynamics, electricity, and crystalline reflection.

(3) This is a course of lectures on the dynamics of continuous systems, written from a special point of view. The inspiration is derived from Hertz, but the author prefers to employ Gauss's principle of least constraint rather than the Hertzian law of the "straightest path." The treatment is somewhat academic, in the sense that stress is laid on unity of method rather than on the specific interest of the various topics discussed, but it is marked by clearness and great mathematical elegance. The subjects considered include the kinetics of rigid bodies and of fluid and elastic media, and, finally, the electromagnetic theory of light. On one point a protest should, in the opinion of the present writer, be entered. The notion that the apparent potential energy of a dynamical system may be accounted for as the kinetic energy of latent internal motions is here, as in many recent Continental writings, attributed too absolutely to Hertz. If nowhere stated so explicitly, perhaps, it must have been present to the mind, not only of Lord Kelvin, but of all students of his various expositions of the theory of gyrostatic systems, to say nothing of the well-known "kinetic theory" of elasticity.

(4) This is intended as a supplement to the ordinary tables of mathematical functions. Of recent years a great deal of work has been done, especially in this country, in tabulating the functions which occur in various important problems of mathematical physics, but the results are scattered in the proceedings of societies and in scientific journals, and are often unavailable, and even unknown, to those who have most need of them. The authors of the present treatise have collected a number of such tables, and have appended explanations of the notations, and lists of the important formulæ. The whole is brought within a moderate compass by restricting the entries to four significant figures; this is, of course, ample for most physical purposes, and more than sufficient for graphical representation. We are

glad to note that the author pays a tribute to the British Association Committee on Mathematical Tables, the activity of which has, unfortunately, in recent times somewhat slackened. The collection includes tables of the sine-integral, cosine-integral, and exponential-integral, the Fresnel transcendents, the gamma-function, the error-function, elliptic integrals, spherical harmonics, and the Bessel's functions of both kinds. Especially welcome are the tables of the latter function in which the argument is complex.

Every worker in applied mathematics will applaud this publication, and will wish it such success that it may be speedily followed by new and still more comprehensive editions.

(5) A "philosophical" discussion of the nature of centrifugal force is hardly suited for review in these pages. Such discussions are apt to resolve themselves into verbal questions, and we fear that the present one is no exception. The author insists, for example, on a distinction between "motive forces" and "resistances," the tension of a string being reckoned as belonging to the former category, the pressure of a smooth surface to the latter! The tract is lengthy and diffuse.

(6) A formal treatise on the theory of interpolation from the former professor of astronomy at Copenhagen is sure of respect. The present work is carefully written, and apparently from an independent standpoint. There is, indeed, hardly any explicit reference to the work of previous writers other than Newton and Lagrange, and novel notations are introduced freely without any reference to accepted forms which have long been in general use. The author claims for the subject an important place in schemes of mathematical instruction. To this we can hardly assent; processes of interpolation are, of course, constantly required, in one form or another, but a systematic study of the subject as an independent discipline would, in the case of most students, be an unnecessary infliction. The case of those who are training to become experts in certain special subjects is, of course, different. H. L.

OUR BOOK SHELF.

An Introduction to Petrology. By F. P. Mennell. Second edition. Pp. viii+204. (London: Gerrards, Limited, 1910.) Price 8*s*. net.

THIS is a plain and clearly written introduction to a branch of geology that has assumed much importance among students, and it has the merit of including a short description of the minerals that go to make up rocks. The author's personal studies, as is well known, have been carried on mainly in Rhodesia, and there is something pleasant in finding familiar facts illustrated from Bulawayo, Kimberley, or the Rand. The palisade structure of basaltic flows is thus well seen in the view of the Zambezi gorge on p. 92. In addition, we gain by the introduction of the results of tropical weathering on rocks; and the remarkable banded siliceous ironstones of South Africa (p. 180) are referred to the concentration of mineral matter in a stratified series near the surface.

Theoretical questions are touched on sufficiently to arouse interest, and a sane balance seems to be preserved between what can be seen in the field and what may be variously inferred. The discussion of the absorption of schists and sediments by the granite of the Matopos and Mashonaland is sustained by evidence that seems convincing, and it has been our good fortune to go over something of this ground in the company of the author. The arguments derived from the amphibolites (p. 171) might have been supported by work of earlier date than that quoted, such as that done in Saxony and round Mont Blanc; but the introduction of matter of this kind, of chapter xiii. (on the origin and variations of igneous rocks), and of the well-reasoned chapter xix., on metamorphism, show that the author regards petrology as far more than the mere description of rock-specimens. Enough is said on each point to show what researches lie before the worker in the open country.

Simple and descriptive as the book is, it will undoubtedly encourage thought in all who read it. The illustrations are excellent, though we should like fewer rock-sections, and more landscapes, such as that on p. 101. Very few misprints—"Brux" for "Brüx," "Fougué" for "Fouqué," and "entectic" for "eutectic," twice on p. 89—have been noted. The formulæ of the silicates might be modernised in the next edition, since comparison is thus rendered more easy. On p. 70 the resemblance between kaolin and serpentine is unnecessarily obscured by a small difference of method. A comma is wanted in the dolomite formula on p. 75; but is not this better written $MgCa(CO_3)_2$? The change of appearance in a section of calcite when the polariser is rotated beneath it (p. 75) is due to differences in "relief" at the surfaces, and not to differences of absorption within the section. This well-printed book, as a whole, is a very pleasant one to read. G. A. J. C.

Map of Eastern Turkey-in-Asia, Syria, and West Persia. Scale, 1/2,000,000, or 1 inch=31·56 miles. (London: Royal Geographical Society, 1910.)

THE issue of this map occurs at an opportune moment. Public attention has been much directed lately to the once fertile strip of country that lies between the deserts of Arabia on the one hand, and the mountains of Asia Minor on the other. It is needless to dwell here on the visions of the past that a mere inspection of the names on this map will call up in the mind of the historian. Looking to the future alone, it is obvious that we have before us the representation of a piece of country destined once again to play an important part in human history, and to be the scene of a busy commerce and a thriving agriculture. Whatever be the political difficulties now blocking the way, it is certain that before very long we shall see the construction of the railway joining the Mediterranean with the head of the Persian Gulf, a route possibly extending through southern Persia and Baluchistan to India itself. In the more immediate future we shall see the rich land that lies between and about the great twin rivers wake from its sleep of four centuries and water again flow through canals and irrigation channels long choked with the desert sands.

The report on the irrigation system recently published by Sir W. Willcocks makes it clear that, with no great engineering difficulties, and even with no great expenditure of capital, some, at all events, of the old irrigation works can be reopened and a large area of land once more taken into cultivation. The enterprise and energy with which this work is now actually being taken up is the best evidence of the change that has come over the spirit of Turkish administration since the advent of constitutional government.

It is sincerely to be hoped that the prime importance of carrying out an accurate survey in advance of agricultural development will not be lost sight of. In

this matter the example of Egypt should be constantly borne in mind, both as showing the difficulties and loss incurred when survey is allowed to lag behind the necessities of land development and taxation, and also as an example of the methods upon which the cadastre of such a piece of country should proceed. The map before us is produced in the excellent style that its origin would lead us to expect, and the thanks of all geographers are due to its compilers and publishers. E. H. H.

The Anatomy of the Common Squid, Loligo Pealii, Lesueur. By L. W. Williams. Pp. xv+92. (Leyden: late E. J. Brill, n.d.) Price 10*s*.

THIS work, published under the patronage of the American Museum of Natural History, but printed in Holland without date, is a very complete and well-illustrated description of the anatomy of one of the commonest Cephalopods. As such it should meet with a warm welcome from all serious students of the mollusca. We believe the squid is a type not usually dissected by zoological students in this country, but for the sake of comparison, at any rate, the work should find a place in the zoological laboratory.

We do not expect very much in the way of novelty in a memoir of this kind, but the author is to be congratulated on the important discovery of a pair of giant nerve-cells situated in the pedal ganglion, and each giving off a giant fibre. The giant fibres pass backwards to the centre of the visceral ganglion, where they cross one another, forming a "chiasma"; each fibre then passes on through the viscero-stellate connective to the stellate ganglion of the side opposite its origin, where it divides into a number of branches, one of which enters each of the larger nerves given off from that ganglion. There appears to be no doubt about the facts of the case, which are sufficiently remarkable, but the term "chiasma" hardly seems suitable for the simple crossing of a single pair of fibres. According to the author, this is the first time such fibres have been described in any mollusc, though similar structures are, of course, widely distributed throughout the animal kingdom. We may mention that in the first text-figure we have what seems to be a variation of Lankester's well-known schematic mollusc which does not appear to us to be any improvement on the original.

The Siege and Conquest of the North Pole. By George Bryce. Pp. xvi+334. (London: Gibbings and Co., Ltd., 1910.) Price 7*s*. 6*d*.

As a record of a group of Arctic journeys which had the object of attaining the North Pole, this volume has a real value. It gives, usually in the explorers' own words, the most stirring stories of the Far North, many of which are now difficult to procure in the original form. The record only deals with the last hundred years, the three centuries of earlier efforts being dismissed in a brief introduction. The expeditions chronicled are those of Parry in 1827, Kane in 1853–5, Hayes in 1860–1, the German expedition of 1869–70, the *Polaris* expedition of 1871–3, the Austro-Hungarian expedition of 1872–4, the British expedition of 1875–6, the voyage of the *Jeannette* in 1879–81, Greely's in 1881–4, Nansen's in 1893–6, Sverdrup's in 1898–1902, the Duke of the Abruzzi's in 1899–1900, Peary's from 1886 to 1909, and lastly, Cook's in 1907–9. There were, of course, several other expeditions in the period covered, some, such as Andrée's, avowedly aimed at the pole; others, like the Jackson-Harmsworth, the Ziegler, and the Wellman expeditions, in which the attainment of the pole was at least as much an object of ambition as was the case with Nansen, and much more so than with Greely or Sverdrup. We are, indeed, inclined to suspect that the hope of gaining the fame of first reaching the pole has animated a good many explorers whose ostensible ideals were more modest.

The author's comments and criticisms are few, but usually sound; and we are the more surprised to find that in the light of the adverse opinion of the University of Copenhagen he was able to say "it is impossible at present to pronounce a final judgment" on the story of Cook's journey in 1908. The summing up is strongly in favour of Dr. Cook's claim, and Mr. Bryce does not seem to be staggered by the coincidence of a group of highly improbable statements. He seriously reproduces, without comment or criticism, the absurd assertion that, after finding a latitude of 89° 59′ 45″, the explorer advanced "a distance equal to the 15″." With the exception of the last chapter, however, we can commend the book unreservedly as giving in brief compass a graphic account of many of the greatest trials of human endurance. The sketch-maps suffer from the common fault of being over-reduced, but they help the reader to follow the narratives all the same.

The author does not point out, but the book itself bears abundant testimony to the fact, that the greatest results have been gained since the naval or military organisation of polar expeditions has been abandoned, and the personal ambition or scientific zeal of the leader has become the driving power of a small, well-equipped party, strong in the realisation of the lessons of past failure.

Les États physiques de la Matière. By Prof. Ch. Maurain. Pp. 327. (Paris: F. Alcan, 1910.) Price 3.50 francs.

THIS book is, as the title suggests, an exposition of the properties of matter in its various states. The author confesses, however, in his introduction, that he is principally concerned with the properties of crystals, the different states of solid bodies, liquid crystals and colloids. Thus we find only twenty-three pages devoted to the study of gases, and rather more than fifty to that of liquids. Prof. Maurain has found it convenient to preserve the old divisions of solid, liquid, and gas, but he points out that the distinctions are as regards degree only, and that no properties are peculiar to a particular state.

The treatment is practically devoid of mathematics. The contents of the book are mainly a collection of experimental facts, particularly those which have been brought to light by the use of the microscope and ultramicroscope. The former as applied to crystals, and the latter to emulsions and colloids, have recently widely extended the knowledge of these states of matter.

There are, in all, eleven chapters. The first is devoted to gases and gaseous ions. Reference is made to the kinetic theory, and estimates are given of the sizes and masses of the molecules. The second chapter deals with the properties of liquids. Much attention is paid to the question of the thickness of liquid films and its bearing on the molecular dimensions, and there is also included a discussion of the various methods of estimating the molecular weights of substances. In the next three chapters the properties of solid bodies are fully treated. The various systems of crystals are defined, and examples are given of their directed properties relating to thermal and electrical conductivities, elasticity, magnetism, and optics. The crystalline structure of solid bodies as seen through the microscope is described, and is applied to explain the various properties of metals. Chapter vi. deals mainly with the production of double refraction in isotropic bodies by external means, such as mechanical pressure and electric and magnetic fields. Liquid crystals form the subject of chapter vii. The special properties

of thin solid films are next treated, including Quincke's experiments on the range of molecular action. Chapter ix. is devoted to the behaviour of homogeneous mixtures, both liquid and solid, and chapter x. to heterogeneous mixtures, such as alloys and mixtures of salts. The concluding chapter concerns colloidal solutions, their preparation, structure, &c.

The book, as a whole, is very good. It contains a large fund of information, clearly put and in logical order. It is therefore both readable and instructive.

Aids to Microscopic Diagnosis (Bacterial and Parasitic Diseases). By Capt. E. Blake Knox. Pp. viii+156. (London: Baillière, Tindall and Cox, 1909.) Price 2*s.* 6*d.* net.

THIS little book is a *résumé* of clinical methods as applied in the diagnosis of bacterial and parasitic infections of man, and contains a large amount of useful matter in a small space. It is not meant to take the place of the ordinary text-books on these subjects, but to be used for revision purposes, and will be found handy by travellers who are unable to burden themselves with many books. Protozoal organisms, such as malaria, trypanosomes, and spirochætes, filaria, pathogenic bacteria, and the diseases they cause, pathological secretions, the opsonic index, and vaccine therapy are all dealt with, together with the methods required to demonstrate and isolate the causative organisms.

We have noticed a few slips and omissions, *e.g.* the *Streptococcus pyogenes* is spoken of as the *S. pyogenes aureus*; no mention is made of the fact that the *Staphylococcus pyogenes* group liquefies gelatin, while the *Staph. cereus* group does not; it is questionable if the tubercle bacillus can ever be detected in the blood; the term "subtertian," now commonly applied to the malignant form of malaria, is not mentioned; toxin and not dead culture is used for the preparation of diphtheria antitoxin; prophylactic vaccination in cholera is given under the heading "serum therapy," &c. Within the limitations stated by the author, we think a useful purpose will be served by this little book. R. T. HEWLETT.

Lift-Luck on Southern Roads. By Tickner Edwardes. Pp. xv+301. (London: Methuen and Co., 1910.) Price 6*s.*

HERE is a pleasantly written description of a journey, of some two hundred miles, through five southern English counties, on an unusual plan. Mr. Edwardes says, "My plan consisted in waiting by the roadside or strolling gently onward, until something on wheels, it mattered not what, overtook me . . . by dint of laying under use the whole gamut of country perambulation, at length, after many days of travel, I found myself at my journey's end." Having only a camera and a pack, the author was able to go into every byway he fancied and investigate any subject which presented itself. His account of his wanderings and his illustrations will delight all lovers of the country.

Praenunciae Bahamensis. II., *Contributions to a Flora of the Bahamian Archipelago.* By C. F. Millspaugh. (Chicago: Field Museum of Natural History, 1909.)

THIS is the second fascicle of a contribution to a flora of the Bahamian Archipelago, issued by the Field Museum of Natural History. It contains observations on old species, the establishment of the new genus Euphorbiodendron, and the description of eleven novelties distributed among the genera Dondia, Portulaca, Chamæsyce, Croton, Centaurium, Heliotropium, Varronia, Catesbæa, and Callicarpa, collected in fifteen different islands of the group.

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.]*

Halley's Comet and Magnetic and Electrical Phenomena.

HALLEY'S comet has been a source of interest to magneticians as well as to astronomers. The question was: Would the proximity of the comet's tail occasion a magnetic storm or would it not? If the tail consists of electrified particles, and if it were to envelop the earth, then a magnetic storm appeared a reasonable concomitant. It was thus with some expectancy that I consulted the magnetic curves recorded at Kew on May 19. The conclusion that will be drawn from these and similar records will, I suspect, depend somewhat on the temperament of the inquirer. A large magnetic storm unquestionably there was not, but there was disturbance.

The position may perhaps be best explained by reference to the international lists that are published as to the magnetic character of individual days. Days are classed as "0," "1," or "2," according as they are magnetically quiet, moderately disturbed, or highly disturbed. Taking the three years 1906, 1907, and 1908, the Greenwich and Kew lists, while differing in details, agreed in putting 39 per cent. of all the days in class "0," 58½ per cent. in class "1," and 2½ per cent. in class "2." No day practically is absolutely quiet, and a good many days are so near the line of demarcation of classes "0" and "1" that it is a good deal a matter of chance to which they are assigned. Again, there are an appreciable number of days so near the common margin of classes "1" and "2" that they may well be assigned to either. Thus while the Kew and Greenwich lists for the three years mentioned each assigned twenty-nine days to class "2," only nineteen days were common to both lists. If, then, a day is chosen by haphazard, it is most likely to be of disturbance class "1," while the odds against its being of class "2" are not so great that if it should prove to be of that class one is compelled to accept the coincidence as necessarily more than accidental.

In the present instance what was *a priori* the most probable event has happened; May 19 was undoubtedly of disturbance class "1." So far, indeed, as the declination curve was concerned, the choice between classes "0" and "1" was not very clear, but the horizontal force curve—while very far from being *highly* disturbed—was unquestionably up to the average class "1" level. The most rapid horizontal force changes occurred between 10 a.m. and noon, the range of the largest oscillation being about 50γ (0·0005 C.G.S.). There were also changes of nearly the same size between 0 and 2 a.m., and again between 3 and 5 p.m. The largest irregular declination movements occurred between 0 and 3 a.m., the range being about 9′. Later in the day there were some oscillatory declination movements synchronous with those shown in the horizontal force curve, but their amplitude was only 2′ or 3′.

As a rule, days of class "0" and days of class "1" disturbance occur in groups. The present occasion follows the general rule. From May 13 to 20 no day, except possibly May 16, was of class "0," May 13 being the most disturbed. There were horizontal force changes on the afternoons of May 17 and 18 similar in size to those on May 19. The afternoon of May 20 was also disturbed, though less so. The disturbances on May 18 and 19 were similar in magnitude to those which in 1902–3 accompanied what Prof. Birkeland termed "polar elementary" magnetic storms in the Arctic, and if Prof. Birkeland expected no more than a "polar elementary" storm from the passage of Halley's comet, then I have little doubt that the special observations he has been making in the Arctic will have supplied him with what he was looking for.

