THURSDAY, MARCH 24, 1898.

A BIOGRAPHY OF WILLIAM HARVEY.

Masters of Medicine. William Harvey. By D'Arcy Power, F.S.A., F.R.C.S. Edited by Ernest Hart, D.C.L. Crown 8vo. Pp. xi + 296. (London: T. Fisher Unwin, 1897.)

THERE is probably no name in the roll of European physicians antecedent to our own time so familiarly known as that of the discoverer of the circulation of the blood. Harvey was one of the founders of the modern method of investigating nature, and he takes rank with Galileo and Descartes among the select few who stand out as landmarks in the early history of exact science. His life and work have therefore an enduring interest for all educated men. Dr. Willis's classical biography of Harvey, published twenty years ago, was not cast in a popular mould, and is now almost out of print. It was therefore time, and there was room, for a new life of Harvey; and the late Mr. Hart was fortunate in his selection of Mr. D'Arcy Power for this task. Mr. Power tells us in his preface:

"It is not possible, nor have I attempted, in this account of Harvey, to add much that is new. My endeavour has been to give a picture of the man and to explain in his own words, for they are always simple, racy, and untechnical, the discovery which has placed him in the forefront of the Masters of Medicine."

Notwithstanding this modest disclaimer, Mr. Power has succeeded in collecting a good deal of fresh collateral information which throws much interesting side light on the career and surroundings of Harvey.

William Harvey was born in Folkestone in 1578. He was the eldest son of an opulent Kentish yeoman, and his career was never hampered by pecuniary difficulties. His school boy days were passed at Canterbury. Thence he migrated to Caius College, Cambridge, where he graduated in arts in 1597, at the age of nineteen. There were at that time no organised Schools of Medicine in Britain, and Harvey had to look elsewhere for the means of prosecuting his medical education. He chose Padua; and became a pupil of Fabricius—the foremost anatomist of his day. Fabricius was then engaged in perfecting his discovery, or rather re-discovery, of the valves of the veins. Fabricius, no doubt, demonstrated the existence of these valves to his class; and it may be inferred that Harvey's interest in the motions of the heart and blood was first awakened by these demonstrations. Fabricius taught that the purpose of these valves was to prevent over-distension of the vessels when the blood passed from the larger into the smaller veins (a double error), whilst they were not needed in the arteries because the blood was always in a state of ebb and flow. It was reserved for Harvey to point out their true use, and to indicate their importance as an anatomical proof of the circulation of the blood.

Harvey spent four years at Padua, and obtained the degree of Doctor of Medicine of that University. He then settled in London, and came rapidly to the front. At the age of twenty-nine he was elected Fellow of the College of Physicians; at thirty-one he became physician to St. Bartholomew's Hospital; at thirty-seven he was chosen Lumleian Lecturer on Anatomy to the College of Physicians. About the same time he was appointed Physician Extraordinary to James I., and subsequently Physician in Ordinary to his successor Charles I. These latter appointments gave Harvey command of the herds of deer in the royal parks, for the purpose of the vivisections and dissections which he practised in the course of his researches on the motions of the heart and blood, and in his investigations on embryology.

Harvey delivered his first course of Lumleian Lectures in 1616. It was in these lectures that he first propounded his views on the circulation of the blood, and demonstrated the anatomical and experimental evidence on which his conclusions were based. These demonstrations were, as he tells us, annually repeated at the Lumleian Lectures for nine successive years. It was only after this long probation that Harvey ventured to give his discoveries to the world. This he did in the form of a small Latin quarto of 76 pages, entitled "Exercitatio Anatomica de motu cordis et sanguinis," published at Frankfort in 1628. This little book is in several respects a remarkable one. It constitutes the earliest record we possess of a really scientific investigation in the domain of biology based on systematic observation and experiment. Although written 270 years ago, the work is essentially modern in tone and method. It is, in fact, the precursor and prototype of the scientific "monograph" of our own day, and stands favourable comparison with the best master-pieces of recent times. In this treatise Harvey established absolutely the fact of the circulation of the blood, and the fact that the heart was the propulsive agent in the movement. But he was unable, from his want of a microscope, to indicate the precise path along which the blood travelled from the terminal arteries to the commencing veins. He erroneously conjectured that the blood percolated the organs and tissues as water percolates the earth and produces springs and rivulets. In less than two years after Harvey's death the improvements in the microscope enabled Malpighi and Leeuenhoek to demonstrate the completion of the circuit of the blood through the capillaries in the web of the frog's foot.

After the publication of his treatise on the circulation, Harvey seems to have concentrated himself, as regards physiological work, on his investigations concerning the generation of animals. He gradually accumulated an immense amount of information on this subject, which was eventually collected together and printed, towards the close of Harvey's life, in a separate volume, under the supervision of his friend Sir George Ent, with the title of "Exercitationes de Generatione Animalium." This book, though many times larger than the treatise on the motions of the heart and blood, is incomparably less satisfying. To the modern reader the reason of this shortcoming is plain enough; Harvey was stopped at every critical point by his want of a larger magnifying power. He had at his disposal only a pocket lens, which magnified perhaps four diameters. He knew nothing, and could know nothing, of the cellular elements of the ovum, nor of the motile filaments which constitute the essence of the spermatic fluid.

The later years of Harvey's life were passed in peaceful retirement. The civil troubles of the time had broken up his household and scattered his patients, but had left his private fortune unimpaired. At the age of sixty-eight he relinquished his appointments and practice, and went to reside with one or other of his brothers, who were wealthy London merchants. He still continued the studies he loved so well—for he had an enduring passion for original research—and maintained his interest in the College of Physicians, to which he was a large benefactor.

Sir George Ent gives us a touching glimpse of him as he appeared in his seventy-third year at the house of his brother Daniel, at Combe.

"I found him, Democritus like, busy with the study of natural things, his countenance cheerful, his mind serene, embracing all within its sphere. I forthwith saluted him and asked if all were well with him? 'How can it,' said he, 'whilst the Commonwealth is full of distraction and I myself am still in the open sea? And truly did I not find solace in my studies and a balm for my spirit in the memory of my observations of former years, I should feel little desire for longer life. But so it has been, that this life of obscurity, this vacation from public business, which causes tedium and disgust to so many, has proved a sovereign remedy to me.'"

Harvey had the satisfaction of living to see his great discovery generally accepted as true. In his old age he was known and honoured throughout the learned world. The College of Physicians erected a statue in his honour. In his seventy-sixth year he was elected president of the College, but declined the honour on the plea of the infirmities of age. Harvey made a peaceful ending in his seventy-ninth year, and was buried in what is now called the "Harvey Chapel" in the parish church of Hempstead in Essex.

Mr. Power has produced a work of permanent value, which is not likely to be superseded. The book is invitingly got up, and is eminently readable. It should attract a large circle of readers both inside and outside the professional pale. W. R.

THE NOTIONS OF CLASSICAL WRITERS ON GEOGRAPHY.

A History of Ancient Geography. By H. F. Tozer. Pp. xvii + 387. (Cambridge University Press, 1897.)

THE want of a short, popular history of classical geography is one which has been long felt, and there is no doubt that the little volume before us will help to fill it. The great work by the late Sir Henry Bunbury, from which Mr. Tozer has so largely drawn, is hardly fitted for a text-book, even for advanced students, for the subject of ancient geography is treated therein in such an exhaustive manner, that no ordinary student who has other subjects to master can ever hope to have sufficient time to study it in the way in which it should be studied. It is somewhat a matter of doubt if Mr. Tozer's, with its three hundred and seventy pages of closely-printed matter, is not too long when the absolute needs of the student are taken into consideration; still the reader will soon see how to pick out the important facts from this pleasantly written treatise, and how to let alone the generalisations and discussions of theories which though interesting enough are not essentials.

The first thing that strikes the reader is the fact that Mr. Tozer has described his work inaccurately; it is not a "History of Ancient Geography," but a "History of Ancient Classical Geography." In days gone by when Oriental studies had not attracted the attention of workers, and the works of Greek and Latin writers were believed to contain all the history of the nations that are past and gone, the title which Mr. Tozer has given to the work would have been well enough; in these days, however, it is misleading. On p. 3 Mr. Tozer says:

"The natural starting-point for such a history must be the shores of the Mediterranean, because the peoples that dwelt in the neighbourhood of that sea first cultivated the science of geography on an extended scale, and it was from that quarter that the information was originally derived which furnished the material for such a study."