As it was conceivable that the intrusion of a comet's tail into the earth's atmosphere might exert a visible effect on the electric potential, I have also examined the Kew electrograms. The electrograms from May 19 to May 20

were throughout their greater part of the usual fair weather type, the potential being neither specially high, specially low, nor specially variable. There were, however, two intervals, between 8.40 and 9.20 p.m. on May 19, and between 1.30 and 3 a.m. on May 20, when there were rapid oscillations and negative potentials, which were not accompanied—as is usually the case—by a rainfall visible in the rain-gauge curves. Thunderstorms were, however, in active progress at the time at no great distance, a good many peals of thunder being audible in Richmond; there was thus nothing in the electrical phenomena that is not adequately accounted for by the observed meteorological conditions.

C. CHREE.

May 21.

The Magic Square of Sixteen Cells. A New and Completely General Formula.

THE ancient problem: *To construct a Magic Square with sixteen consecutive integers*, may be regarded as a special case of the general problem: *To construct a Magic Square with any sixteen positive integers, no two of which shall be identical.* The solution of the problem thus generally enunciated throws much new light upon the ancient special one, and will, in fact, enable us to classify and tabulate its 880 known solutions (8×880, if we admit reversals and reflections of the same square to be "different") much more scientifically than has hitherto been done.

The following is the completely general formula for the Magic of Sixteen Cells:—

$A-a$	$C+a+c$	$B+b-c$	$D-b$
$D+a-d$	B	C	$A-a+d$
$C-b+d$	A	D	$B+b-d$
$B+b$	$D-a-c$	$A-b+c$	$C+a$

For (1) this formula obviously represents a Magic Square, since every row, every column, and both the central diagonals sum to A+B+C+D.

Also (2) it is a function of eight independent variables.

Let S be the sum of our sixteen unknown quantities; then the constant total of the square will =S/4. If three of the rows sum to S/4, the fourth row must do the same; similarly with the columns.

Hence only *eight* of the ten given conditions are independent; we have to solve eight simultaneous linear equations involving sixteen unknown quantities. The solution, if general, must thus involve eight arbitrary constants. Therefore the above solution, which does involve eight arbitrary constants, is a perfectly general one.

I proceed to a numerical example. If A=10, B=12, C=8, D=5, $a=8$, $b=-9$, $c=-10$, $d=2$, our formula gives us a Magic summing in every direction to 35:—

2	6	13	14
11	12	8	4
19	10	5	1
3	7	9	16

It will be noticed that the number 19 is used, and the number 15 is not.

We have here an example of a Magic in its simplest form, with none of the superfluous (accidental) relations such as appear among the components when those numbers happen to be consecutive; and we see that the "complementary pairs" (each summing to half the constant total) upon which previous writers have laid such stress are a purely adventitious feature, and have no real connection with the laws of construction of the square.

In the fourth volume of the "Récréations Mathématiques" of Edouard Lucas (Paris, 1894) are set out three theorems and three corollaries, enunciating various equalities which must exist between the component numbers of every Magic of Sixteen Cells. The proof of these takes up four pages and a half, and requires twelve illustrative diagrams. My formula proves them all by simple inspection.

If, in the formula, $a=b$, the square assumes the type which Frénicle designated by the letter δ.[1] If $a=-b$, it assumes the type which Frénicle, in his table, left unmarked. Of the latter type, there are exactly 120 in consecutive numbers. I append an example of each type:—

δ

1	12	13	8
16	9	4	5
2	7	14	11
15	6	3	10

(A=7; B=9; C=4; D=14; $a=6$; $b=6$; $c=2$; $d=4$.)

1	9	16	8
7	15	10	2
14	4	5	11
12	6	3	13

(A=4; B=15; C=10; D=5; $a=3$; $b=-3$; $c=-4$; $d=1$.)

It must be borne in mind, however, that a complete numerical solution of the δ type necessarily includes the squares which Frénicle marked α and β, because both of these are, algebraically, particular cases of the δ form.

My formula readily supplies an infinity of solutions of the problem, *To construct a Magic Square with sixteen different prime numbers.* The following example (first published by me in the *Pall Mall Gazette* of February 26 last) omits two only out of the first eighteen odd primes, and sums to a far smaller constant than any other investigator has been able to obtain:—

1	47	13	53
61	17	31	5
29	7	59	19
23	43	11	37

(A=7; B=17; C=31; D=59; $a=6$; $b=6$; $c=10$; $d=4$.)

It is obvious that every 4^2 Magic formed by the addition of two Latin squares is divided into equal quarters. No proof, however, has up to now been given of the "converse" of this proposition. I will deduce the theorem from my general formula.

Theorem.—Every 4^2 Magic in equal quarters can be expressed as the sum of two Latin squares.

That the form of the result may be more convenient, I

[1] "Ouvrages de Mathématique." Par M. Frénicle. (La Haye, 1731.)

re-state my general formula, with interchanged letters, as below :—

$A+d$	$C-a-d$	$B+a-b$	$D+b$
$D+c-d$	B	C	$A-c+d$
$C+b-c$	A	D	$B-b+c$
$B-b$	$D+a+d$	$A-a+b$	$C-d$

The condition that each quarter shall be equal to A+B+C+D is obviously $a-c+d=0$. Substituting $-a+c$ for d, the universal formula for a *square in equal quarters* is therefore :—

$A-a+c$	$C-c$	$B+a-b$	$D+b$
$D+a$	B	C	$A-a$
$C+b-c$	A	D	$B-b+c$
$B-b$	$D+c$	$A-a+b$	$C+a-c$

which, by putting $A+a$, $B+b$, $C+c$, for A, B, C, respectively, becomes :—

$A+c$	C	$B+a$	$D+b$
$D+a$	$B+b$	$C+c$	A
$C+b$	$A+a$	D	$B+c$
B	$D+c$	$A+b$	$C+a$

This is the familiar traditional form, being the addition of one Latin square (A, B, C, D) to another (o, a, b, c). It is usually written (inaccurately) as if it involved eight arbitrary variables, instead of seven.

ERNEST BERGHOLT.

Windsor House, Bream's Buildings, E.C.

Magnetic Deflection of β Rays.

THE nature of the emission of α rays from radio-active bodies, and the mechanism of their absorption when passing through matter, are well known from the experiments of Rutherford, Bragg, and others.

As regards β rays, our knowledge is not so complete. Although in recent years a large number of experiments have been undertaken in order to study the laws of their absorption, there still remains considerable doubt concerning several fundamental points. From the study of the absorption of β rays emitted from different radio-active substances, Otto Hahn and Lise Meitner arrived at the conclusion that the β rays, in the same way as α rays, are characterised by a definite initial velocity of expulsion. For different β-ray products the velocity may, of course, be different, but for a simple substance this velocity is characteristic of the rays. It was assumed by Hahn and Meitner that a homogeneous substance could be recognised as such by the exponential law of absorption by aluminium of the β rays which are emitted.

The experiments of W. Wilson were not in accord with this hypothesis. He found that the exponential law is not a measure of the homogeneity of the radiation, but, on the contrary, that homogeneous rays are absorbed according to a linear law.

In addition, the experiments of Kaufmann and Bucherer, who obtained a continuous magnetic spectrum of β rays in their determination of e/m and v for those rays, appeared to be contrary to the view of Hahn and Meitner. Such a spectrum could not be obtained on the assumption of groups of homogeneous β rays.

During the last few months the authors have investigated by a photographic method the magnetic deflection of β rays, and were able to show that in some cases very well-defined lines of deflection can be obtained. Experiments were especially successful when the active deposit from thorium served as source of radiation. As Hahn and Meitner have shown, this contains two groups of β rays (ThA and ThD). The authors obtained in this case two distinctly separated lines in the magnetic field. The line due to thorium A, which was further deflected, was nearly as well defined as if it were produced by α rays. Of course, by use of a stronger field, a third line, fairly well marked, was absorbed very near the ThA line, the source of which we are not yet quite certain.

But it is of interest that Hahn and Meitner recently discovered a new easily absorbed β radiation in ThX, and that the photographic impression, when using thorium X, really gave one more line as when using the active deposit alone.

Mesothorium gave a number of well-separated lines (about five or six). In this case the absorption experiments of Hahn and Meitner had already indicated a complex β radiation.

In the case of radium we have not, so far, been able to obtain single bands. This may perhaps be ascribed to the fact that the β rays from the radium products do not differ much in their velocities, and that the bands were consequently superposed, the intensity of the magnetic field being only about 80 Gauss. As a whole, the photographic impressions produced by the hard β rays are not very clear, since the rays pass through the photographic film without appreciable absorption, giving rise to a secondary radiation which fogs the plate.

The authors have proved by their experiments, at least for several of the radio-active elements, that these elements emit groups of β rays of definite velocity for which e/m and v can be separately determined.

A more detailed account of these experiments will be published elsewhere.

OTTO VON BAEYER.
OTTO HAHN.

Berlin, May 1.

Peripatus papuensis.

AT the end of last June I received from Mr. A. E. Pratt, the well-known naturalist, a number of fine specimens of Peripatus which he and his son, Mr. F. B. Pratt, had found in New Guinea on their recent expedition to that island. This is the first time Peripatus has been found in New Guinea. It was found by Dr. Willey in New Britain in 1897, and by Mr. Muir and Mr. Kershaw in Ceram last year (see NATURE, July 1, 1909, p. 17, and *Quarterly Journal of Microscopical Science*, liii., 1909, p. 737). The New Guinea specimens were found in January, February, and March at Sarayu, at an elevation of 3500 feet in the Central Arfak Mountains. Mr. Pratt, in describing his discovery, writes as follows :—"After my son found the first specimen amongst the roots of the grass, we at once showed it to the natives, offering them a large knife (which is most valuable to them) for every specimen. Quite sixty of the natives were searching for

the above months, and you have the results; so evidently they are not common in the part we were in. The curious thing is that, although we searched for weeks, we never found another specimen. The natives told me they found them at the roots of grass, under stones, and at the damp roots of clumps of bamboo."

Until the Ceram species was described it was quite uncertain whether the Papuan species would, when discovered, be found to belong to the Australian type or to the New Britain type, or to neither. Messrs. Muir and Kershaw's discovery settled that point. As a result of their work we know that *Peripatus ceramensis* belongs to the group Melano-Peripatus. It was therefore to be expected that the Papuan species would belong to the same type, as indeed it does. I propose to name the species *papuensis*, with the following characters:—

Peripatus papuensis, n.sp. Colour very similar to that of Capo-Peripatus, the principal pigments being a greenish-blue and an orange. Number of legs is variable, from twenty-three to twenty-nine pairs. Legs with three spinous pads. Nephridial openings of legs four and five on the proximal pad. Feet with three distal papillæ, of which one is anterior, one posterior, and one dorsal. Genital opening subterminal behind the legs of the last pair. Ovary small, with small ova (size not determined). Oviduct with a receptaculum seminis. Uterine embryos of very different ages in the same uterus. Spirit specimens which have been killed extended reach a length of 3¾ inches.

From this it seems fairly clear that we are dealing with a Melano-Peripatus. As the specimens are admirably preserved I hope soon to be able to work out the other characters. A. SEDGWICK.

Imperial College of Science and Technology, May 13.

The Bibliography of the Biology of the European Seas.

MAY I through the columns of NATURE direct attention to the fact that the Bureau of British Marine Biology, which for some time past has been engaged in the preparation of an extensive MS. bibliography of the fauna and flora of the European seas, is now making the experiment of printing and circulating, in the form of a periodical, the records which are thus being brought together?

The number of scientific journals has increased so enormously of late, and the output of biological work has now become so vast, that there would seem to be a very real need of some means by which the student may keep more fully in touch with the published work of his colleagues than is possible with the aid of the existing bibliographies alone; it has already become quite impossible for the specialist to himself search through all the various journals, &c., as they appear (even should he be fortunate enough to have access to adequate libraries), and, at the same time, to accomplish any research work of his own.

The bibliography of European marine biology now in progress (the first part was published on April 2) in the "Contributions from the Bureau of British Marine Biology" aims at providing a full title-entry and summary of the contents of every publication as it appears which is in any way concerned with the biology of the European seas (including the North Atlantic, Arctic, and Mediterranean). These summaries will, in general, appear *within a few weeks* of the publication of the works to which reference is made, while entries in the existing annual bibliographies are, of course, necessarily at least one or two years behindhand. The analysis of works indexed by the Bureau is also carried very much further than is attempted in any existing bibliography; for instance, a separate entry is made for practically *every mention* of a species in the work analysed. In addition to the bibliography and analysis of current work, the MS. records of the Bureau also include extensive annotated lists of the marine fauna and flora, alphabetical reference lists of specific and subspecific names and synonyms, particulars of type-localities, type-specimens, &c.; it is likewise intended to publish these records in the "Contributions." It may also be mentioned that all entries are being printed in such a form as will admit of their use as a card catalogue.

There is, of course, no desire to make a profit by the publication of these records, but, on the other hand, the Bureau cannot afford to incur any considerable financial loss by the undertaking, and the publication of the bibliography will therefore not be proceeded with for any length of time unless there is *by an early date* distinct evidence that sufficient support will be forthcoming to meet the cost of printing. For this reason I would urge all who may be willing to assist the undertaking to notify as soon as possible their intention of subscribing. The bibliography will, I am sure, prove most useful to those interested in any department of marine research if only publication can be continued for a sufficient period to enable the "Contributions" to become established. Full particulars, forms for subscription, &c., will be forwarded upon application to the undersigned. S. PACE.

6 Provost Road, Haverstock Hill, London, N.W.,
May 11.

An Improved Weight Dilatometer.

THE ordinary form of weight dilatometer is troublesome to dry and fill, and the filling takes much time. Air bubbles are removed with difficulty, and after cooling to a low temperature there is a risk of loss of mercury while weighing the dilatometer unless special precautions are taken.

To obviate these disadvantages the form of dilatometer here illustrated has been devised. The neck of the dilatometer is short and straight, and is enclosed in a cylindrical cup projecting a few centimetres above the neck, and sealed on to the body of the dilatometer.

To dry the bulb, the cup is fitted with a cork and a piece of tubing, and connected to the water-pump. By gently heating the bulb and exhausting, moisture is removed. In the second form (Fig. 2) air is drawn through the bulb by removing the clip and pad from the side tube.

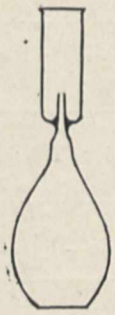


FIG. 1.

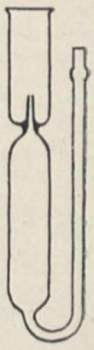


FIG. 2.

To fill the simpler form, Fig. 1, dry mercury is poured into the cup; by gently tapping, the mercury falls into the bulb. The operation is repeated until the bulb is filled. To remove air from the neck the dilatometer is warmed, and when the mercury oozes out the cup is re-filled, and the dilatometer placed in ice water above the level of the neck. After cooling, the excess of mercury is poured out of the cup. The dilatometer is dried and weighed, any mercury expelled by expansion being collected in the cup. After heating to a higher temperature, the expelled mercury is poured out, and the dilatometer weighed after cooling. In the form shown in Fig. 2 the filling is more rapid, as air is expelled through the side tube; when this is filled with mercury the clip is fixed, and the tube closed by a screw pad. A. V. C. FENBY.

The Wyggeston Boys' School, Leicester, May 11.

THE INTERNATIONAL ASSOCIATION OF ACADEMIES.

FOURTH MEETING, MAY 9–14.

IT is now ten years since the association was inaugurated in a preliminary meeting held at Wiesbaden, and since then regular triennial assemblies have taken place in Paris, London, Vienna, and finally in Rome, where the fourth meeting, conducted under the presidency of Prof. P. Blaserna, of the Accademia dei Lincei, has just come to a close. The representatives of the Royal Society were Sir Archibald Geikie, Sir Joseph Larmor, Prof. Schäfer, Colonel Prain, Prof. Turner, and Dr. Arthur Schuster. In judging of the past activity and the prospects of the association, it must be borne in mind that, having no funds at its disposal, its influence must be mainly

a moral one. It is intended to coordinate international enterprises, to initiate and encourage undertakings, and to act as an advisory body where advice is asked for, either by Governments or by the many special international organisations which have recently sprung up. The list of resolutions passed at each meeting may appear meagre to those who do not realise that they represent only the crystallised results of the discussions which have come to an issue, and that it often takes a considerable time before questions can be presented in a sufficiently definite form to admit of treatment by an international committee which can only meet at rare intervals; but those who have watched the proceedings of the association do not doubt that it has justified its existence, and that there is an important future before it.

That part of the association's work which prevents the overlapping of international enterprises has been illustrated in Rome by the manner in which the proposal of the Swedish Academy to take international action towards the prevention of the diseases of cultivated plants was dealt with. Everyone agreed that the subject was a most important one, and fell within the province of the association, but there is in Rome an International Agricultural Institute, which might be expected to include remedial measures against the diseases of plants within its range of activity. Apparently, however, there are difficulties which hitherto have prevented the Agricultural Institute from attacking the problem; these are partly financial, but partly also due to the terms of the convention under which the institute was founded. After a full discussion, the representative of the Swedish Academy accepted the following resolution, which was proposed by Colonel Prain, one of the representatives of the Royal Society:—

"The International Association of Academies of Science, while in entire sympathy with the proposal that further international cooperation in the study of plant diseases is necessary, considers that the question of deciding what ought to be done in the direction of combating these diseases might appropriately be entrusted to the International Agricultural Institute.

"In the event of its being found that the terms of the convention of 1905, under which it was established, prevent the International Institute from extending its activities so far as is desired in the interests of science and agriculture, this association recommends that the constituent academies bring to the notice of their respective Governments the desirability of conferring adequate powers upon the International Agricultural Institute."

A further question in which the association endeavoured to prevent a possible overlapping of enterprises arose out of the proposal to give the support of the association to an international committee formed to prepare tables of "physico-chemical" constants. Here a consultation with the International Scientific Catalogue Committee seemed advisable, and the following resolution was adopted:—

"The International Association of Academies gives its patronage to the International Committee of Physico-chemical Tables, and expresses the wish that this committee put itself into communication with the International Committee of the Catalogue of Scientific Literature."

The coordination of international scientific work which results from the extension of the patronage of the International Association of Academies to different independent enterprises is an effective method which deserves to be further extended. The International Union for the Study of Solar Phenomena has set a good example in this respect by asking the Association of Academies to nominate one of the three members of its executive committee. Prof. Riccò, of Catania, was nominated two years ago as the member representing the Accademia dei Lincei when that body became the leading academy, and he will hold office until the end of the year, when a new member will be nominated by the academy which will next act as host to the International Association.

The scientific questions which are dealt with by the association are frequently handed over to autonomous committees which regulate their own proceedings and act very much like independent international bodies. All that appears at the meetings is a short report summarising the activity of the committee. One of these committees deals with the investigation of the functions of the brain, and works under the chairmanship of Prof. Waldeyer, of Berlin. The work of a number of institutes specially endowed in different countries for the study of this question is thus coordinated, and a more rapid progress is secured.