Very true as far as it goes, but Egypt and Syria both form part of the Mediterranean coast on the south and east, and yet Mr. Tozer's book tells us next to nothing about either, although so much is now known of both countries, and of the ancient intercourse which existed between them in very old times. Hieroglyphic inscriptions are extant which describe military and other expeditions to the heart of Africa and to the coasts of Arabia from the period of the sixth to the eighteenth dynasty, and several long historical texts which describe the progress of Egyptian arms in Western Asia are so well known as to make it difficult to see why Mr. Tozer has not made use of them. The Tell el-Amarna tablets, which have now been translated into English, French, and German, form a most valuable mine of information for the student of ancient geography, and yet they are not mentioned in Mr. Tozer's work. It is not yet possible to identify all the places the names of which are given in these remarkable documents, but it is quite easy to sketch the main trade and military routes between Egypt and Northern Syria, Western Mesopotamia, &c. About the fifteenth century before our era a certain Egyptian gentleman set out on a journey to Syria and, fortunately for us, he wrote an account of his experience to a friend wherein he detailed the events of the way, the names of the places at which he stayed, and several matters of considerable interest to the geographical student. M. Chabas' edition of the text and translation have been so long before the public that the Mohar's "itinerary" might well have been described by Mr. Tozer. Passing from Egypt to Babylonia and Assyria we think that enough of the early geography of these countries might have been gleaned from the cuneiform inscriptions to make two valuable chapters at least, as well as a tolerably full map.

Speaking of the pygmies (p. 30), Mr. Tozer says:

"We may conclude therefore that the Pygmies of Homer were a real people. . . . The Egyptians might easily have heard of them, and through them the story might have found its way into Greece."

A little searching of Egyptian records would have shown him that the Egyptians knew a great deal about the pygmies, and that King Assa, about B.C. 3300, kept

a pygmy, who had been brought from Central Africa by an Egyptian official called Bāurtet, at his court to dance and to amuse him. About seventy years later another king, Pepi II., sent a despatch to Heru-khuf, his officer commanding the garrison at Aswân or Syene, in which he promised him a greater reward than was conferred by Assa upon Bāurtet if he would go and bring back for him a pygmy "alive and in good health." In the inscription which covers the walls of Heru-khuf's tomb at Aswân (see Schiaparelli, "Una Tomba Egiziana," Rome, 1893), an account is given of the countries through which this brave officer passed, and though it is impossible to identify accurately all the places named, it is perfectly clear that, like the officer Una, he passed through the lands of great trees south of Khartûm, and so on to the districts described by Stanley ("Darkest Africa," i. p. 198; ii. p. 40) and Schweinfurth ("Im Herzen von Africa," ii. p. 131 ff.), to the land of the pygmies. The pygmies were so well known in Egypt that a reference to them is made in a version of the "Book of the Dead" of the sixth dynasty. In the temple at Karnak is an inscription of a later period which states that "the pygmies came from the lands of the south to do service in it," and in it, as in the earlier texts, no doubt can be entertained as to the correctness of the identification of the word *tenk* with "pygmy," for in each case it is followed by the determinative of a thick-set, stunted little man. We are hardly justified in assuming that the Egyptians had any dominion *de facto* in Central Africa, but there is no doubt that as far back as the time of the fifth dynasty they were well acquainted with the products and people of that remote land.

Again, on p. 21 the firmament of bronze which Mr. Tozer describes is nothing but the square metal plate which the Egyptians thought formed the sky and the floor of heaven, which was supported by four mountains or props placed one at each of the cardinal points; from this at night the stars were hung out like lamps, and in fact one of the names for stars, *khabesu*, means nothing but "lamp." The god Atlas is, of course, nothing but a Greek form of the god Shu, whose functions were to lift the sky up from the earth at dawn, to support it during the day, and to let it down again at night. The inscriptions of Egypt would similarly afford many an explanation of passages in Mr. Tozer's book.