A very useful piece of work has been undertaken at the instigation of the Royal Society, with the object of introducing order into the chaos which reigns at present in the nomenclature of prominent features on the surface of the moon. The advice of all astronomers interested in the subject has been obtained, and a committee has been formed, under the presidency, first of M. Loewy, and since his death of Prof. Turner. Maps of the moon are being drawn by Mr. Wesley from maps supplied by the Paris observatories, and the details of the nomenclature, according to a definite scheme agreed upon, will then be prepared by Messrs. Saunders and Franz.

Questions which are of importance in the general theory of terrestrial magnetism have been under the consideration of a special committee almost since the foundation of the association. The general magnetic survey of the ocean basins which is being carried out by the Carnegie Institution of Washington is expected to prove of fundamental importance in this respect, and the work of the committee is dormant at present until that survey is more generally advanced.

The association has further interested itself in the publication of the collected works of Leibnitz, which is being promoted jointly by the Academies of Paris and Berlin, and in that of Euler's works, which has been undertaken by the Société helvétique des Sciences naturelles. The association has more especially approved at its recent meeting the decision to publish all memoirs in their original language. It may seem strange that such approval should be necessary, but it was called for by attempts that had been made to persuade the Swiss society to translate the Latin writings into a modern language.

A few words should perhaps be said on the literary side of the work of the association. The subjects dealt with included the preparation of an edition of the "Mahâbhârata," and of an "Encyclopædia of Islam," of Greek documents, and of a "Corpus Medicorum Antiquorum"; further, the very difficult question of an international exchange—by way of loan—of manuscripts belonging to public libraries.

That a young association should still have to devote a considerable part of its time to matters of organisation is not surprising, and there is one question which is likely to occupy its attention very seriously before a definite conclusion is reached. At present the association has no legal status, not being subject to the laws of any country. It cannot, therefore, accept any legacies, and it is rumoured that it has lost in consequence a very considerable sum of money. The simplest manner to overcome the difficulty would be to establish a domicile in some country, such as one of the smaller States of Europe. It is claimed by some that other advantages would accrue to the association if it had a definite home, and its business matters could no doubt be carried on in a more satis-

factory manner; but at present there is still too wide a divergence of opinion to render a definite proposal generally acceptable. In order to evade the difficulty at present preventing the association from having funds of its own, the committee of the association, at a meeting held last year, at which nearly all the academies were represented, passed a unanimous resolution recommending that the different academies should declare themselves ready to accept legacies or gifts to be held in trust by them for the purposes of the association. When this resolution came up for discussion at the present meeting, objections were raised by several delegates, and the matter had to be referred to the several academies for an authoritative expression of opinion. Doubts were expressed in several quarters whether it would be advisable for the association to be in possession of funds, and at any rate one delegate thought that it would be more powerful if satisfied with its present "moral" force. Time, further reflection, and the force of circumstances will no doubt lead to a generally acceptable solution.

By the admission of the Société helvétique des Sciences naturalles, which was decided upon almost unanimously, the association has established the important, and, I believe, wise, principle that it attaches greater importance to the representation of countries in which important work is being done and of societies which take a leading part in such work than to the more or less exclusive tests of membership which a society may adopt. The Swiss society is not an academy in the old and perhaps proper sense. It may be the poorer for having no mediæval traditions, but it is the richer for not having adopted, without such traditions, a mediæval organisation.

Our association now consists of twenty-one societies, and fears have been expressed that our work would become more difficult if the number were to be increased substantially. These fears are not, perhaps, groundless, if the addition of a new society does not mean the inclusion of new interests and of independent directions of activity. Now, if we look at the proper balance of representation of such independent scientific activity, it seems altogether anomalous that the British Empire should only be represented by the Royal Society and the British Academy. The non-representation of India more especially denotes a gap which should be filled without delay. Both on the literary and on the scientific side our work has dealt with matters in which India is directly concerned. The publication of the "Mahâbhârata," more especially, cannot be carried out without substantial help from India, and at the present meeting in Rome it was announced that several of the Indian native rulers have subscribed to the undertaking. In the Asiatic Society of Bengal, India possesses a society of full academic rank, and without it the International Association of Academies is not complete. Some formal changes in its organisation, the dropping of the word "Bengal" from its title (I understand that its inclusion was purely accidental and not originally intended), and an increased activity on the scientific side may be desirable, but even with its present organisation there is no reasonable doubt that a proposal coming from the Royal Society to add the Asiatic Society to the list of academies forming the union would be generally welcomed.

In his introductory speech, Prof. Blaserna made a feeling reference to the death of King Edward, and several of the festivities prepared in honour of the meeting were modified in consequence of the Court mourning. A state dinner which the King had intended to give was changed into a private reception of the delegates, and in place of a garden-party arranged for by Queen Margherita, the Queen entertained the delegates informally one afternoon at her palace. Soirées were given by the Syndics of the City of Rome in the Museo Capitolino, by Prince Teano and by Countess Lovatelli, but these were, as a matter of course, not attended by the British delegates. An interesting excursion by motor-car to Ostia, including a visit to the important excavations which are being carried out in that locality, concluded the meeting.

ARTHUR SCHUSTER.

HALLEY'S OBSERVATIONS ON HALLEY'S COMET, 1682.

IN the record-room at the Royal Observatory, Greenwich, are preserved nineteen manuscripts of Edmund Halley. In one of these, Halley's original observations of the comet afterwards called by his name were recently discovered by Messrs. Davidson and Burkett. The book is of about octavo size; it appears to have been originally a college notebook. On the cover Halley has written "Edmund Halley his Booke and he douth often in it Looke." Part of the book contains neatly written notes (in English) on geometrical conics, with carefully drawn figures, chiefly written on alternate pages. The observations (in Latin) and calculations have been jotted down subsequently wherever there is room, and in many cases have been written over the original contents of the book. By a strange coincidence (it can, I think, be no more than a coincidence) the observations, now identified as those of Halley's comet, are interspersed among notes on the parabola.

It will be recalled that Halley's researches which led to his discovery of the periodicity of this comet were not made until about twenty years after its appearance of 1682; in fact, the law of gravitation was not published until 1686. It is, however, well known that Halley saw the comet, but I believe that details have hitherto been lacking.

The observations now identified are given below in full, with practically no changes, except that punctuation has been added. In the original, symbols are used for the days of the week and the signs of the zodiac. The observations, which must have been made with the naked eye, are almost entirely alignments with stars; they are, of course, too rough to have any scientific value now, but are of historic interest. Calculations to determine the R.A. of the comet from these observations are intermingled with them. Although the observations can hardly be correct to 15′, six-figure logarithms are used in the calculations! Halley, however, did not use his own observations in his determination of the orbit of the comet. The references to the "hand," "foot," "knee," "pastoral staff," &c., of Boötes are of some interest as illustrating the early method of specifying stars, based on the Almagest.

The year is not given, but as the observations are certainly those of Halley's comet, and the days of the week agree, we may supply the date, 1682.

Saturday, August 26, 7h. 29′. Culminante 277° A.R., Cometa visus in linea recta cum Arcturo et capite Ophiuchi; et ex altera parte cum Corde Caroli et secunda caudæ Ursæ Majoris; vel linea recta a cometa ad 1^{am} caudæ Ursæ Majoris relinquebat in consequentia stellam dictam Cor Caroli 30′ A.R.

Tuesday, August 29, 7h. 15′. Cometa in linea recta cum Arcturo et medium inter duas precedentes Coronæ, item in altera linea per Cor Caroli quæ relinquebat in conseq. stellam in radice caudæ Ursæ Majoris 30′; item in altera per genu præced. Bootis et medium inter contiguas dorsi; item in altera per genu sequens et med. inter 3^{am} et 4^{am} Serpentis. Ascent. Recta Cometæ 198° circiter.

Wednesday, August 30. Culminante 280° A.R., visus est Cometa in linea recta quæ transiens genu præced.

Bootis relinquebat 15′ ad ortum [? orientem] stellam humeri præced. Bootis; altera recta ducta per Cometam et genu sequens Bootis transivit medio loco inter 2^{am} et 3^{am} Herculis; et parum forsam 20 minuta reliquerat rectam per Arcturum et 8^{am}. . . .

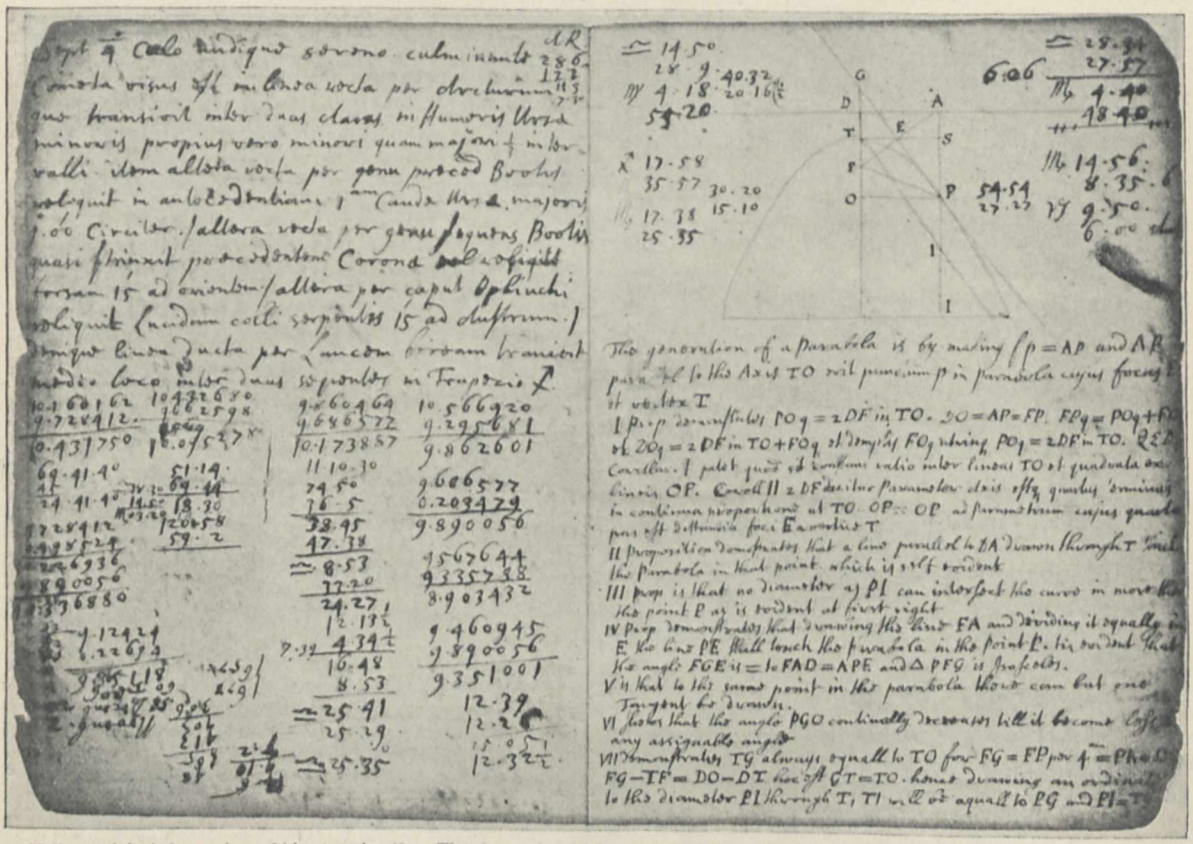
Thursday, August 31. Cometa in linea recta cum crure præced. Bootis et cubito sinistræ manus. Hinc nubes Horizonti vicinæ Cometam excepere.

September 4. Cælo undique sereno, culminante 286° A.R., Cometa visus est in linea per Arcturum quæ transivit inter duas claras in Humeris Ursæ Minoris propius vero minori quam majori $\frac{1}{3}$ intervalli; item altera recta per genu præced. Bootis reliquit in antecedentiam 1^{am} caudæ Ursæ Majoris 1° 00′ circiter; altera recta per genu sequens Bootis quasi strinxit precedentem Coronæ vel reliquit forsam 15′ ad orientem; altera per caput Ophiuchi reliquit lucidem colli Serpentis 15′ ad clustrum; denique linea ducta per Lancem Boream transivit medio loco inter duas sequentes in Trapezio Sagittarii.

September 8. Jam statim occasurus, Cometa videbatur

observations. No record is made of an observation on September 10; but in Flamsteed's "Historiæ Cælestis" there is a note that it was seen through a gap in the clouds by Dr. Halley on this date, but could not be referred to stars, after which, on account of its nearness to the sun and increasing south declination, it was not seen again.

A. S. EDDINGTON,
(*For the Astronomer Royal*).



Halley's original observations of his comet in 1682. The observations of September 4, 1682, with their reductions, occupy the left-hand page: the right-hand page contains notes on the parabola.

in linea recta ducta per Lancem Boream et medium cap. Sagittarii; itemque in altera per Arcturum, quæ reliquit in consequentiam præcedentem in manu Bootis 50′ circiter; videbatur estimatione Libra 29° 40′.

September 9. Eadem hora visus Cometa in linea recta per Lancem Boream quæ transivit grad. unum infra dextrum genu Ophiuchi; itemque in altera per crus sequens Bootis, quæ transivit medio loco inter superiorem colobori et caput Bootis; item linea ducta per Arcturum medio erat loco inter præced. manus Bootis et ult. caudæ Ursæ Majoris.

A page is torn out at the beginning of the book which may have contained observations prior to August 26. There is a note in Halley's handwriting on the inside of the cover, "August 16, primum visus ad initium Leonis," which evidently refers to this comet, but need not necessarily refer to his own

SOME NEW ORNITHOLOGICAL WORKS.[1]

(1) "THE Home-life of a Golden Eagle" is a valuable contribution to the history and psychology of birds. It reminds one of the daily entries in the hospital ward-schedule of an interesting maternity case, by the medical officer in charge, to whom, unseen, have been revealed instincts of mother and child which would never be displayed during the ordinary visitation. Mr. Macpherson is to be heartily congratulated on the completeness of his record, and on the dogged perseverance with which

1 (1) "The Home-life of a Golden Eagle." Photographed and Described by H. B. Macpherson. Pp. 45+32 mounted plates. (London: Witherby and Co., 1909.)

(2) Bulletin of the British Ornithologists' Club. Edited by W. R. Ogilvie-Grant. Vol. xxiv., Report on the Immigrants of Summer Residents in the Spring of 1908; also Notes on the Migratory Movements and Records received from Lighthouses and Light-vessels during the Autumn of 1907. By the Committee appointed by the British Ornithologists' Club. (London: Witherby and Co., 1909.)

(3) "Catalogue of Canadian Birds." By John Macoun and James M. Macoun. Pp. viii+761+xviii. (Ottawa: Government Printing Bureau, 1909.)

(4) "The Birds of the Leeward Islands, Caribbean Sea." By C. B. Cory. (Chicago: Field Museum of Natural History, 1909.)

(5) "Birds of Illinois and Wisconsin." By C. B. Cory. (Chicago: Field Museum of Natural History, 1909.)

he carried out his observations under weather conditions of the most trying and discouraging sort. Wind, rain, sleet, and intense cold companioned him throughout the—"unbrokenly wet and gloomy"—period of investigation—from April to July.

The eyrie where this royal mother established her nursery was situated on a narrow ledge of rock, 200 feet perpendicularly above a stream "in a dark gloomy corrie in a wild deer forest"—which, with excellent circumspection, the author does not more definitely locate—"in the heart of the Grampian range," into which "the sun penetrates for a few short hours during the long summer day." Here, with the aid of a very sympathetic stalker, the recorder constructed, within a few yards of the nest, a "bothy" as an observatory, so well disguised that it deceived the "eagle eyes" of the parents—into which he could just crowd himself and his cameras. From April 23, 1909, when the mother eagle was found sitting hard on two eggs, to the end of July, eleven weeks in all, we are made partakers, with Mr. Macpherson, of the most intimate privacy of the home-life of a member of a very exclusive set of bird society, and see every domestic incident performed naturally, and not through fear or suspicion, or under the distraction of an intruder. We feel, therefore, at the close of our vigils, that there is little we do not know about the upbringing of a prince of the avian blood royal, and the parental care and solicitude of the hen-eagle towards her offspring. About May 13 two eaglets were hatched; but one having mysteriously disappeared, the fortunes of its brother alone form the burden of this history.

It would be unfair to the author to extract, as one is tempted to do, the more intimate and touching episodes from his well-told story. Every ornithologist will desire to read this diary for himself in its entirety, unspoiled by disjointed quotations. He will follow with unflagging interest the mother eagle sheltering her downy chick; feeding him at regular hours during its tenderest days; comforting him with wonderful solicitude on the approach of a violent thunderstorm; teaching him—when about a month old—how to feed himself for the first time. The diverting manœuvres of the youngster, his games with himself, and his toilet operations as he grows older are interestingly recorded; how, also, after eight weeks old, when nearly as big as his parent, he began practising exercises by which he acquired strength in his wings and legs, and, in addition, a fierce hunger and vigorous appetite, which demanded a daily ration of two grouse, and the hindquarters of two full-grown hares; and, finally, how, under his mother's instruction, his tuition in aviation, which, every day, was preparing him by short flights for his fast approaching supreme adventure, when he must fare forth for the first time into space "on his own." Mr. Macpherson must allow us to quote his own account of the eaglet's last hours in the eyrie:—

Father and Child. From "The Home-life of a Golden Eagle."

"At length he stepped forward to the edge of the cliff and gazed intently upwards, at the same time uttering the low cheeping note with which he had always greeted his parents' return. . . . Then suddenly a dark form flashed up the corrie and his mother swung past on silent wings . . . and tried to tempt him from his fastness. But the Eaglet was unwilling to obey. . . . Again and again she hovered round, then a wild, weird cry rang echoing down the glen. For the first time I had heard the yelp of the adult Eagle, the voice of the Queen of Birds calling to her young. . . . The Eaglet cheeped continuously till . . . he flapped to the very edge of the abyss . . .

listening to her call. And now he, too, changed his cry, his voice seemed to break, and the adult yelp . . . burst from his throat. The Eagles called to each other, yelp answered yelp. . . . The young Eagle gazed around him . . . spread out his giant wings and vanished for ever from my sight among the ledges below. . . . The Eaglet had left the nest and had flown."

This record is illustrated by thirty-two beautifully clear plates, reproduced from the author's photographs, which are splendid achievements when the difficulties of the situation and of the weather are considered. In them the eaglet's history is depicted from the egg to the day when it takes flight from the nest. Plate 18, "Father and Child" (Fig. 1), is here reproduced by courtesy of the publishers as a specimen of the series, every one of which is worthy of the ornithologist's careful study.

(2) This is the fourth report of the Migration Committee of the British Ornithologists' Club, appointed in November, 1904, for the purpose of collecting and collating evidence regarding the arrival and dispersal within England and Wales of some thirty strictly migratory species which winter abroad and nest within these limits. These reports are based on the records supplied by voluntary observers on land and on off-shore lightships and lighthouses, who have filled up and returned to the committee schedules of questions issued to them. Each report deals with the spring immigration and the chief autumn movements of the scheduled birds, the one under notice being for the autumn of 1907 and the spring of 1908. It opens with a summary of the weather reports from March to May, 1908, the period covering the spring immigration. The second section details the chief movements observed at the lights during the same period, and indicates the moon's phase and the direction of the wind on each occasion. Next are discussed the schedules of the thirty-three species, individually, each accompanied by a map, on which are plotted the more important data of their arrival and dispersion. Supplementary to this, the main and important portion of the report, are recorded observations on birds not specially scheduled. The migratory movements of the autumn of 1907 are then dealt with, but we regret to find no meteorological notes associated with this section, in which the weather conditions have a special bearing on the causes which impel the birds to start on their autumn journey southwards. A statement of the days and nights on which migration was recorded at the lights between Spurn Head and the Bristol Channel during the autumn of 1907, and a list of the observers close the volume.

The report calls for little at this stage in the way of discussion, as it is not a final digest, but a further instalment of data towards the elucidation of the great mystery of bird-life, compiled with great care and labour, for which ornithologists generally will desire to offer their grateful thanks to the committee. Nor is there much in its contents deserving of criticism, except, perhaps, to direct the editor's attention to the rather irritating omission from the maps of the elucidatory legends which appeared on those of some of the earlier reports, especially as no explanation is given in the text of the various symbols employed in any of the maps in the report under review. In the two maps devoted to the "swallow," in the first report, for instance, we find that a date within a circle was employed as the symbol for "2nd migration" on the one map, as well as for "5th migration" on the other; while on that for "the nightjar" it stands for "main migration." In other maps the "5th migration" is represented by the date within a triangle. It would be a great advantage if in every map the same symbols were used to indicate the same migration. Failing this, those used in each map should be printed upon it. On the map devoted to the blackcap in this report (p. 74), we find circles, squares, ellipses, and parallelograms, with no explanation of their import, the sole legend being "M = May; all other dates are in April." Further, on consulting the letterpress of the schedule for the same bird (p. 75) we read, "the earliest arrivals were reported from Gloucestershire on the 10th, 14th, and 21st of March, and these were followed by a pair in Devonshire on the 28th"; yet on referring to its map we discover no entry for any of these dates in the shires named; nor is the bird's earliest appearance in Wiltshire, on April 6, indicated on it, yet that of the 13th is entered, although it is stated in both cases that "the great proportion of the records were of single birds." Again, the same species is noted at St. Catherine's light on April 10 and 11, and the date is plotted on the map unenclosed by a line; its occurrences for April 27–30 are surrounded by an ellipse, while the dates of birds arriving four days later are enclosed in a parallelogram; yet the two records can hardly, we imagine, be assigned to a separate migration. Without, therefore, a legend or explanations in the text it is difficult to follow comfortably the map entries, the plotting of which must cost much in time and in money. Indeed, it may be a matter for consideration whether, at this preliminary stage of the inquiry, they might not be dispensed with, without much loss, seeing that the "chronological summary" under each species supplies all, and more than, they do.

The time is yet far distant when a digest of the valuable records in this report and its three predecessors can be attempted. It does seem, however, that, unless simultaneous observations can be taken over a far wider area than a portion of the British Isles, the true solution of the intricate and baffling problem of migration will not be greatly advanced. Besides ascertaining the flight-lines of the birds arriving in or departing from England and Wales, the state of the weather and the abundance or scarcity of food at these periods, we want to discover whence the individual birds that reach us in spring started; where those that nest within our shores in autumn actually spend our winter; why they adopt the particular routes they do; why they hasten to "change their skies" now to the north, now to the south; if the same individuals and their young invariably follow the same route in going and returning; and if they and their young drop out of the migrating flock every year at the same places in order to "build and brood in their old haunts." The pressing need in the migration inquiry is for the systematic marking in very large numbers, not only of nestlings, but of old birds, in this country and on the Continent of Europe, during both the summer and the winter visitation, but also, which is equally important, of those that spend our winter in southern latitudes, and at various halting places of the ranges of the species from furthest north to furthest south, in the Asiatic, Euro-African, and the American continents.

If the mark attached to the birds were a small facetted ring of aluminium, a light metal which long retains its brilliancy, it would often attract the eye by flashing in the sun, and thereby many birds would be detected as marked individuals by interested or chance observers on the look out for them, in districts especially where such labelling was known to have taken place. The birds could then be followed up, temporarily captured for their mark to be recorded, and then liberated, and the record thereafter promptly published. Until some such united action and extended system for identifying the movements

of individual birds—their actual routes of travel, their retreat during our winter, and their home in our spring and summer—is adopted, there appears little hope of our ignorance of the mystery of migration being quickly or greatly dissipated. We suggest this subject for consideration at the approaching International Ornithological Congress in Berlin.

(3) The "Catalogue of Canadian Birds," by the Macouns, father and son, is an endeavour, successfully carried out, "to bring together facts on the range and nesting habits of all birds known to reside in, migrate to or visit the northern part of the continent," including Newfoundland, Greenland, and Alaska. The authors enumerate 768 species as the avifauna of the region indicated. There is a full account of the distribution, nesting habits, and migration of each species, with many interesting notes on their habits and life-history. An introductory note by the director states that the present volume is an enlarged and to a great extent re-written edition of a previous catalogue, in three parts, which became exhausted immediately after publication. This is excellent evidence, not only of the interest taken by the public in the birds of their own country, but of the value to ornithologists generally of the work, for which we have nothing but commendation—except to say that it deserves a better binding—and to express the hope that the same fortune may be in store for the present edition which attended its predecessor.

(4 and 5) These two volumes belong to the series of publications being issued by the Field Museum of Natural History in Chicago. Both are by Mr. C. B. Cory, the curator of the Department of Zoology. The first of these, on "The Birds of the Leeward Islands," enumerates all the species inhabiting Aruba, Curaçoa, Bonaire, Islas de Aves, Los Roques, Orchilla, Tortuga, Blanquilla, Los Hermanos, the Testigos, and Margarita. The collections were chiefly made by Mr. J. F. Ferry and Dr. N. Dearborn. Each island is dealt with separately, the list of birds from each being prefaced by a short account of the island and a list of its ornithological literature. Dr. Hartert, now of Tring, had previously visited the larger islands of the group, and has described in detail their avifauna in the Hon. Walter Rothschild's *Novitates Zoologicae*, and in the *Ibis*, so that in few of them were there many novelties to be expected. Nevertheless, five new species and three new subspecies were discovered, chiefly on the smaller islets which Mr. Cory's energetic collectors were the first to visit.

Mr. Cory's second book is a much more pretentious volume, and includes, "as far as known, all species and subspecies of birds that occur in Illinois and Wisconsin," the total number being 365 (not 398, as stated in the preface), with descriptions of their various plumages, nests, and eggs, and geographical distribution, together with more or less brief biographical notes concerning them. It is more, however, than an avifauna; it is, in addition, an ornithology for less advanced students. The book is divided into two parts, the first devoted to a key to the families and species, and the second to biographical notes on the species. No fewer than 274 pages are given to the key, which is constructed on a series of highly artificial characters. In the first place, the birds are divided into two great divisions—water birds and land birds. In the former, Mr. Cory includes landrails, herons, golden plovers, and peewits (because they may sometimes be found feeding near water!); yet ospreys, sea-eagles, and kingfishers, which find their food chiefly in that element, are classed as land birds. The collector with a bird in his hand must first decide whether it is a land or a water species, and, having determined this (not, perhaps, as Mr. Cory would), he must, in order to run down the family, enter tables prepared for him according to the length of the wing. "A large series of specimens has shown," says Mr. Cory, "that while adult birds of the same species differ considerably in length, the wing measure is very constant." Recent investigations have, however, showed this statement to be far from true. Wings vary greatly, not only in actual length in different individuals of the same species, but the wing feathers, the primaries, for instance, vary in length in different proportions. Even Mr. Cory's tables show this. The species *Passerherbulus* (!) *caudacutus nelsoni* is to be found in a group with wings from 1·75–2·5 inches; also in a second, with wings from 2·15–2·37 inches long, as well as in a third, with wings from 2·37–2·75 inches! Examples of the same sort are numerous. Another species appears in one group as having "belly clear yellow"; in a second with "underfronts yellow or greenish yellow," and in a third with "under-parts pale greenish yellow."

A curious error occurs on p. 114, where an illustration entitled "first *five* primaries emarginate: Bald eagle," is drawn with *six* primaries! The author here adheres also to a method of enumerating the primary quills which has long been given up by all modern ornithologists, who number these feathers from the carpal-joint outwards, and not from the point of the wing inwards.

The second and really valuable portion of the work deals with the history of the 365 species found in the two States, in which the very numerous (and excellent, be it said) illustrations appearing in the key are all needlessly repeated, thus adding greatly to the cost and to the bulk of the book. The volume is beautifully printed on a fine-surfaced paper, and is worthy of a better binding than the flimsy paper covers in which it is issued; but it would be greatly improved by having the system of keys to the families and species remodelled and much condensed.

PORTUGUESE ZAMBEZIA.[1]

FOR the pictures alone this book is worth purchasing. We have rarely seen in any similar work dealing with Africa a better collection of admirable photographs which are apt illustrations of the text. The book is not written round the illustrations, nor are these photographs stuck into the work without relation to its text and purport. If Mr. Maugham had further confined himself in his text to his own personal observations of this relatively vast region of Portuguese Zambezia, and to his own theories based on his personal observations and experience, there would be nothing in the book to criticise unfavourably. But he has conceived it necessary to borrow largely from the works of other writers, borrowings which he frankly acknowledges in the preface, but which, one might plead, were quite unnecessary to his purpose in view.

Somehow or other, a mischievous idea has spread amongst many writers on Africa of late years that it is not sufficient for them to relate their own experiences and to describe a portion of the country they have visited, but that their work must make an attempt at being encyclopædic. If they write as historians of their own personal researches, then they feel obliged to give summaries of linguistics, natural history in general, or botany, which they extract from already published works, and again set forth either

[1] "Zambezia: a General Description of the Valley of the Zambezi River, from its Delta to the River Aroangwa, with its History, Agriculture, Flora, Fauna, and Ethnography." By R. C. F. Maugham. Pp. xiv+408; with maps and illustrations. (London: John Murray, 1910.) Price 15s. net.

as due to their own original research, or, quite fairly (as does Mr. Maugham), as the work and conclusions of other people. But in this transposition, not having sufficient technical knowledge, perhaps, they allow themselves or their printers to mar these summaries with ridiculous mistakes in names, English or Latin, or they repeat the few errors of the persons from whom they borrow. Mr. Maugham does more. He adds a little acid to his work by recounting the theories of his predecessors or fellow-travellers (and very often misinterpreting them in the repetition) and then holding them up to ridicule; while at the same time it is patent to a specialist that he has not taken the trouble to understand what appears to him absurd. I pointed out the same tendency in an earlier work of his, in which he chose—one does not know why—to ridicule theories of the origin of the Bantu languages set forth by English and German philologists, while by his own confession (and certainly by the evidence in his text) he was without special knowledge of the subject.

If it were not for this desire on his part to have a dig at all and sundry who have at one time or another written on the countries of South-East Africa, he would have given us a most agreeable, as well as a most interesting, book; for when he confines himself to his own researches and observations he arouses the interest of the reader and secures the adhesion and respect of those who know Africa as well as he does, or even better. The reader's attention should be directed to the author's sensible remarks on pp. 157–9, as to the proportions of the European hold over the southern half of Africa. These should be a corrective to any excessive exultation. In several directions also he renders service to the very few persons in the United Kingdom, and to the three or four individuals in the southern half of Africa, who are foolish enough to care for the preservation of big game and of interesting birds and beasts. He points out with absolute truth the nonsense of the theory that connects the spread of the Glossina tsetse-flies with the abundance of big game: the theory which is quoted by the officers of the British South Africa Company, and of other great companies controlling South Central Africa, and by the thousands of "sportsmen" now swarming over Africa and slaying everything right and left, as their justification for spurning game regulations and mocking at the attempts of a few "fanatics" who think that at any rate a selection of the big and interesting wild beasts might be preserved for the intelligent appreciation of later generations. He cites this example of the falsity of the theory.[1] There is a considerable region of desolate country lying between the west bank of the Shiré River and the north bank of the Zambezi up to the vicinity of Tete. In this district, across which passes the Cape-to-Cairo telegraph line, there are few human inhabitants, and there is absolutely no wild game. Yet here the tsetse swarms, as it does, possibly, nowhere else in Africa; in fact, its extraordinary abundance has driven away most of the human inhabitants because they have found it impossible to keep any form of domestic animal. Now, if this district swarmed with game, one would be justified in supposing that by destroying the game one might drive away the tsetse. But apparently the Glossina flies have made life unbearable for all creatures that do not fly or burrow in the ground, and yet they continue to swarm.

Mr. Maugham, however, is not always consistent in his desire to create a little tolerance for the existence of beasts and birds, not as yet of interest to South African settlers or sportsmen. He says contemptuously that "the rhinoceros will have to go," but gives no justification for such an utterance. To the intellectual interests of the world the two forms of existing African rhinoceros are quite as important as (let us say) the moderate prosperity of a few European settlers.

But, of course, the only proper solution of this question in Zambezia, as well as elsewhere, is the marking off of game preserves which shall grow by degrees into national parks, and shall harbour and sustain the wild fauna. In the intervening regions the land must be given up to exploitation by man, black or white, and any game straying beyond the reserves should receive no protection. But, of course, the

Zambezian Goldsmiths: and Huts built upon Piles. From "Zambezia."

[1] Further support is given to his remarks in the very interesting article on the flora and fauna of Ngamiland (by Major Lugard) just published in the Kew Bulletin and deserving special notice.

farce of the "reserve" system at present is, first, that the local white and black population do not obey the law, and the local authorities seldom enforce it, and second, that the Government is somewhat too ready to set aside the law in favour of distinguished sportsmen.

In no book which the reviewer has yet seen have the great beasts, the landscapes, and the people been more admirably photographed than in this work on Zambezia, while at the same time due justice is done to the Portuguese towns, the Portuguese officials, and generally to such civilisation as Portugal has been able to introduce into these lands.

H. H. JOHNSTON.

PELLAGRA AND ITS CAUSE.

A GOOD deal of notice has been taken lately in medical journals and in the newspapers of the disease pellagra. It is difficult for British folk to realise the scourge this disease causes in many countries, but chiefly in Italy, Roumania, Spain, Tyrol, and other countries in south-eastern Europe. In the United States of America, pellagra has spread recently to an alarming extent, and in several British colonies and protectorates, markedly the West Indies and Egypt, pellagra is a serious ailment. Persons who contract the disease present a train of symptoms which may be summarised as follows:—"sunburning" of face, neck, chest, and hands is an early and very prevalent manifestation; stomachic and intestinal catarrh; feverishness; skin rash; lassitude and weakness. Spring and autumn recurrences continuing for years further tend to mental excitement and bodily weakness, leading all too frequently to lunacy and a fatal issue.

The disease has hitherto been attributed to eating damaged maize, which is so largely consumed as "polenta," the "porridge" of Italy. In the United States maize is termed Indian corn, and under various names it is used in many countries. In 1905 Dr. L. W. Sambon, at a meeting of the Tropical Section of the British Medical Association, criticised the accepted theory, pointing out that pellagra did not seem to be a food disease or due in any way to unsound maize, but that in all probability it was due to a parasite—a protozoon. Dr. Sambon supported his theory by arguments based upon the well-established priniciples applicable to protozoal infections, and put in a form which appealed to men of science. His theory gained adherents until it gradually came to be considered a duty to humanity and to science that the question should be fully inquired into. With this object in view, a Pellagra Investigation Committee was formed in London by Mr. James Cantlie, and Dr. Sambon was sent to Italy on March 20, 1910.

At present the field commission in Italy, consisting of Dr. Sambon and his assistants, is engaged in inquiring into the epidemiology of pellagra. Many pellagrous districts in northern Italy have been visited and the banks of the streams searched for possible carriers of the disease. The field commission has come to the conclusion that pellagra occurs amongst the cultivators and not amongst the consumers of maize; that it is the agricultural labourer, not the town dweller, who suffers from pellagra, and that it is whilst working in the field that the labourer becomes infected. In a telegram dated Rome, May 13, and published in the *Times*, May 14, Dr. Sambon states that it "has been definitely proved that maize is not the cause of pellagra." In addition the telegram assures us that "the parasitic conveyer is the *Simulium reptans*." The Simulium is a species of fly commonly called a "sandfly"; its larvæ are met with on the rocks and stones along the streams in pellagrous countries, and Dr. Sambon seems to connect this fly with the spread of pellagra.

So far as we know, Dr. Sambon has not found the parasite, nor is there direct proof that the Simulium is the actual carrier. That he has found cause for the statement that eating maize is not the cause of this disease is highly probable, for several men of science, such as Babes (Roumania) and Alessandrini (Rome), have declared in favour of Sambon's theory, and have been working on the lines suggested by him for the elucidation of pellagra. Even with the announcement above quoted, stating what work has been done, there is much yet to do. Questions of the kind are not settled in a day, and it may take years of inquiry before we have finally settled what Dr. Sambon has so well begun.

The fact that it is a duty to humanity and to science that pellagra should be investigated does not provide the necessary money, and the committee in London has endeavoured to keep the inquiry going by appealing to friends to help. So far some 245*l.* have been actually collected, and further sums have been guaranteed; but even should the Government favour the work by contributing the 150*l.* which the committee was led to believe might be the case, the sum is quite inadequate, and unless further donations are speedily to hand the field commission must be recalled from Italy in a fortnight. Sir Lauder Brunton, Bart., is the chairman of the committee; Prof. F. M. Sandwith vice-chairman; the bankers are the London and South-Western Bank, Great Portland Street branch; and donations may be sent to the treasurer, Dr. Clement Godson, 82 Brook Street, W., or to Mr. James Cantlie, 140 Harley Street, London, W., honorary secretary, Pellagra Investigation Committee.

NOTES.

FOR some time past a scheme for the distribution of time signals by wireless telegraphy has been mooted with the view of assisting navigation and for the determination of longitude. The Eiffel Tower in Paris and the summit of Teneriffe have been proposed as suitable sites for the emission of these signals, and we now learn that the plan for which M. Bouquet de la Grye and Commandant Guyou are more especially responsible is so far complete that the first signals were dispatched from the former station at midnight on May 23. The Paris correspondent of the *Morning Post* states that Paris time was transmitted from the observatory by way of the Eiffel Tower by wireless telegraphy to all wireless stations and ships fitted with wireless apparatus within a radius of between 2500 and 3000 miles. The system is an automatic one, and a Morse sign is sent into space first at midnight, again two minutes after midnight, and, finally, four minutes after midnight. Thus, steamers furnished with wireless telegraphic apparatus will no doubt be placed in a more favourable position, but the suggestion that has been made in some quarters, that chronometers can be dispensed with, seems premature. The receipt of a signal will not enable a ship to determine its position or even its longitude. All it will do is to give the error of the chronometer. The ship's officers will not be able to forgo the use of Sumner lines and other devices, and for these the knowledge of local time and the use of a ship's chronometers will be convenient. It may be desirable to point out here what is the kind of error in longitude to which in these days of accurate navigation a ship is liable, or what is the

amount of error which the employment of telegraphic signals can correct. Of course, the error accumulates with the time at sea, but a ship that carries three chronometers, the usual number in a well-found ship, should not after 100 days be in doubt about the longitude by a greater quantity than twenty seconds; usually it is much less. At the equator this would amount to an uncertainty of about five miles, in the longitude of Paris correspondingly less; but the number of time signals scattered over the world is now so large that every steamer has the opportunity of correcting its chronometers much more frequently than is suggested here. While, therefore, we welcome every advance which increases accuracy and demonstrates the value of scientific application, we cannot consider that the practical benefits of the scheme will be immediately apparent.