Among minor matters it seems to us very doubtful if the name Samos is derived from the Semitic *shamah* (p. 5); the Arabic word *ḳasdîr* is, of course, derived from the Greek as Dozy showed (Suppl. ii. p. 355, col. 2); it is very doubtful if the names "Asia" and "Europe" are derived from the Assyrian words "to go forth" (of the sun), and "to set" (of the sun); the Peutinger Table was published in its entirety, and it is only Desjardin's description of it which is unfinished (p. 310); and we should have preferred the conical to the elliptical projection of Ptolemy's map given on the plate which faces p. 341. It only remains to say that so far as it goes Mr. Tozer's book is good, and that the classical portions of it have been carefully done; in a new edition we hope that the sources of the information which we obtain from Greek and Latin writers, and which may be traced to hieroglyphic and cuneiform records, will be duly described and set forth.

OUR BOOK SHELF.

La Teoria dei Raggi Röntgen. By Prof. Filippo Re. With two plates. Demy 8vo. Pp. 64. (Palermo: Alberto Reber, 1898.)

IN the first three chapters the author discusses the existing theories which regard Röntgen rays as longitudinal waves, molecular streams, and transverse waves of extremely short wave-length. He then proceeds to summarise the various hypotheses which have been advanced to account for the electro-dispersion of these rays, and their capability of bending round obstacles. Chapter vi. deals briefly with other kinds of new rays—namely, Becquerel rays, Le Bon's rays, and Winkelmann and Straubel's "spathofluoric" rays. A comparison of the properties of X-rays with those of Hertzian electric oscillations of considerable length, leads Prof. Re to propound the hypothesis that the former are electric waves of practically infinite length. This hypothesis, the author remarks, has close analogy with that proposed by Sir G. G Stokes at Liverpool, who suggested that Röntgen rays might be due to non periodic disturbances of the ether.

In attempting to show how this theory accounts for the physical properties of Röntgen rays, Prof. Re has, of necessity, left unanswered many questions which naturally suggest themselves, and in answering others has hardly made out a strong case in favour of his views. He attributes absence of reflection to the great penetrating power and diffusion of the rays, and absence of observed polarisation to the impossibility of arriving at any practical result with the means commonly employed; but these explanations can hardly be said to support the present theory more than any other. To account for cryptochröism the author has to suppose that, although the waves are of practically infinite length, their lengths are nevertheless of different magnitudes. We should have liked to see the question of the magnetic deformation of Röntgen and Lenard rays discussed in connection with the present theory. Why such rays should be produced by an apparatus so different from a Hertzian oscillator as a Crookes' tube, might also well be asked.

The author's familiarity with current research affords sufficient guarantee of his competency to put forward a theory possessing certain points of novelty. We are still so much in the dark as to the nature of Röntgen rays, that every new theory is worthy of the careful consideration of physicists. Without wishing to commit ourselves, the theory of electric waves of very great length strikes us at first sight as being no less plausible than many of the other hypotheses which have been propounded.

A Text-book on Applied Mechanics. By Andrew Jamieson, M.I.C.E., Professor of Electrical Engineering in the Glasgow and West of Scotland Technical College. Vol. ii. Pp. xiii + 388. (London: Charles Griffin and Co., Ltd., 1897.)

THIS text-book, of which this is the second volume, was written mainly for second and third year students of applied mechanics. Parts i. and ii., which form vol. i., deal with the principle of work and its applications, and gearing; the present volume, divided into Parts iii. to vi., includes motion and energy, graphic statics, strength of materials, and hydraulics.

The volume is divided into fifteen chapters, called lectures, though the ground covered in any one of them is generally much greater than any teacher would attempt in one lecture and numerous illustrative examples are given at the end of each chapter. It is refreshing to find the author introducing the calculus so freely into a text-book primarily intended for science and art students. In Part iii. the author discusses very fully such important practical questions as the energy of fly-wheels, engine governors, and the balancing of moving parts: the whole section is a very complete and good one. The next

section, Part iv., is entitled "Graphic Statics," and is devoted to the graphical determination of the stresses in the bars of framed structures, and to the theory on which these graphical constructions depend. The examples selected are comprehensive, and include most of the ordinary roof and bridge trusses; cranes, sheer legs, &c., are also studied. Bending moment and shear diagrams, which come very much better in Part v., are rather out of place in Lecture xxviii.; it would certainly have been far better, and less confusing to the reader, to have taken them up in the section on strength of materials, which forms Part v. of the book. This section is by no means as complete as the others preceding it. The lectures dealing with the stresses and strains in beams and shafts are full, and well worked out; but tension is treated in a very half-hearted way, while struts and their strains and stresses are simply entirely ignored: this is most unsatisfactory. It is to be hoped that in a new edition Prof. Jamieson will look to this. The omission detracts greatly from the practical value of Part v.