MR. J. B. TYRRELL has been elected president of the Canadian Institute, the oldest scientific society in Canada.

WE regret to see the announcement of the death, on May 23, at eighty years of age, of Mr. J. B. N. Hennessey, F.R.S., late deputy surveyor-general in charge of the Trigonometrical Surveys, Survey of India.

IN consequence of the death of King Edward, the council of the Institution of Civil Engineers has decided not to hold a conversazione this year. The eighteenth "James Forrest" lecture will be delivered at the institution on June 22, at 8 p.m., as already announced.

PROF. R. W. WOOD, of the Johns Hopkins University, Baltimore, will spend the coming autumn, winter, and spring in England and on the Continent. He has accepted invitations to deliver the Thomas Young oration of the Optical Society and the Traill Taylor lecture before the Royal Photographic Society, and will arrive in London early in October.

ON Tuesday next, May 31, Mr. C. J. Holmes will begin a course of two lectures at the Royal Institution on "Heredity in Tudor and Stuart Portraits"; on Thursday, June 2, Major Ronald Ross will deliver the first of two lectures on "Malaria"; and on Saturday, June 4, Prof. J. A. Fleming will commence a course of two lectures on "Electric Heating and Pyrometry" (the Tyndall lectures).

THE King, on the recommendation of the Home Secretary, has approved of the reconstitution of the Royal Commission on Mines for the purpose of an inquiry into the health and safety of persons employed in metalliferous mines and quarries. The new commission will consist of Sir Henry Cunynghame, K.C.B. (chairman), Mr. R. A. S. Redmayne, Dr. J. S. Haldane, F.R.S., Mr. John S. Ainsworth, M.P., Mr. R. M. Greaves, Mr. R. Arthur Thomas, Mr. R. T. Jones, Mr. W. Lewney, and Mr. U. Lovett.

DURING the Whitsuntide excursion of the Geologists' Association to Swanage, Mr. John Newton obtained a well-preserved upper jaw of the small mammal Triconodon from the Lower Purbeck beds. The specimen was found in the fresh-water limestone above the well-known mammal-bed, which was carefully examined at two places in Durlstone Bay without success. It appears to be the first discovery of a mammalian fossil in the Purbeck beds since 1880, when Mr. Edgar Willett obtained the lower jaw of Triconodon now in the Museum of Practical Geology. Mr. Newton has placed the new fossil in the British Museum (Natural History), where it will be exhibited with the Beekles collection.

DURING the next few weeks the Somersetshire Archæological and Natural History Society will commence the excavation of the lake village at Meare, three miles north-west of Glastonbury. Besides interesting mediæval buildings, such as the Fish House and the Manor House, the parish contains the remains of a lake village much larger than that of Glastonbury. Trial excavations have already disclosed many interesting objects, and the thorough examination of the site will certainly prove to be of much importance in elucidating the history and antiquities of the late Celtic period, dating back a century or two before the Christian era. Assistance, which is much needed in support of the excavation fund, will be gladly received by the secretaries, Taunton Castle, Somerset.

THE series of aëronautical calamities which figures so prominently in the issue of the *Deutsche Zeitschrift für Luftschiffahrt* for April 20 is continued in the issue for May 4, where the destruction of the *Zeppelin II.* at Weilburg, and that of the Delitzch balloon, which was struck by lightning on April 6, are described and figured. In addition, there are figures and references to accidents to Rougier's and Chavaz's machines at the Nice aviation meeting, the former having fallen into the sea and been picked up by a steamer.

M. JACQUES DE LESSEPS, grandson of the engineer of the Suez Canal, crossed the English Channel on May 21 in a Blériot monoplane. Instead of a three-cylinder Anzani motor of 25 horse-power, such as was used by M. Blériot, M. de Lesseps employed a seven-cylinder Gnôme rotary engine of 50 horse-power. He started from Les Baraques, near Calais, at 3.40 p.m., and landed close to Wanston Court Farm, near St. Margaret's, at 4.17 p.m. According to the French Press, the crossing took thirty minutes, as compared with M. Blériot's thirty-one minutes' flight. M. de Lesseps reports that he travelled at a height of from 350 to 400 metres to avoid the fog, which obscured his view, and that he was unable to make use of a compass on account of the effect of the great vibration upon the instrument. By his successful flight M. de Lesseps wins the Ruinart prize of 500*l.* and the 100*l.* cup offered by the *Daily Mail* for the second airman to cross the Channel in the air.

IN an article on the London to Manchester flight (NATURE, May 5) reference was made to the desirability, now that the possibility of long-distance flights has been clearly demonstrated, of devising means for encouraging the pursuit of aviation without taxing the physical endurance of aviators or subjecting them to risks more than was necessary. From an article in the *Deutsche Zeitschrift für Luftschiffahrt* we gather that the arrangements made at the Nice aviation week afforded an excellent example of what could be done in this direction. In the first place, the long-distance flights were performed mainly over the sea between Cap Ferrat and Cap d'Antibes, where steamers were available (in the language of the *Zeitschrift*) to "fish out" any aviator who descended, and this actually happened to Latham; in the next place the prizes offered included a cumulative prize for the longest total distance covered, excluding individual flights of less than 5 kilometres, and prizes were also offered for the quickest flight performed on each day, the best start and the best landing, so that the chances of success were less dependent on meteorological conditions than they would have been if competitions at fixed hours had alone been provided for. That progress is being made in aërotechnics was shown by the fact that while at Berlin last year flights were only made when the wind velocity was less than 3 metres per

second, the anemometer at Nice often showed velocities of 7 to 10 metres per second without interfering with the flyers. It is interesting to note that the starting place was close to the mast where the late Captain Ferber made his early experiments. The writer also refers to the liberality of the citizens of Nice and others in contributing to the prize funds.

A spell of really warm weather occurred over the British Islands, and the weather report for the week ending May 21, issued by the Meteorological Office, shows that the shade temperature was everywhere above the normal, the mean for the period ranging from about 3° to 6° in excess of the average in different parts of the kingdom. The warmest district was the south-east of England, where the mean was 58°, and the absolutely highest temperature was 83°, at Hillington, in the east of England, on May 20. The lowest shade temperature anywhere was 37°, but slight frost occurred in the open in several places. The mean temperature of the sea was considerably higher than during the preceding week on many parts of the coast, and was generally higher than in the corresponding week of last year. The rainfall was mostly in excess of the average, and the aggregate measurement since the commencement of the year is largely in excess of the average, the excess being more than 3 inches in several of the northern and western districts. There was a good deal of sea fog and mist along the east and north-east coasts of Great Britain. Thunderstorms were very common in England, and rather so in Scotland and the south of Ireland. On May 20 and 21 they occurred over a wide area in Great Britain, and several persons were killed by lightning.

IN our issue of December 2 last full particulars were given of the eighth International Zoological Congress which is to be held at Graz (Austria) on August 15–20 next, under the presidency of Prof. Ludwig von Graff. We have received a second circular in connection with the congress which gives much practical guidance to foreign visitors. It is pointed out that as the most direct route to Graz is *via* Vienna, many of the scientific institutions of that city have made arrangements to receive foreign visitors during August 12 and 13. Arrangements are being made to secure a reduction of fares on the Austrian railways. The circular also provides full details of the numerous excursions which have been arranged. We may remind zoologists that all inquiries relative to the congress should be sent to the Präsidium des VIII. Internationalen Zoologenkongresses Graz (Österreich) Universitätsplatz 2.

IT is with great regret that we have to announce the death of M. Bernard Brunhes, the director of the observatory of the Puy de Dôme. M. Brunhes died at the early age of forty-seven, and had been in charge of the observatory for only the last nine years, but he brought to its administration a high reputation for capacity and industry, qualities which were recognised while a student at the Sorbonne, and had been further developed during his occupancy of important scientific positions both at Dijon and Clermont-Ferrand. Under his directorship the observatory won a prominent position for researches in the several departments of terrestrial magnetism, the physics of the earth's crust, and the exploration of the upper atmosphere. M. Brunhes will be particularly remembered for his researches in meteorology, in which mechanical contrivances could be employed to elucidate physical phenomena. With considerable ingenuity he discussed the mechanical action exerted by a horizontal current of air upon a whirlwind, having sinistrorsal and dextrorsal motion about a vertical axis susceptible of lateral displacement. Another subject which engaged his attention was the effect of a want of symmetry in the action of running water, as exhibited in the erosion effects upon opposite banks of rivers. His reputation must, however, rest mainly on the work of weather forecasting, to which purpose the activities of the observatory were chiefly directed. He held in scorn those who attempted forecasting without any knowledge of the general movement of the atmosphere, and on the occasion of the proposal of the sensational scheme for competition in weather forecasting, his denunciation of those who, to acquire a little brief notoriety, were willing to run the risk of bringing science into disrepute was both merited and timely. As a writer of scientific treatises intended to make science popular, he was exceedingly successful. In crystallography, terrestrial magnetism, and meteorology, his books have been welcomed as models of clearness and accuracy, while his latest work on "La dégradation de l'Énergie" has won a well-deserved approval.

THE scientific side of geographical exploration has suffered a severe loss by the death of Lieut. Boyd Alexander, in the Sudan, at thirty-seven years of age. From information received at the Foreign Office it appears that Lieut. Alexander was killed at Nyeri, about seventy miles north-east of Abeshr, the capital of Wadai, on April 2, a few days before the French troops met and defeated the native bands opposed to the French occupation of the country. Lieut. Alexander began his career as a traveller-naturalist in 1897 by an expedition to the Cape Verde Islands, and in the following year he made expeditions to the Zambezi and Kafue Rivers. In 1904 he visited Fernando Po, and made some valuable ornithological observations. His most important work, however, was accomplished during the Alexander-Gosling expedition of 1904–7, which crossed the African continent from west to east. One of the objects of this expedition was to study the distribution of the fauna between the Niger and the Nile from the point of view of zoological relationships between the west coast region and the Nile basin. The expedition mapped a large area, made systematic observations of the natural history and ethnology of the region traversed, and secured collections of great value to science. For this achievement Lieut. Alexander was awarded the gold medal of the Royal Geographical Society. Toward the end of 1908 he left England for further zoological and geographical explorations, and was in the German Kamerun Colony during the great earthquake in that part of Africa about a year ago, and the subsequent eruption of the Kamerun Mountain. He then passed to the Lake Chad region, and at the time of his death appears to have been making his way to the Nile by the north of Wadai and Dafur. It is greatly to be deplored that this adventurous journey has deprived science of an explorer and naturalist of such great distinction and promise.

WE learn from the *Builder* for May 21 that next year, in connection with her International Exhibition, Italy will inaugurate the great national monument to Victor Emmanuel, which has been a quarter of a century in building, and has cost an immense sum of money. By its importance, and, on the whole, by its artistic excellence, it is worthy of the patriot king. The breadth of the monument is 460 feet and its depth 480 feet. Standing on a spur of the Capitoline Hill, it is one of the most prominent objects in the City of Rome. On a lofty pedestal in the midst of a stately lay-out of steps and terraces stands the colossal equestrian statue of "il ré galant'uomo" by Enrico Chiaradia. It is approached from below by a stair 130 feet wide in four flights of convex plan, and as a background it has a gigantic

colonnade of concave plan backed by a wall parallel to it. At either end of this are square open halls decorated internally with coloured marbles, and supporting quadriga groups. Among the many works of sculpture by Italian artists is a fine series of statues personifying the provinces of Italy—Latium, Lombardy, Venetia, and so forth. The architect was Count Giuseppe Sacconi, who died in 1906 without having seen the completion of the monument.

IN the *Cairo Scientific Journal* for February Mr. Harold Sheridan gives an account of that curious musical instrument, the *rabâba*, which was introduced into Europe by the Crusaders, and, with a slight modification of the original name, is now known as the rebeck. It has certainly been evolved from the one-stringed lyre of the early monuments, the single string twanged with the finger developing into the present double-stringed instrument played with a rude bow and provided with a body. Even in its present state it is a most primitive instrument, made up in the rudest way out of a long iron nail, a cocoa-nut, a few strands of horse-hair (that of the living animal being most in request), a piece of fish-skin, and sundry pieces of wood. The last are coarsely glued together, and the body is made of half the cocoa-nut, over which a piece of moist skin—that of the Nilotic fish known as the *bayad*—is tied tightly until it dries. The tone is regulated by incisions made in the body, those being most numerous when the tone is intended to be loud, and this is further regulated by moving the bridge. The *rabâba* is thus of considerable interest as marking an early stage in the evolution of the modern violin.

A MEMOIR issued in the Eugenics Laboratory Series (Dulau and Co.), by Miss Ethel M. Elderton, assisted by Prof. Karl Pearson, discusses the influence of parental alcoholism on the physique and ability of the offspring. The memoir is based on two series of data, the one contained in a report of the Edinburgh Charity Organisation Society, the other in an unpublished report, by Miss M. Dendy, on the special schools of Manchester, and relating only to families in which one child was sufficiently defective to be educated in such a school. Very little trace of any unfavourable influence of the parental alcoholism is found. The mean heights and weights of the children of sober parents are, on an average, slightly greater than those of the children of alcoholic parents, age for age, but the difference is extremely small, and the general health of the children of intemperate parents appears to be rather the better of the two; cases of tuberculosis and of epilepsy are stated to be markedly less frequent than amongst the children of sober parents. No marked relation of either sign is found between parental alcoholism and the intelligence of the child. The data of the Edinburgh report as regards the extent of parental alcoholism are rather remarkable. A school of a "widely representative character" was chosen for investigation, and the fathers of more than half the children in this school, and the mothers of more than one-third, are classed under the headings "drinks" or "bouts," *i.e.* are judged to be drinking more than is good for them or their homes.

ACCORDING to the report for 1909, the Field Museum at Chicago extended its operations, and at the same time largely increased its collections, by the dispatch of expeditions to Tibet, the South Sea Islands, and the Philippines, and smaller parties to Guatemala, New Guinea, Fiji, &c., while important collections have been acquired by purchase from Egypt and New Guinea. To make room for these, obsolete and unsatisfactory specimens have been removed from the exhibition galleries, while economy of space has been gained by re-arrangement of the store-collections. Among striking additions to the public galleries, special reference may be made to the Tonopah meteorite from Nevada, weighing nearly two tons, to a pair of African elephants mounted in striking attitudes, and likewise to a fine male gorilla.

AFTER mentioning his regular attendance, when Prince of Wales, at the meetings of the trustees at the Natural History branch of the British Museum, the *Field* of May 14 states that in the early 'nineties, when Sir William Flower commenced to replace the old specimens in the mammal galleries by well-selected examples of modern taxidermy, the late King gave instructions that a series of rats, rabbits, and hares should be trapped on the Sandringham estate and forwarded to the museum, and it is these by which the species are still represented in the British saloon. To the late King the museum is also indebted for the skull and the mounted heads of three Spanish draught oxen, an Indian wild boar, and, in some degree, the makhna (tuskless) male Indian elephant, Jung Pershad. King Edward's last gift to the museum was the skeleton of Persimmon. The only specimen in the bird gallery presented by his late Majesty, when Prince of Wales, is a fine Reeves's pheasant, shot in the Sandringham coverts in 1890. It was, however, at the late King's suggestion that Mr. Andrew Carnegie presented the model of the skeleton of Diplodocus to the museum.

IN the May number of the *American Naturalist* Dr. W. J. Holland, director of the Carnegie Museum, Pittsburg, discusses the views recently expressed—particularly those of Dr. Tornier—with regard to the proper position and pose of the limbs of Diplodocus and other sauropod dinosaurs. Early in his criticism the author takes occasion to emphasise the marked distinctness of the Dinosauria from all other reptiles, a circumstance which is of itself in some degree sufficient to render it probable that their limbs may have approximated to the mammalian type in regard to the relative position of their bones. Important evidence in support of this is afforded by the compressed, instead of depressed, form of the thoracic cavity, which appears absolutely incompatible with limbs arranged after the crocodilian fashion. It is also shown that if the femur is placed, as Dr. Tornier suggests, in a horizontal plane, its head cannot be made to enter the acetabular cavity of the ilium, while, on account of projections, no movement would be possible. Further, in this mode of restoration the distal articular surfaces of both humerus and femur would project at right angles to the axes of the bones of the lower segment of the limbs without being opposed to the corresponding articular surfaces of the latter. After a reference to the extraordinary position which would be assumed in certain circumstances by the fore-limbs of Diplodocus according to the new restoration, Dr. Holland maintains that the form given to the limbs in the skeleton in the Natural History Museum is in all essential features correct.

EGGS with two yolks occur not uncommonly, but eggs with three yolks are exceptionally rare. Such an egg was recently laid by a barred Plymouth rock pullet at the Maine Experiment Station, and is described in some detail in a Bulletin recently issued. The egg was somewhat above the average size, but no other abnormal feature was noticed.

IN past years, when sugar cultivation was the only industry of importance in Barbados, it was customary to issue annually a bulletin on sugar-cane experiments, but now that the cotton industry is developing so rapidly, it

has become necessary to issue a report on similar lines to those already sent out from other West Indian colonies. The first of these, which has been sent to us, contains an account of the sugar experiments which are still being continued, of experiments to find more suitable types of cotton than those at present in cultivation, and on important food crops such as sweet potatoes, cassava, eddos, and tannias.

THE March number of the *Journal of the Board of Agriculture* contains an article by Mr. A. D. Hall summarising the results of trials at Rothamsted on the new nitrogenous fertilisers, cyanamide and calcium nitrate ("nitrate of lime"). Both proved equally as effective as sulphate of ammonia and nitrate of soda in increasing the yield of grain, but the nitrates were perhaps the better for straw production. Sulphate of ammonia and cyanamide gave somewhat less offal corn than the nitrates—10 per cent. of the total, against 13 per cent.—but the differences throughout are so small that they may be disregarded. The choice between the manures will therefore be dictated by their relative price and by the character of the soil.

THE results of the experiments carried out by the scientific staff of the Royal Agricultural College, Cirencester, have hitherto appeared in the *Agricultural Students' Gazette*, but it has now been decided to publish them in a separate journal, the first issue of which has reached us. Summaries are given by Prof. Kinch of the experiments on grass land carried on continuously since 1888, the general result being that nitrogenous and phosphatic manures are particularly necessary, and the addition of potassium salts desirable, over a long series like the present. The cereal experiments (barley from 1885–91, oats from 1894–5) are also described, together with others that have gone on for a shorter period. A meteorological summary would add to the interest of these papers. Whilst there are many advantages in separate college bulletins for the publication of demonstration results, we hope that all papers of general interest bringing out new facts will appear in the recognised journals, where there is no risk of them being overlooked.

IN the Bulletin of the Cracow Academy, 1909 (June and November), Dr. Maryan Smoluchowski discusses the instability or "buckling" of elastic plates and its applications to problems of mountain formation.

IN the Journal of the Royal Statistical Society, lxxiii., 1 (1910), Mr. G. Udny Yule gives a solution, based on probability considerations, of the problem of the distribution of deaths with age, based on the supposition of a succession of causes of death which act cumulatively, and he considers applications to deaths in man caused by disease and to the extinction of bacteria by successive applications of disinfectants.

IN the *Popular Science Monthly* for March and May Prof. John B. Smith gives an address on "Insects and Entomologists: their Relations to the Community at Large." While the first article deals with insects in their economical aspect, the second consists of a collection of biographical notices, with portraits of the principal entomologists of America.

DR. JEAN MASCART, of the Paris Observatory, has issued a list of errata which he has discovered in Borda's classical tables of logarithms. It is interesting to note that the tables were completed by Borda by the year 1792, but were not all in print at the time of the author's death. The publication was concluded by Delambre, who carefully checked them with the help of Briggs, Vlacq, Véga, Hobert, and Ideler, and the present list evidently represents purely typographical errors which escaped notice, and which would probably in most cases be obvious to anyone who happened to take these particular logarithms from the tables.

THE assessment of income-tax is a question which does not, as a rule, fall within the purview of a scientific journal. We have, however, received a reprint from the *Daily Telegraph* of an article on this subject by Mr. William Schooling (London: Constable and Co., 1910), in which the author proposes a substitute for the present illogical and unscientific system of graduation. According to his system, the tax which a man pays would increase continuously with his income, as shown by a continuous graph. Under the existing system the tax increases discontinuously at certain points where the rate becomes infinity in the pound, and the amount of the tax depends, not only on a man's income, but on whether this income falls on a lucky number such as 4999 or on an unlucky number such as 5001, the man in the latter case paying more and receiving less than in the former. Mr. Schooling's system is much more rational and scientific, and has all the advantages which he claims for it.

THE illustrated catalogue of microscopes and accessories recently issued by Messrs. Flatters and Garnett, 32 Dover Street, Manchester, provides a very full list of apparatus by leading English and foreign makers for which they act as agents, and numerous sundries, some of which are the special designs of the firm. Among these are the hand microtomes provided with discs for regulating the thickness of sections and arrangements for keeping the paraffin blocks steady. The firm also specialises in turn-tables, water-baths and ovens, and slide cabinets.

WE have received separate copies of several contributions from the Jefferson Physical Laboratory of Harvard University which appeared in the March number of the Proceedings of the American Academy of Arts and Sciences. Amongst them is one on certain thermal properties of steam by Mr. H. N. Davis, in which the author, after a critical examination of the experimental work on the subject done during the last twenty years, comes to the conclusion that the total heat of saturated steam up to 190° C. is best represented by the expression

$$H = H_{100°} + 0{\cdot}3745\,(t - 100) - 0{\cdot}00099\,(t - 100)^2,$$

where $H_{100°}$ has the most probable value 639·11. Outside this range of temperature the latent heat L is best given by an equation of the form suggested by Thiesen, *i.e.* $L = 92{\cdot}93(365 - t)^{0{\cdot}315}$, in which 365° is the critical temperature of steam. The question of the true value of the specific heat of steam at constant pressure cannot be settled on the contradictory experimental data at present available.

MESSRS. A. GALLENKAMP AND CO. (19 and 21 Sun Street, E.C.) have just issued a circular containing a description of a technical series of physical apparatus. The majority of the items described are connected with the subject of heat, and relate to the determination of coefficients of expansions of solids, liquids, and gases, vapour pressures, and specific heats. A simple apparatus for the rapid determination of specific heats consists of a Dewar flask which contains a hot liquid; into this the cold body under test is dropped, and the fall of temperature is noted; the procedure is therefore the converse of that usually adopted in the method of mixtures. The use of the Dewar flask enables this to be done without sensible error. A lecture apparatus to illustrate Carre's ice machine is designed to

overcome the difficulty experienced by lecturers in causing water to freeze by its own evaporation. A glass tube 50 cm. long and 5 cm. diameter is closed at both ends and filled with coarse glass wool to give more surface. A lateral tube near one end connects with a round-bottomed flask (or, better still, with a Dewar flask); another lateral tube near the other end connects with an exhaust pump. The flask is first half-filled with water, and the glass wool is saturated with fresh strong sulphuric acid. The formation of ice is very rapid. Grace's apparatus for determining the mechanical equivalent of heat also deserves mention as being a cheap pattern of the modern rotating cylinder form of apparatus for this purpose.

THE May number of *Knowledge* appears under new auspices. The editors are now Mr. Wilfred Mark Webb and Mr. E. S. Grew; and Hardwicke's *Science Gossip* is incorporated with the journal, as well as *Illustrated Scientific News*. In an introductory note Principal Miers gives encouragement to scientific amateurs to pursue their observational work in spite of the gulf that may exist between them and the trained specialist. In astronomy and natural history particularly, the work of amateurs is often of great value to science, and any efforts made to stimulate it must be appreciated by professional men of science. The new number of our contemporary should be of assistance in this direction. There are several fine illustrations in the form of plates and other figures, and the articles are by contributors who write with authority and not as the scribes. Among the astronomical articles we notice one on Halley by Mr. T. A. Bellamy, a characteristic contribution by Mr. J. E. Gore on counting the stars, and a description of Prof. Lowell's observations of Martian canals. Dr. D. H. Scott, F.R.S., writes upon the earliest flowering plants—a subject which he has made his own—Prof. F. Cavers upon liverworts, and Prof. A. W. Porter upon electromagnetic mass. There are also the usual notes upon recent advances in the various departments of science, and reviews of books. We offer our congratulations to the editors upon the attractive character of their first number, and trust that their efforts to promote and extend intelligent interest in science will meet with success.

BOTANISTS alone, so far as we are aware, have a journal dealing purely with the jests and humours of their subject. The first number of the *Sportophyte*, edited by Dr. Marie Stopes, emanates from Manchester University, and is to appear yearly. It contains anecdotes, verse, and articles parodying serious journals, of which the highly technical and friendly humour will appeal to professional botanists.

THE first part of a catalogue of books on natural history, to be obtained from Mr. Francis Edwards, 75 High Street, Marylebone, W., has been received. It is concerned with miscellaneous and general books and those dealing with ornithology and oology. The second part of the catalogue will deal with works on botany, gardening, ichthyology, and other subjects.

OUR ASTRONOMICAL COLUMN.

TOTAL SOLAR ECLIPSE OF MAY 9.—According to the *Daily Mail* of May 19, Mr. Driffield, a surveyor, reported to Mr. Baracchi, director of the Melbourne Observatory, that he observed the solar eclipse of May 9 at Queenstown, Tasmania, in clear weather. According to him, the corona appeared regular in form, concentric with and evenly distributed around the moon's disc, except in the south-eastern quadrant, where two streamers were seen running straight for some distance, and then curving downward like a plume. The extent of the corona was more than half a degree from the limb. Its structure was striated, the colours merging gradually from deep orange to pale green. The streamers were two moon's diameters in length. Mr. Baracchi is recorded to have said that this is the best observation which was obtained.

SOLAR ACTIVITY.—After a period of quiescence the sun has, during the past week, exhibited a recrudescence of spot activity. Several moderately sized groups have been observed containing well-defined extensive umbræ.

COMET 1910*a*.—According to an ephemeris published by Prof. Kobold in No. 4410 of the *Astronomische Nachrichten*, comet 1910*a* is still almost stationary to the west of the Great Square, and its estimated magnitude is about 12·0. For May 27 its position is given as

$$\alpha\ (1910{\cdot}0) = 22\text{h. } 31{\cdot}5\text{m.}, \quad \delta = +29^\circ\ 29{\cdot}8'.$$

THE PROBLEM OF THE RESISTING MEDIUM.—In No. 4408 of the *Astronomische Nachrichten* Mr. Selig Brodetsky, of Cambridge University, discusses Prof. See's assumptions concerning the possible part played by a resisting medium in the capture of satellites. In conclusion, he shows that the arguments employed by Prof. See will not stand close analysis, and are such as to render the possibility of capture, with an assumed resisting medium, very uncertain. That such a satellite as the moon was captured in the manner suggested appears to be extremely improbable; while some of the larger planets have apparently been able to capture a number of comets, rendering them periodic, there is no known case in which the earth has been able to perform a similar operation.

THE CALCIUM BANDS AT λ 6382 AND λ 6389.—In the spectra of sun-spots the calcium bands with heads at λλ 6382 and 6389 are an important feature, to which attention was directed by Prof. Fowler, but their precise origin is not quite settled. Investigations on this point have been carried out by Prof. Barnes at Bryn Mawr College, who describes his latest results in No. 2, vol. xxxi., of the *Astrophysical Journal*.

In dry air at atmospheric pressure, and with pure metallic poles, these bands do not appear in the arc spectrum, but with the pressure reduced to 3 cm. of mercury, or less, they come out strongly. In atmospheres of dry hydrogen and pure dry nitrogen the bands do appear, but not so strongly as when the arc is run *in vacuo*; with the arc burning in SO_2 they do not appear.

It has been suggested that these bands are due to a compound of calcium and hydrogen, but, from his experiments, Prof. Barnes concludes that they may be considered as true metallic radiations, a conclusion which is important in discussing the probable origin of the sun-spot spectrum.

STARS WITH VARIABLE RADIAL VELOCITIES.—In No. 2, vol. xxxi., of the *Astrophysical Journal*, Mr. O. J. Lee publishes the results of recent observations of radial velocities with the Bruce spectrograph at the Lick Observatory. For α Cygni a range of 9 km., from −9·0 to −0·1 km., was found, but the observations do not suggest a period. Two members of the Taurus stream of stars discovered by Prof. Boss, Nos. 1007 and 1092 in his catalogue, have also been shown to vary their radial velocities. The first is 58 Tauri, the range of its velocity being from +41 to +15 km., and the second is B.D. 7°·681 Tauri, which exhibits a range of from +34 km. to +17 km. θ Pegasi is also shown to be a spectroscopic binary with a range of from −32 to +19 km., and on one plate shows a very faint component at +62 km.

OCCULTATION OF MARS BY THE MOON ON APRIL 13.—Through a break in the clouds Dr. W. Krebs was able to observe the last contact during the occultation of Mars by the moon on April 13, and, in No. 4407 of the *Astronomische Nachrichten*, he gives the time as 10h. 49m. 30s. ± 15s. (G.M.T.).

OBSERVATIONS OF HALLEY'S COMET.

Observations at the Madrid Observatory and Malta.

IN a communication which has been received from Dr. F. Iñiguez, the director of the Astronomical and Meteorological Observatory of Madrid, a brief account is given of the visual observations of Halley's comet made at that observatory, accompanied, not only with several excellent photographs showing its general appearance, but with a photograph and drawing of the spectrum of the nucleus and tail.

According to Dr. Iñiguez, the nucleus underwent many variations in size, and these changes can be gathered from the following figures which he gives. Thus on April 21 it had a diameter of 10″; on May 5, 7″; on May 7, 8″; and on May 10 it was only 5″ in diameter. During May the nucleus was comparable with a star of the first magnitude, that of May 10 being a little brighter.

From photographs taken with a doublet of 5 inches aperture, the first view of the comet only indicated a tail a few minutes of arc in length. On April 25 it extended to one degree. On April 28 it was increased to four degrees. By May 5 it had reached a length of ten degrees;

FIG. 1.—Photograph of Halley's Comet taken at the Madrid Observatory on May 11.

on May 11 its length was thirty degrees, and on May 14 it is described as extending about sixty degrees. The accompanying illustration (Fig. 1) shows the comet as photographed on May 11, the exposure lasting from 2h. 58m. a.m. to 3h. 44m. a.m. official Madrid time.

On May 7 and 8 the comet was photographed with a prismatic camera, using a Grubb lens of 8 inches aperture and a prism of twenty degrees angle. The photographs obtained displayed a spectrum which was continuous, but crossed by three monochromatic bands. On May 9 and 10 visual observations of the comet's spectrum were also made, and these also indicated a continuous spectrum crossed by three bands. The wave-lengths of the bands in the spectrum of the nucleus are given as 561 λ, 510 λ, and 472 λ, while those in the tail are 550 λ, 505 λ, and 461 λ. The forms and positions of the bands are given in the accompanying drawing (Fig. 2), which is a reproduction of that sent by Dr. Iñiguez.

The second communication is from Mr. C. Leach at Malta, dated May 16, who writes:—

"Enclosed is a sketch of what was seen here between 2.45 and 3.15 a.m. of May 13 and 14. The position and size of comet were easily noted owing to the clear sky. The chief thing noticeable was the great change in position since May 10, on which date I sent you a sketch of same. The position of the head on May 14 was as shown, forming a rough parallelogram with β, α of Andromeda and γ of Pegasus; in fact, the head was below γ to the extent of the distance α, γ. The tail was quite distinct to ζ of Pegasus and γ of Aquarius, and just filled the space between them. A star was seen through the tail at its extremity.

"The width of the comet at the head was about one-seventh of side γ, α of Pegasus, and the tail about one-third of same at broadest part, roughly speaking, 2° and 5° respectively. By referring to a star-map, I made out the head to be near to ε of Pisces, so that the length must have been nearly 45°.

"We must have been in a very favourable position and have had ideal conditions, as I see Greenwich observations on May 10 make out the tail only 45 minutes.

"I am sorry I cannot sketch better, but I have a difficulty in representing just the correct degree of light in the tail, which is much fainter after α of Pegasus.

"The nucleus was equal to α of Andromeda in brightness.

"The reflection of Venus on the sea was splendid.

"I think there can be no mistake about the length of the tail of the comet being great enough to allow the earth to pass through it, in spite of statements to the contrary.

"It was seen by several people here; in fact, the general appearance of the comet is summed up exactly in the comparison used by several, 'Just like a searchlight from the fort.' It was not seen on May 15 and 16 owing to a sirocco haze."

Mr. Leach's drawing is here reproduced (Fig. 3) on a

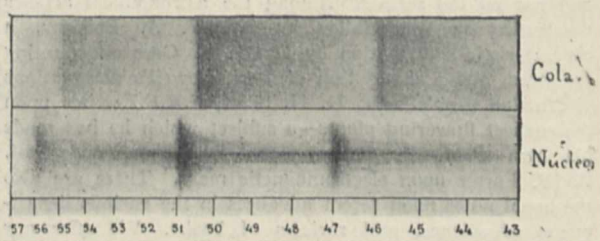


FIG. 2.—Spectrum of Halley's Comet observed at the Madrid Observatory.

reduced scale, and illustrates very clearly the comet's form and position among the stars.

Passage between the Sun and Earth.

The possibility of the mutual interaction of the comet and earth when the former passed directly between the earth and the sun on May 19 aroused great interest. A telegram from the Kiel Centralstelle gave the time of the comet's passage across the solar disc as ingress 3h. 22·7m. a.m. (G.M.T.), egress 4h. 22·5m. a.m., but, with one exception, all the reports yet to hand state that no trace of the comet was seen during the passage. The exception was at the Munich Observatory, where, according to Reuter's Berlin correspondent, the observers "succeeded in catching a glimpse of the comet as it passed across the sun's disc"; until official confirmation is forthcoming, this statement should, we think, be accepted with reserve. At other German observatories no trace of the comet was seen, and at Munich the sun would not rise until the commencement of the passage; its altitude, therefore, would be very small.

The greatest hope for detailed observations of the comet during its passage was centred on the Kodaikanal Observatory, in southern India, where careful preparations had been made for visual, photographic, and spectroheliographic observations. *Inter alia*, it was proposed to take photographs with the spectroheliograph, with the primary slit set on one of the strongest cyanogen bands, in the hope that the cometary radiations might thereby become differentially intensified in the image, just as the hydrogen or calcium radiations ordinarily are. But, according to a telegram sent by Prof. Michie Smith to the *Daily Mail*,

the results were negative; neither the visual nor the photographic observations revealed any certain trace of the comet during its transit of the sun's disc. The day was cloudy, but the definition was splendid, and the comet's tail had been easily seen in the early morning. It therefore seems certain that the tenuity of the matter forming the head of Halley's comet has not been overstated.

In England the sun did not rise until, according to computation, seven-tenths of the passage was effected, and bad weather effectually prevented any possibility of observation. In a telegram to the *Daily Mail* Prof. Dyson reports that the sky was clear, on May 19, from 1 a.m., but no meteors, aurora, or other unusual phenomena were seen at the Edinburgh Observatory. The reports from the African and Australian observatories are similarly negative.

The Rev. Dr. A. Irving writes, however, from Bishop's Stortford on May 18 as follows:—

"We are here at about 250 O.D. and well away from the London atmosphere. The day has been overcast until about 4 p.m., but the later hours have been clear. I have looked for anything abnormal, but have not been able to observe anything beyond a slight and diffused haze, which seemed to be perhaps more continuous than usual into the upper strata of the atmosphere. At sunset the western sky was clear of clouds, but the glow was quite an ordinary occurrence, except that it seemed somewhat fainter than usual with such a sky. But I do not recollect having ever seen a sunset in such a sky with such feeble after-effects. It may be said that there was no *after-glow* at all: merely a dull grey effect, as if the comet's tail had no effect beyond acting as a sort of screen to the sun's rays. It might be interesting to know if similar 'naked-eye' observations were made by others."