The last Section (vi.) is hardly entitled to the name of hydraulics, and it would have been far better to have omitted it altogether. There are only two chapters: one deals with the hydraulic plant in a modern gas-works; it is, however, almost exclusively descriptive, quite unlike all the rest of the book.

The last chapter is given up to refrigerating machinery; though what this has to do with hydraulics the author does not condescend to explain: it is, in fact, good matter in the wrong place. We confidently recommend the book to engineering students, who will find it of much use in their study of the various branches of practical mechanics touched upon by the author.

H. B.

Twenty-first Annual Report (1896) *of the Department of Geology and Natural Resources, Indiana.* By W. S. Blatchley, State Geologist. Pp. viii + 718. (Indianapolis, 1897.)

THE contents of this volume refer very largely to the economic natural resources of the State of Indiana, and embrace the results of the work accomplished by the different divisions of the Department under Mr. Blatchley's administration during the year 1896. The papers deal with the petroleum industry in the State, composition of Indiana coals, Indiana caves and their fauna, the geology of the middle and upper Silurian rocks of Clark, Jefferson, Ripley, Jennings and Southern Decatur Counties, the oölitic limestone of Indiana, the natural gas of the State, the geology of Vigo County, and the uncultivated ferns and fern allies and the flowering plants of the same county. Several excellent plates illustrate the report, and the whole volume shows that the State, which twenty years ago was noted mainly for her agricultural products, possesses great natural resources, and is rapidly assuming high rank as a mineral producing and manufacturing centre.

The Mines of New South Wales, 1897. Compiled and edited by C. W. Carpenter. Pp. 552 + lxxviii. (Sydney, London, &c.: George Robertson & Co.)

THE vast mineral resources of New South Wales may be judged by reference to this handy volume. The mines—which range from the mines of the Broken Hill Proprietary Company, with 6,512,000*l.* of dividends, to a coal mine worked by its proprietor in his spare time—are in the first place arranged geographically, and, in the case of each, particulars are given—as the proprietors, development, yields, area, &c. In the geological section of the book the mines are arranged under the names of the minerals obtained from them. The remainder of the volume is taken up with descriptions of batteries and ore-reducing works, and lists of directors of mining companies, New South Wales mining patents, and an alphabetical list of mines.

LETTERS TO THE EDITOR

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The Submerged River-Valleys and Escarpments off the British Coast.