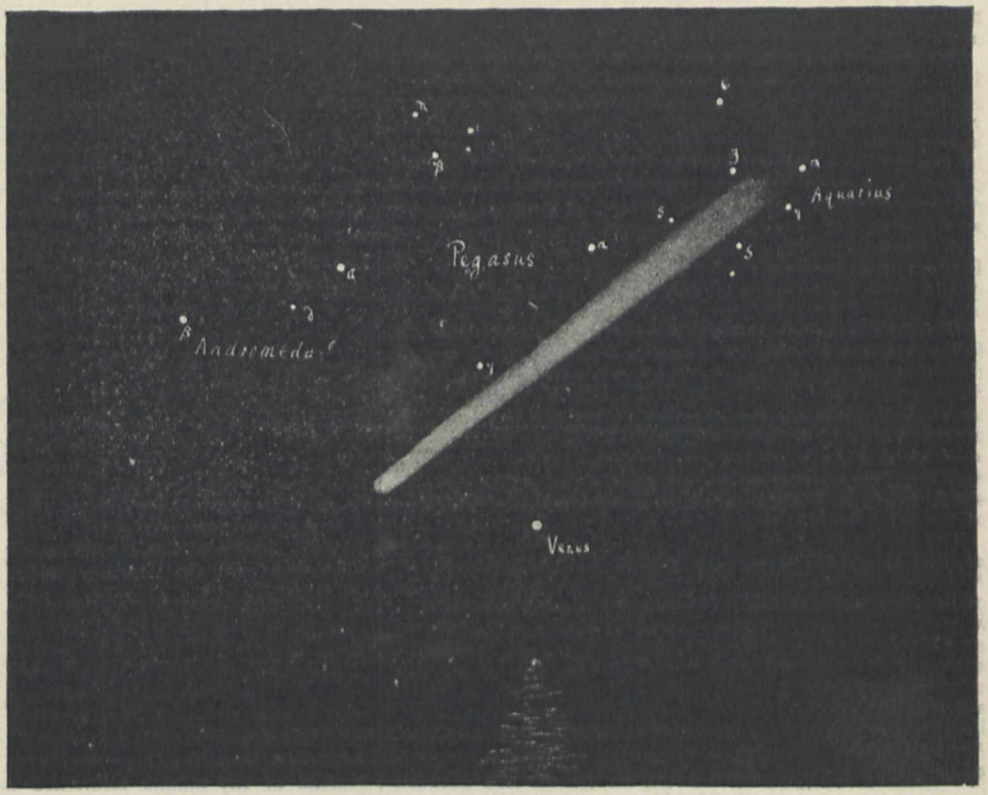


FIG. 3. Halley's Comet as seen at Malta on May 14 by Mr. C. Leach.

The time of the passage of the earth through the extremely tenuous tail was, and apparently still is, uncertain. A week or so before the passage was due there appeared to be some doubt whether the tail was sufficiently long to reach the earth, but this was dispelled by the later observations. Prof. Barnard, on May 18, traced it to a distance of 107° from the head, which implies an actual length of more than fifty million miles, more than three times the necessary extent.

But the actual curvature of the tail could not be determined, and in that lay the uncertainty as to a passage taking place; for the same reason the time of the earth's passage was indeterminable, although Dr. Franz calculated that it should occur some time later on May 19. Observations at Johannesburg indicate that the earth passed under the tail on Saturday morning.

The possibility of this occurrence appears to have incited a great deal of fear and excitement, despite the explicit statements of well-known astronomers that any catastrophe was improbable in the extreme. The fear of poisoning by cyanogen seems to have been the best defined, and to have led to some eccentric precautions, such as an oxygen-supplied sealed room, &c. The accounts of prayer-meetings held by negroes in the southern States, and of general absolution being given by Italian priests, vividly recall the Biela scare of 1882, when Holmes's comet was discovered.

Unfortunately, astronomers and sensationalists alike have been disappointed. According to Johannesburg observations on Thursday, the tail was seen still well above the ecliptic, and observations generally failed to indicate any phenomena which might assuredly be connected with an encounter. Careful preparations were made to observe possible magnetic disturbances, auroræ, and meteors, all or any of which might be produced by the earth's passage through a charged, meteoric agglomeration. The magnets at Greenwich indicated no abnormal disturbance on May 19, but, according to Reuter, Prof. Birkeland's instruments at Finmarken registered a well-marked magnetic storm on that day, although the days before and after were exceedingly quiet. Prof. Birkeland ascribes this to electrical effects produced by the passage of the earth through the charged cometary matter, and has secured excellent magnetograms and earth-current curves, as well as valuable electrical and meteorological observations.

The reports received at the Meteorological Office contain no references to unusual meteorological phenomena which may be associated with Halley's comet. Thunderstorms occurred on each day of the week in some part of the United Kingdom. A sharp storm in the south-east of England in the early morning of Thursday, May 19, just about the time of the calculated transit of the earth through the comet's tail, attracted much attention. It would, however, be rash to attribute their electrical manifestations to cometary influence, for the general meteorological situation, which was characterised by high pressure over Scandinavia and low pressure over the Bay of Biscay, was of a type which in summer is generally associated with thunderstorms over the British Isles. The results of the kite and balloon ascents carried out on May 19 have not yet come to hand.

The Comet and its Spectrum.

M. Coggia, in No. 19 of the *Comptes rendus* (May 9, p. 1165), gives positions for, and descriptions of, the comet for a number of dates between April 16 and May 6. On April 16, 17, and 18 the comet was seen to have a large nucleus, ovoid in shape, but no tail. Seen with the naked eye on April 21, it was of about the third magnitude and yellowish in colour; telescopically, the enveloping coma showed two jets in position-angle 120°. With the moon nearly full, a 3° tail was seen on April 23, and was bifurcated. On April 26, with the moon at full, a 1° tail was seen, and a telescopic view showed that the nucleus was smaller than formerly, but was extraordinarily brilliant and decidedly stellar. May 5 found the comet as a second-magnitude object with a tail 10° in length having a curved, plume-like form at its extremity. Seen in the telescope, the nucleus was round and very bright, and was surrounded by a coma containing two aigrettes. These were broad and were symmetrical with regard to the nucleus, from which they emerged in directions perpendicular to the axis of the tail. On May 6 the nucleus was yet brighter, and the aigrettes had disappeared, but there was a very bright sector turned towards the sun.

A circular from Kiel announces that observations at the Lick Observatory, on May 20, showed the length of the tail to be 140°, that is to say that, were it all visible, it would traverse more than three-quarters of the visible hemisphere. The observations were made in the morning in the eastern sky, and showed the tail to lag far behind the radius vector, so it was suggested that the earth would not pass through it. On the morning of May 21 the tail was fainter, but was traced to beyond Aquila.

A correspondent, Mr. E. Clegg, at Morenas, near Pernambuco, reports that during the early days of this month the comet was seen very plainly at about 4 o'clock each morning by a number of people.

Despite the smoke and cloud near the horizon, and the full moon, the comet was seen as a conspicuous object by thousands of people in various parts of the country on Sunday evening last. At Gunnersbury it was first picked up at 8.45, although the sky was by no means dark, but, probably owing to the bright moonlight, the tail was only suspected. Mr. W. E. Rolston reports that, to the naked eye, it appeared as a white, nebulous cloud, of appreciable size, having a bright centre. By averted vision 2° or 3° of the tail was glimpsed at intervals.

The results of a number of spectrum observations, made at the Meudon Observatory during the period January-May, are published, by MM. Bernard and Idrac, in No. 19 of the *Comptes rendus*. In January the cyanogen band at λ 388 dominated the spectrum of the head. The photographs obtained on February 9 and March 2, 3, and 4 show, in addition, the blue "carbon" band at λ 474 and others, more feebly, near λ 408 and λ 438; in the later spectra the bands at λ 388 and λ 474 were nearly equal in intensity. A visual observation by M. Giacobini on April 17 showed the nucleus to be stellar in character with a circular nebulosity surrounding it, but to the Meudon observers on April 25 the condensation was planetary in character, with uniform luminosity over a circle some 5″ in diameter. A nebulosity of 30″ diameter surrounded it, and showed two short jets on the opposite side to the sun. Photographs taken on April 26 showed that the tail was developing in the form of two jets about 1° in length separated by an angle of some 8° or 12°.

Spectrograms obtained on April 26 showed only the band at λ 474, but others, secured on May 4, showed the continuous spectrum of the nucleus, and, in the head, the bands at λ 474 and λ 388. It is interesting to note that, probably owing to the differential absorption of the earth's atmosphere at a low altitude, the band at λ 388 was much fainter than that at λ 474.

On May 7 the comet was much brighter, its estimated magnitude being 0·5, and a tail 1° long was easily seen with the naked eye. The head of the comet exhibited several modifications, the nucleus now being elongated in the direction perpendicular to the sun-comet line, and having a luminous jet at each extremity of its major axis. Spectra, taken on Σ and Wratten and Wainwright's orthochromatic plates, show the intense continuous spectrum of the nucleus extending from λ 660 to λ 395. The band at λ 474 is very intense in the spectrum of the head, which also shows condensations at λλ 516 and 563; the cyanogen band at λ 388 is much weaker than on the earlier plates.

Messrs. V. M. Slipher and Lampland also give a good preliminary account of the comet and its spectrum in Bulletin 47 of the Lowell Observatory.

Photographs were secured on every morning between April 14 and May 1 inclusive, except April 28, and indicated some remarkable changes in the form of the comet. On April 30 it was seen that the bilateral symmetry of the earlier photographs of the tail had disappeared; the northern edge was now nebulous, whilst the southern was bright, well defined, and showed several sharp bends. On May 1 the tail was gently curved, first to the north, then to the south, for seven degrees from the head, and then became nebulous, with a number of brighter condensations. This outer part indicates the action of some shattering, perturbative agency, and the proximity of Venus is tentatively suggested as a possible cause. The lengths of the tail, shown on the photographs, range from 1° on April 15 to 18½° on May 1.

The photographic spectra cover the whole range from the red to the ultra-violet, and show many interesting features. One of the most striking is the intensity of the continuous spectrum of the nucleus, the solar origin of which is indicated by the presence of many Fraunhofer lines. More than a dozen emission bands were photographed, the typical cometary bands 3883, 4737, 5165, and 5635 being generally the most prominent. The cyanogen band at λ 3883 is the strongest, and shows progressive intensification. Other notable bands are at λ 4000, prominent in tail; 4214, strong and increasing; 426, prominent in tail; 455, apparently composite, and prominent in tail; 570, faint and narrow; 5893, sodium (emission) lines, varying in intensity; 630±; the continuous band is photographed to a short distance beyond B. The study of the sodium lines from day to day indicated that they fluctuated in intensity.

The objective-prism photographs show that the head and tail are not alike in composition, a point brought out in the study of Morehouse's comet. Two bands, in fact, at λλ 4000 and 4260, were first recognised in the tail; 4550 is also prominent in the tail, but inconspicuous in the head. The cyanogen bands at λλ 4214 and 3883 are practically absent from the tail.

Other observations of the comet are recorded by M. Esclangon and M. Borrelly in No. 20 of the *Comptes rendus* (May 17).

While visual observations show the tail as straight and bifurcated, photographs show it to be more of the intricate form exhibited on photographs of Morehouse's comet. According to the *Times*, a splendid photograph was secured by Mr. Evershed, with the 9-inch reflector at the Kodaikanal Observatory, on April 22. This shows the nucleus as surrounded by a parabolic envelope, from which radiate a number of streamers in the form of a fan. Instead of the simple bifurcated extension seen visually, this photograph represents the tail as a number of disturbed, bent streamers, one of the brightest of which actually crosses the others. The photograph certainly suggests energetic disruptive action rather than a steady streaming forth, and demonstrates the danger of comparing modern photographic representations of comets with the earlier drawings.

An excellent series of photographs has also been secured at the Helwan Observatory, and copies forwarded to the Royal Astronomical Society.

The complicated structure of the tail is also shown on photographs taken at the Transvaal Observatory on April 16. Describing them in No. 4411 of the *Astronomische Nachrichten*, Mr. Innes says that they show a tail 3° long, divided into five rays, one set of which cross over the others. In the telescope, on the same date, the nucleus was seen to be double, the secondary nucleus being in position-angle 48° 11′. No. 4413 of the *Astronomische Nachrichten* also contains numerous reports of observations of the comet.

The following is part of an ephemeris published by Dr. Ebell in No. 4411 of the *Astronomische Nachrichten*:—

Ephemeris for 12h. Berlin M.T.

1910	R.A. h. m.	Decl. ° ′
May 30 ...	9 45·0 ...	+2 53·0
,, 31 ...	9 50·9 ...	+2 23·5
June 1 ...	9 56·0 ...	+1 57·2
,, 2 ...	10 0·4 ...	+1 34·2
,, 3 ...	10 4·3 ...	+1 13·4

The estimated brightness for May 30 is about 0·5 mag., and for June 2, 1·0 mag.

HALLEY AND HIS COMET.[1]

WHAT do we know of the nature of a comet's tail? Near the head we notice that there is a dome-shaped envelope which suggests that something has been spouted from the head and turned back by some repelling force of the sun, much as water spouted from a jet into the air is turned back by the attraction of the earth. The shape of a fountain is, in fact, closely like that of a comet near the head. The same curve, a parabola, characterises both, and accordingly the adopted view of the nature of the tail is on these lines. But Mr. Eddington has recently directed attention to a grave difficulty; he has calculated from comet Morehouse, which appeared eighteen months ago, what must be the magnitude of the sun's repelling force to accord with this view, and he finds it almost inconceivably great. The suggestion was made, accordingly, that possibly a different view might fit the facts better, viz. that the matter was not spouted from the comet's head and turned back by the sun, but came from the sun and was turned back by the comet. Mr. Eddington has done something already to examine this view, and finds several striking facts in its favour. In the first place, the shape of the curve, the parabola, which has been taken as good evidence for the former view, equally fits the latter. Secondly, since the matter is streaming out from the sun, and the comet is moving across it, we must take into account the motion of the matter relative to the moving comet. It should be possible to test the correctness of the view by observing the direction of the comet's tail, which should not lie accurately in the line away from the sun, but should be slightly inclined to it. Measurements of several photographs seem to support this view.

Besides the particles of solid matter which exist in the tail (whether spouted from the comet or from the sun), there are also certain gases. Sir William Huggins found with his spectroscope, as early as 1881, that there were certain carbon compounds in the head of a comet which are doubtless also present to some extent in the tail. Some very interesting spectroscopic observations made on the daylight comet showed that there was sodium vapour, not only in the nucleus, but extending out into the tail on either side. The strong yellow lines in the spectrum have been thought to have possibly some other origin, perhaps helium or a carbon compound. It may appear curious that there should be any doubt, but it must be remembered that when an object is in motion the lines in its spectrum never correspond *exactly* with the lines of a terrestrial substance. They are displaced to one side or another according as the object is moving towards or from us. However, in the present instance measures made at the Lick Observatory seem to identify the lines as sodium lines when due allowance is made for the comet's motion away from the earth. Prof. Fowler has recently made an interesting identification of the spectrum of a comet's tail with that of some substance which at present he has not completely recognised, but which he believes to be a compound of carbon, hydrogen, and oxygen in a state of great tenuity. He can obtain a spectrum in his laboratory when the pressure is reduced to less than 100,000th of atmospheric pressure.

The particular interest of Halley's comet lies, not in the fact that we shall pass through its tail, not in the magnificence of the spectacle which we hope to see (for this will be much less sensational than, for instance, the comet of 1858, or even of 1882), but in the circumstances which first brought its existence to the knowledge of the world. It was the first comet of which the return was predicted with success. Halley reaped this reward, the great reward of having an enduring monument in the skies, as the well-deserved outcome of his devotion to science. He was one of those men who seem to have an instinct for discerning at any particular moment the most important thing to be done, and the energy to do it, such a man as would have made a great general or a great statesman, or succeeded in many other walks of life, and such a man as is only too rare in the history of science. When an undergraduate at Oxford (Queen's College) he was struck by the fact that our knowledge of the stars was practically limited to those of the northern hemisphere, and he determined personally to rectify this at the earliest possible moment. Accordingly, he did not wait even to take his degree, but started for St. Helena to make a catalogue of southern stars. Bad weather rendered his expedition far less successful than he hoped, but, nevertheless, a beginning was made, and the foundations of our knowledge of the southern hemisphere were laid. He gracefully acknowledged the help and patronage of the King by naming a small constellation "Robur Caroli II.," but the name was afterwards omitted by a German editor. His name for a striking double star, Cor Caroli, has survived. In later years his studies of the positions of the stars convinced him that they were not really fixed in their places, but that some of them must have moved since the observations of Ptolemy. From this beginning, due to Halley, springs our knowledge of the proper motions of the stars and all that has come from it.

Another of Halley's great enterprises was the attempt to determine longitude at sea. It is quite easy for a sailor to determine his latitude (how far, that is, he is north or south of the equator), but his longitude is a different matter, and the uncertainty often led to grave difficulties and often disasters. Here, again, Halley saw that a great effort must be made to remove this disability. He obtained the loan of a ship from the King (not Charles II. by this time, but William of Orange), and was instructed to make a long voyage, especially in the southern hemisphere, to observe the magnetic variation, that is to say, the amount by which the compass points east or west of due north in various localities. In spite of the mutiny of his lieutenant (which caused his return home after first setting out), he completed his voyage. He made a chart of the variations, and thus solved, for the first time, this problem of determining the longitude. His solution was very soon superseded by a better, in the invention of the chronometer by John Harrison; but this does not alter the fact that Halley was the first to give a solution at all. Even his own defects seem to have inspired him to a method of compensating them. He was himself not a very accurate observer, nor skilled in the use of the instruments of a fixed observatory. Possibly his experience with rough and ready methods at sea may have contributed to this end. Be that as it may, he was so far out of personal sympathy with accuracy in observation that he used to say, "Take care of the minutes of arc and the seconds will take care of themselves." It is, therefore, not to be wondered at that his observations as Astronomer Royal were not of any value; and it might have happened that he would look for a successor equally indifferent to accuracy, but he was too great a man to make such a mistake. He set his heart upon being succeeded by Bradley, the most painstaking and accurate observer of the time (possibly of all past time), and Bradley's skill soon made up for any deficiencies of the previous twenty years.

But Halley showed his greatest insight in connection with the discovery of the great law of gravitation. He shared with others the suspicion (for in 1684 it amounted to little more) that a law of attraction, varying as the inverse square of the distance, would explain the movements of the planets round the sun; but while others were content to let the matter rest there, or to claim, falsely, that they had satisfactorily proved the proposition, Halley saw the vital necessity of sifting the matter to the bottom. When other inquiries had failed, he determined to visit Newton, at Cambridge, with the idea of enlisting his help in solving this great problem. To his great delight he found that it was already solved. Newton had already

[1] From the Aldred Lecture delivered before the Royal Society of Arts on May 4 by Prof. H. H. Turner, F.R.S.

proved that an object attracted by the sun in this way would move round it in an ellipse, and, since Kepler had already shown that the planets did move in ellipses, the existence of gravitation was established. Halley saw, further, how important it was to publish this discovery, and paid for the publication from his own pocket when other means failed. It might also be said that in this one particular of recognising the thing to be done and doing it Halley compared favourably with his great friend Newton, for Newton, after proving the proposition, had tossed it aside, shrinking from publication, which had sometimes engaged him in disagreeable controversy. Had it not been for Halley we might have lost this discovery, at any rate for a number of years; but Newton, though he was diffident as to publication, and failed perhaps to realise the importance of his discovery to the world, proved his own remarkable insight in a different manner. He, and he alone, saw that, even after the proof about the ellipse had been formulated, there was yet a grave difficulty in accounting completely for a universal gravitation as the cause, not only of the planetary movements, but of the falling of objects towards the earth. He realised that there was need of a further proposition, which he ultimately succeeded in proving, viz. that a sphere, however large, would attract another sphere, however close to it, as though it were concentrated at the centre. This completed the great law which was given to the world in 1686; but without this great proposition the law of gravitation would have remained a mere rough approximation instead of taking its place at once, and thereafter, as the most accurate law known to science.