IN connection with the observations of American geologists—especially those of Prof. J. W. Spencer and Mr. Warren Upham—on the "drowned" terraces and cañons of the American coast, the eastern borders of the North Atlantic afford some interesting results when examined with the aid of the Admiralty charts. It has long been known from the researches of the late Mr. Godwin-Austen, Prof. T. Rupert Jones, and others, that the British Isles are planted on a platform, of about 100 fathoms near its margin, and known under the name of "the 100-fathom platform." I am now engaged an a careful study of this physical feature, and the results, though as yet incomplete, are of such interest that I may be permitted to place them briefly before your readers. By tracing the contours, which may be drawn on the chart of the British Isles from the neighbourhood of Rockall as far south as the entrance to the Bay of Biscay by the aid of the very numerous soundings, two well-marked features may be recognised. The margin of the platform is very nearly defined by the 100-fathom line off the coast of Scotland, where it terminates along "the Vidal Bank"; but from this level it gradually falls away southwards, till at the entrance to the Bay of Biscay it reaches the 200-fathom contour; from this margin the floor of the ocean gradually slopes upwards to the coast, so as to constitute a shelving plain with little interruption. West of the coast of Ireland the platform is as broad as Ireland itself; that is, about 200 miles at its greatest breadth; and here it breaks off in a magnificent escarpment of no less than about 1300 fathoms (7800 feet) in height, its base giving place to a second gently sloping plain from 1500 to 2000 fathoms; or 9000 to 12,000 feet in depth, leading down to abyssal regions. This grand escarpment of about 7000 feet in height is continuous with the Vidal Bank, and opposite the English Channel bends sharply round to the eastward; in some degree conforming to the outline of the land. That this escarpment was once an emergent physical feature, corresponding to those of Eastern America, now submerged, or of the now unsubmerged terraces of Colorado, is a deduction of which I am now absolutely convinced, notwithstanding the stupendous physical changes which the deduction involves. We will now proceed to consider briefly some evidence of a corroborative kind, from which I cannot see any possibility of escape; I refer to the existence of river-valleys now traceable across the British platform, and opening out into gorges on approaching the edge of the escarpment. Some of the existing river-courses, like those of the Severn and the Kenmare rivers, are somewhat obscurely indicated by the soundings across the platform; but there are two distinctly traceable river-courses which are now altogether submerged: the first descending from the Irish Channel; the second through the English Channel. Assuming for a moment, what will scarcely be denied, that the platform down to a depth of 100 to 200 fathoms was formerly a land surface, it is clear that the streams entering from the existing lands must have had an outlet by means of rivers entering the Atlantic westwards. The examination of the soundings shows that this drainage was effected by means of two large rivers running near the centre of these channels, receiving the streams from either side. On tracing them across the platform, and on approaching the edge of the escarpment, we find the channels rapidly deepening, and within a mile or two of the edge taking the form of deep and narrow gorges, ultimately broadening out into "embayments," descending down to the very base of the escarpment itself; a condition corresponding to the "base levels of erosion" of the American geologists; and also represented by some of the Scandinavian fjords. Such physical features are altogether terrestrial. It is impossible (as it seems to me) that they could have been originated while the region referred to was in its present condition of ocean-bed. One portion of the river-valley which drained the English Channel is very clearly indicated on the chart under the name of the "Hard Deep." This gorge, about a quarter of a mile broad and seventy miles in length, occupies that narrow part of the channel between Cape de la Hague on the coast of France and the Bill of Portland. Throughout the

course of this old river-valley over the platform the channel has, to a great extent, been choked up and nearly obliterated by the deposit of sediment constantly going on for long ages; but along this part of its course, owing doubtless to the force of the tidal currents due to the narrowness of the channel, the sediment has apparently not been able to accumulate; hence the well-defined banks of rock which the soundings disclose. As regards the submerged channels of the existing rivers entering the Atlantic westwards, only faint indications can be obtained from the soundings; nor is this surprising when we recollect that the North Sea, the Irish Channel, and portions of the ocean bordering the north-western coasts of the British Isles have been covered in part by land ice, and altogether by the muddy waters of the later glacial seas, giving place to those of the present day; the mud, sand and shingle thus deposited have sufficed to cover the old floor of the platform for many feet in depth in most places, and to fill up the channels of the streams formed during earlier emergence. The total distance from north to south through which these observations extend is about 500 miles. I hope to be able to return to the subject later on. EDWARD HULL.

The Use of Compressed Coal Gas.

IT may be of interest to users of the limelight to put on record the following occurrences.

A 40-feet cylinder was filled with coal gas at a pressure of 120 atmospheres by a leading London firm on March 15, 1897; a small quantity was used, and the cylinder stood till October 9. It was then used for a mixed jet, and at the end of half an hour the light began to decrease, and in another quarter of an hour practically no gases were issuing. On relighting the jet the light was found perfect, and the fault was ascribed to the Beard's regulator.

The cylinder was again used on March 5 last, and again after half an hour the light began to fail; but on turning the taps full on something audibly blew out of the nozzle, and the light was perfectly restored.

The lime blackened excessively: while white-hot, the "hydrogen" was turned off and the oxygen allowed to play on it, when the deposit turned a brilliant orange-red.

The coal gas was then passed through a glass tube gently heated in a Bunsen flame—a copious metallic mirror which gave the test for iron was formed.

It seems probable that the jet was choked by the decomposition of iron carbonyl at the high temperature. In any case there is an obvious disadvantage in storing for a considerable time compressed coal gas in steel cylinders, altogether apart from the possible damage to the cylinders, which has been shown to be small. C. E. ASHFORD.

Harrow, March 19.

THE SCIENCE BUILDINGS AT SOUTH KENSINGTON.