Not only were the movements of the planets explained, but it became possible to calculate the orbits of comets, and Halley took the earliest opportunity of calculating as many as he could. This opportunity did not, however, come to him for nearly twenty years, since he was full of other projects. It was in the interval that he made his great voyage for determining the longitude; and it was not until 1704, when he had been elected Savilian professor of geometry at Oxford, that he found the leisure to make the cometary calculations required. The result was a list of twenty-four orbits, representing all the comets which had been sufficiently observed. He had the insight to see that this was a thoroughly important thing to do, though neither he nor anyone else suspected what was to be the most important outcome. Three of the twenty-four orbits were found to be nearly the same, those of the comets of 1531, 1607, and 1682. The figures were so closely the same that he felt sure they must relate to the same comet, though there was one difficulty, in that the interval between the two returns was not the same. This discrepancy, however, he rightly ascribed to the influence of the planets, especially Jupiter and Saturn. He pointed out that these planets disturbed one another, and therefore would disturb a comet too. He put very clearly also the point that the disturbance would be much greater in the case of a comet. We have said that a comet travels away to a great distance from the sun, and comes almost to a resting point; indeed, as Halley remarked, a very slight change in its velocity would send it away altogether from the sun's influence, that is to say, would make all the difference between a finite and an infinite time for its return. Hence a smaller disturbance might easily affect the time of its return seriously. There was no difficulty that he could see in identifying the three comets as the same, and in predicting a subsequent return in 1758. Halley did not live to see the return, but died in 1742, at the age of eighty-five, but he left on record his conviction that the comet would appear again, and his hope that posterity would remember to credit an Englishman with the prediction.

It was first seen on Christmas Day, 1758. It returned again in 1835, and now it is with us once more. The interval between the returns varies a few years, from about seventy-five to nearly eighty, the variation being due, as Halley surmised, to the interference of the planets with the comet's movements. It is one thing to realise, as Halley did, the general nature of this interference, and quite another matter, involving much laborious calculation, to determine it accurately. Halley, with his national pride, would have been delighted at the skill with which this problem has recently been attacked by two of his countrymen, Mr. Cowell and Mr. Crommelin, of the Royal Observatory at Greenwich. Mr. Cowell, after trying old methods with more or less success, found it advisable to employ a totally new method. It has been the custom, hitherto, in such calculations to consider the path of the comet as an ellipse, according to Newton's great discovery, but an ellipse which is continually changing in detail owing to the disturbances of the planets. Mr. Cowell, however, has found it desirable to abandon the idea of the ellipse altogether, and to follow the comet, step by step, along its orbit, first forecasting a little ahead, then calculating the consequent attractions of the planets, verifying his forecast or modifying it, if required, and so, by making each step secure before proceeding to the next, obtaining, ultimately, the complete and accurate history of the comet between two returns. It will readily be understood that a process of this kind involves much labour. During seventy-four years the comet was followed by calculation alone, for it was hopeless to attempt to observe it. As a result of the calculations, it was predicted that it would be seen in a certain place in the sky in August and September, 1909, and on taking a photograph of this region the comet was found close to the predicted place. The honour of first identifying it in this way falls to Dr. Max Wolf, of Heidelberg, but it is some compensation to Englishmen that, with the help of Dr. Wolf's information, they were able to identify earlier images of the comet on photographs taken at the Royal Observatory, Greenwich, and earlier still at the new Observatory of Helwan, in Egypt. The generosity of Mr. Reynolds, of Birmingham, has furnished this last observatory with a fine reflecting telescope, the mirror of which, 30 inches in diameter, was, like that at Greenwich, made by the late Dr. Common, of Ealing; and with this fine instrument, in the splendid climate of Egypt, the first picture of Halley's comet at its present return was secured.

Messrs. Cowell and Crommelin have not only calculated the recent history of the comet, they have carried it back through the centuries as far as 240 B.C. We have seen that Halley collected all the observations of comets sufficiently good and numerous to enable him to calculate orbits, and these did not include any comet earlier than 1337, nor any appearance of his own particular comet before 1531. But more observations have come to light since then, especially in Chinese annals, and on further search being made, in the first instance by Mr. Hind some half a century ago, it was found that bright comets had appeared in 1456, in 1378, in 1301, and so on, which could with great probability be identified with Halley's. This probability Messrs. Cowell and Crommelin have now converted into a certainty. It was not possible, or even necessary, to carry back the computations into the past with the same accuracy as was adopted for the last return, for the observations available for identification were, in many instances, very rough, specifying, for instance, the position of the comet by the constellation in which it was seen; but they adopted something of the same principle of proceeding step by step, making the appearance at one return secure before working back from it to the preceding, and thus they were able to correct several mistakes in Hind's original list.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Council recommends that a grant of 100*l.* from the Worts Fund be made to Mr. E. A. Wilson, of Gonville and Caius College, who has been entrusted with the organisation of the scientific department of the British Antarctic Expedition, 1910, towards defraying the expense of the equipment.

The scientific staff of the expedition includes Messrs. D. G. Lillie, of St. John's College; E. W. Nelson, of Christ's College; T. G. Taylor, of Emmanuel College; E. A. Wilson, of Gonville and Caius College; and C. S. Wright, of Gonville and Caius College.

Grants of 50*l.* to Mr. C. E. Moss, curator of the University Herbarium, towards defraying the expense of botanical investigations which he proposes to make on the Continent of Europe; and of 25*l.* to Mr. R. H. Rastall, towards defraying the expense of a visit which he proposes

to make to South Africa for the purpose of carrying on geological investigations, are also recommended.

OXFORD.—The following is the text of the speech delivered by Prof. Love in presenting Messrs. P. H. Cowell and A. C. de la C. Crommelin for the degree of D.Sc. *honoris causa* on May 21 :—

"Ducentos fere abhinc annos Edmundus Halley, qui tum apud nos Professor erat Savilianus, a Newtono doctus vi quadam certa planetas suos intra circulos contineri, cum cometam magnum ipse observasset, hunc annorum quinque fere et septuaginta intervallis quasi legitimo tempore semper rediturum esse praedixit. Vates erat verus, et nos hoc anno tertium ex illo tempore cometae reditum videmus. Cum quidem omnes astronomi ineunte statim anno eius adventum specularentur, simul atque visus est id egerunt ut cursum quo circa solem volveretur certissime constituerent. Ad hanc rem acesserunt duo viri, Philippus Herbertus Cowell, Andreas Claudius de la Cherois Crommelin, scientia et peritia singulari praediti, qui hunc nodum nova prorsus ratione solverunt. Qua in re distinguere vix possumus quid huic vel illi acceptum referendum sit: illud constat, nisi alter mathematicorum, alter astronomorum peritissimus fuisset, rem non potuisse navari.

"Duco igitur ad vos Philippum Herbertum Cowell, qui, cum plures annos astronomiae rationibus cognoscendis se dedidisset, multas palmas iam adeptus, id tandem consecutus est ut cometae Halleiani iter nova ratione statueret, et omnes calculos laboriose subduceret.

"Duco etiam Andream Claudium de la Cherois Crommelin, qui cum multos annos cometarum naturam investigasset, doctrina maxima instructus ad hoc munus accessit, et re latissime perspecta cometae redeuntis, iter non solum hoc anno definire potuit, sed quoties per duo millia ducentos quinquaginta annos his caelestis hospes terram revisit."

The Vice-Chancellor (Dr. T. H. Warren), in admitting Messrs. Cowell and Crommelin to the degree, spoke as follows :—

"Salve fratrum par nobile, nec laboribus nec laude divisum, quos dum veluti Geminos illos, vel stellam quamdam duplicem, pari gloria, togis paribus fulgentes intueor, venit mihi in mentem aliquid versu dicere Vergiliano, licet paullum mutato,

'In medio duo signa, Conon et quis fuit alter,
Praedixit flammae reducis qui gentibus orbem?'[1]

"Ego auctoritate mea et totius Universitatis libenter admitto utrumque, te Cononem, te Aratum novum, ad gradum Doctoris in Scientia, honoris causa."

THE honorary degree of Doctor of Laws was conferred upon Commander Peary by the University of Edinburgh on May 24, in recognition of his north polar work.

A REUTER message from Salem, Mass., U.S.A., states that the will of the late Mr. Isaac C. Wyman bequeaths practically his entire estate, valued at 2,000,000*l.*, to Princeton University Graduate School for such use "as the trustees may decide."

A REUTER message from Cape Town states that the late Sir Donald Currie's daughters, Mrs. Mirrielees, Mrs. Molteno, and Mrs. Wisely, have given a sum of 25,000*l.* to the University of Cape Town for the construction of a hall as a permanent memorial to Sir Donald Currie. The University has gratefully accepted the gift, and has reserved a portion of the fund, producing 150*l.* per annum, for the foundation of a Currie Scholarship.

SOCIETIES AND ACADEMIES.

PARIS.

Academy of Sciences, May 17.—M. Armand Gautier in the chair.—The president announced the death of Stanislas Canizzaro, correspondant of the academy, and gave a short account of his work.—Gaston **Darboux**: The use of new methods of recurrence in the theory of orthogonal systems.—M. **Bigourdan** presented photographs of the Halley comet by M. Iñignez, taken at the Observatory of Madrid.—A. **Lacroix**: The mineralogical constitution of the French phosphorites. The optical and physical properties are described in detail, and complete chemical analyses are given.—Paul **Sabatier** and A. **Mailhe**: A general method of direct preparation of the thiols by catalysis, starting with the alcohols. The general method proposed consists in passing a mixture of the vapour of the alcohol with sulphuretted hydrogen over thoria at a temperature between 300° C. and 360° C. The mercaptans from the first five primary alcohols were prepared with excellent yields. The substitution of sulphur for oxygen was also successful with allyl alcohol, benzyl alcohol, and various secondary alcohols, but the yields in these cases were not so good as with the primary alcohols. Thiophenols can also be prepared in the same way.—M. Blaserna was elected a correspondant for the section of physics in the place of Lord Rayleigh, elected a foreign associate.—E. **Esclangon**: Observations of Halley's comet. These results were obtained at the Observatory of Bordeaux, and diagrams are given showing the appearance of the comet on various dates.—J. Comas **Sola**: The flattening of Io, first satellite of Jupiter. Observations with the 38-cm. equatorial at the Fabra Observatory, continued since 1905, have confirmed the view that Io is flattened, in proportion, greater than any other body known in the solar system. The maximum flattening has been determined at one-fourth.—M. **Borrelly**: Observations of Halley's comet made at the Observatory of Marseilles with the comet finder. Data are given for observations for fifteen nights between April 21 and May 10, together with the positions of the comparison stars.—M. **Tzitzéica**: A new class of surfaces.—E. **Ouivet**: The differential equation of the motion of a heavy spherical projectile in air.—Maurice **Fréchet**: Continued functionals.—M. **Herrgott**: The electric thermophile. An account of a woven material containing fine nickel wire, which is supple and can be heated electrically.—A. **de Gramont** and M. **Drecq**: Certain conditions of appearance of the band spectrum attributed to cyanogen. The band spectrum usually considered to be characteristic of cyanogen appears to be due to the simultaneous presence of carbon (in sodium carbonate) and nitrogen. The bearing of this on comet spectra is mentioned.—M. **Houllevigue**: The dimensions of the material elements projected by the kathodes in vacuum tubes. The metal projected (silver) is deposited on a glass plate, and the minimum thickness determined at which the layer conducts electricity. The conductivity appears suddenly, and is only established starting from a certain thickness of the metallic layer. The diameter of the particles calculated from the results of these experiments is of the order of 22 to 26 $\mu\mu$.—A. **Besson** and L. **Fournier**: The action of the silent discharge upon acetaldehyde in the presence of hydrogen. The product of the reaction was a very complicated mixture containing acetic acid and its homologues and several ketones.—F. **Bodroux** and F. **Taboury**: Synthesis of aromatic nitriles. Benzyl cyanide is treated with sodium amide and alkyl iodide or bromide. One or both of the hydrogen atoms of the methylene group can thus be replaced by alkyl groups, and several applications of this general reaction are cited.—Georges **Darzens**: The action of the hydracids upon the glycidic esters.—A. **Arnaud** and S. **Posternak**: Two new isomers of stearolic acid.—Marcel **Godchot** and Jules **Frezouls**: Hexahydrophenylglycollic acid.—C. **Beys**: The estimation of tartaric acid in crude natural materials.—J. **Bertheaume**: A new method of estimating the three methylamines in admixture with ammonia. The hydrochlorides are dried and extracted with pure chloroform, in which the hydrochlorides of dimethylamine and trimethylamine are soluble. These are further separated by means of their periodides, and the ammonia and methylamine separated by François's method with yellow oxide of mercury.—G. **Boyer**: Studies on the biology of the truffle (*Tuber melanosporum*).—Paul **Dop**: The Strychnos of eastern Asia.—J. **Strohl**: The relative weight of the heart and the effect of high altitudes.—Maurice **Nicloux**: The decomposition of chloroform in the organism. A method is described permitting the estimation of small quantities of chloroform mixed with large quantities of air. The author applies this to determine the amount of chloroform destroyed in the blood, and concludes that about one-half the total amount of chloroform fixed at the moment of anæsthesia is decomposed in the organism.—

[1] Cf. Verg. Ecl. iii., v. 40.

H. **Coutière**: Cray-fish of the genus Saron with male dimorphs.—L. **Nègre** and J. **Bridré**: The nature of the parasite of epizootic lymphangitis.—G. **Seliber**: The determination of the volatile acids in the products of fermentation of some micro-organisms according to the method of Duclaux.—L. **De Launay**: The mean atomic weight of the silicated earth's crust.—Jean **Boussac**: The distribution of the levels and *facies* in the so-called autochtone (Nummulitic) of eastern Switzerland.—Maurice **Filliozat**: The chalk of Blois.—Louis **Gentil**: The ancient orogenic movements in the Haut-Atlas of Morocco.

DIARY OF SOCIETIES.

THURSDAY, MAY 26.

ROYAL SOCIETY, at 4.30.—Croonian Lecture: Alterations of the Development and Forms of Plants as a Result of Environment: Prof. G. Klebs.

ROYAL INSTITUTION, at 3.—The Constitution and Internal Structure of Alloys: Dr. W. Rosenhain.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.

ROYAL SOCIETY OF ARTS, at 4.30.—The People of Burma: Sir Richard Carnac Temple, Bart.

FRIDAY, MAY 27.

ROYAL INSTITUTION, at 9.—The Forthcoming Antarctic Expedition: Capt. R. F. Scott, R.N.

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

PHYSICAL SOCIETY, at 5.—On an Oscillation Detector actuated solely by Temperature Variation of Resistance: Dr. W. H. Eccles.—Exhibition of a Resonance Transformer: A. Eagle.—The Limitations of the Weston Cell as a Standard of Electromotive Force: Dr. S. W. J. Smith.

INSTITUTION OF MECHANICAL ENGINEERS, at 8.—*Adjourned discussion* upon Mr. S. N. Brayshaw's Paper on A Research on the Hardening of Carbon and Low-tungsten Tool-steels: Prof. J. O. Arnold.—Comparison of the Tensile, Impact-tensile, and Repeated-bending Methods of Testing Steel: B. Blount, W. G. Kirkaldy, and Capt. H. Riall Sankey.

MONDAY, MAY 30.

ROYAL INSTITUTION, at 3.—Earth-tides: Prof. A. E. H. Love, F.R.S.

TUESDAY, MAY 31.

ROYAL INSTITUTION, at 3.—Heredity in Tudor and Stuart Portraits: Charles J. Holmes.

FARADAY SOCIETY, at 8.—Some Practical Experience of the Sherardising Process: J. W. Hinchley.—Note on the Composition of Eutectic Mixtures: Dr. C. H. Desch.—Relations between Critical Temperature, Boiling-point, and Expansion Coefficient of Phosphorus Pentachloride: E. B. R. Prideaux.—Thermic Reactions in Vacuo. Parts I., II., and III.: F. E. Weston and H. Russell Ellis.

ROYAL ANTHROPOLOGICAL INSTITUTE, at 8.15.—An Anthropological Expedition to the Northern British Solomon Islands: Dr. R. Thurnwald.

WEDNESDAY, JUNE 1.

ROYAL INSTITUTION, at 3.—The Constitution and Internal Structure of Alloys: Dr. W. Rosenhain.

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

SOCIETY OF PUBLIC ANALYSTS, at 8.—The Composition of Malt Vinegar: E. Russell and T. R. Hodgson.—Some Analyses of Ghee: E. R. Bolton and C. Revis.—A Short Method for Detecting and Estimating Coconut Oil in Butter and Margarine: H. S. Shrewsbury and A. W. Knapp.—The Analysis of Ferrocyanides: Dr. H. G. Colman.—Some Unusual Pathogenic Bacteria in Water: W. Partridge.—The Estimation of Small Quantities of Essential Oils in Spices: J. A. Brown.—An Investigation of Pozzi-Escot's Method for the Estimation of Nitrates: E. Cahen.

ENTOMOLOGICAL SOCIETY, at 8.—Notes on the Scoliidæ, and New Fossorial Hymenoptera from Australia: R. E. Turner.—On the Position of the Rhopalosomidæ, with Description of a Second Species: C. Morley.—Descriptions of Micro-lepidoptera from the Malayan Region: E. Meyrick, F.R.S.

THURSDAY, JUNE 2.

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.—On Scandium. Part II.: Sir William Crookes, For.Sec.R.S.—The Flow of Water in Curved Pipes: Prof. J. Eustice.

ROYAL INSTITUTION, at 3.—Malaria: Major Ronald Ross, F.R.S.

INSTITUTION OF MINING ENGINEERS, at 11 a.m.—Presidential Address: Dr. J. B. Simpson.—A Storage-battery Extension to a Three-phase Colliery Power-plant: W. Maurice.—On Measurements of the Downward Increase of Temperature in Bore-holes, their Technics and their Practical Importance for Geological Prognosis: Prof. J. Koenigsberger and Dr. Max Mühlberg.

LINNEAN SOCIETY, at 8.—On the Flora of Gazaland: Dr. A. B. Rendle, F.R.S., and others.

RÖNTGEN SOCIETY, at 8.15.—Practical Observations on Every-day X-Ray and Electrical Work: Filtration of Rays, Measurement of Rays, Rapid Stereoscopic Method: Dr. Howard Pirie.—Recent Improvements in Radiographic Technique: Dr. R. Knox.

FRIDAY, JUNE 3.

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

ROYAL INSTITUTION, at 9.—Renaissance Monuments in the Roman Churches, and their Authors: Sir Rennell Rodd, G.C.V.O., K.C.M.G.

INSTITUTION OF MINING ENGINEERS, at 10 a.m.—Experiments illustrative of the Inflammability of Mixtures of Coal-dust and Air: Prof. P. Phillips Bedson.—Testing for Fire-damp: Prof. J. Cadman.—Some Memoranda concerning Coal-dust: H. W. G. Halbaum.

SATURDAY, JUNE 4.

ROYAL INSTITUTION, at 3.—Electric Heating and Pyrometry: Prof. J. A. Fleming, F.R.S.

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