SINCE the nation acquired, a good many years ago now, a plot of ground from the Royal Commissioners of the Exhibition of 1851, at a cheap rate, on which to erect buildings to foster teaching and research in Science and Art, there have been many schemes put forward, but nothing done, till at last the teaching of Science has become desperate. The Government have known this fully, and a few years ago plans were designed to bring to a head the various schemes by erecting Science buildings on the west side of Exhibition Road, and the Art buildings on the east side, an allocation of the spare land which had been accepted in principle by everybody.

But now it appears there has been a sudden *volte face*. Seeing that *at the present* moment Art does not require all the space at its disposal on the east side, the interstices are to be filled up with certain of the science buildings as we gather from the statement made by the First Commissioner of Works, on Thursday last: "The Government asked for the large sum of 800,000*l*. for the completion of the buildings at South Kensington in connection with Science and Art. He was quite certain that the Committee would admit that the settlement of this question had been demanded both by the House and by the public for many years past. In 1891 the decision was come to to proceed with the building to complete the accommodation for the Art Museum, and for housing the administrative departments of Science and Art. Plans were accordingly prepared by Mr. Aston Webb, and accepted, for a building to occupy the land on the south side of the Museum facing the Cromwell Road; but the sources at the disposal of Chancellors of the Exchequer, on both sides of the House, unfortunately did not permit of the grant of the necessary funds, and the scheme had since then been in abeyance. Since that scheme was formulated, and partly in consequence of the report of the Commission on Secondary Education, it was in contemplation to move to the Education Office the secretariat of the Science and Art Department, and further—in accordance with the recommendation of the Select Committee of last year on the South Kensington Museum—it was decided to remove the official residences and certain other temporary buildings, which were a source of danger from fire. With this additional space at disposal, it would now be possible to provide on the eastern side of Exhibition Road the necessary accommodation for both Science and Art. It was, therefore, intended to build, in addition to the building proposed in 1891, further buildings which would complete the frontage on the Cromwell Road and Exhibition Road sites; and, in the opinion of the Government, that would amply meet the requirements of both branches for many years to come."

On this proposal the *Times* remarks:—

"How far these projects, which the Government regard as all that can be reasonably demanded, will be satisfactory to those who take more than an official interest in the matter it would be premature to speculate."

We do not think it "premature" to state that it is to be hoped that the Government before they go further in this matter will obtain some opinions from men of science. The suggestion appears little short of disastrous, having regard for the future representation of scientific teaching and illustrations in our National Institutions, for surely the Empire will outlast another century. These remarks are not made because the sum asked is too little, for we do not believe a Committee, say of the Royal Society, or the President and Council of the Society itself, appointed to consider the matter, would see its way to spend more than 250,000*l*. to cope with the present needs of Science.

SKIAGRAPHY AFTER INJECTION OF THE BLOOD VESSELS WITH MERCURY.

TO elucidate the relations of the various opaque structures of the body to one another whilst undisturbed by the processes of dissection, is one of the numerous uses to which skiagraphy has been applied.

It is obvious that this process may be extended to the blood vessels in the dead body by filling them with some medium which is opaque to the X-rays, and in this way their relative situations to each other and to the bony skeleton may be studied with facility. Various experimenters have occupied themselves with the task of producing such skiagraphs, and amongst a considerable number who have obtained successful pictures may be mentioned Dutto, Raw, and Remy and Contremoulins, the former of whom employed a plaster injection mass, the latter one of wax in which bronze powder was suspended.

These results, though sufficiently encouraging, were not wholly satisfactory, and one of us (H. J. S.) determined to follow out a method which he had devised before he became acquainted with the work of other observers, and in which metallic mercury had been selected as the substance to be injected. The results of our experiments with it have been most satisfactory, and it seems probable that with the greater experience which we have now gained in the methods of carrying out the

details of the process, still better work may be done than has yet been accomplished.

The plan which has been adopted is very simple. The blood vessels of the part to be injected are well washed out with a solution of six parts of common salt in a thousand parts of water, and the mercury is then injected by inserting into the principal artery a canula connected with a small reservoir of the metal by a piece of rubber tubing. Care must be exercised to prevent the presence of air in the tubing or canula, and the mercury should be injected at a moderately low pressure, which naturally varies in different cases, but as a general rule may be taken at about 30 to 50 mm. of mercury. If the pressure is excessive there is considerable risk that the resistance

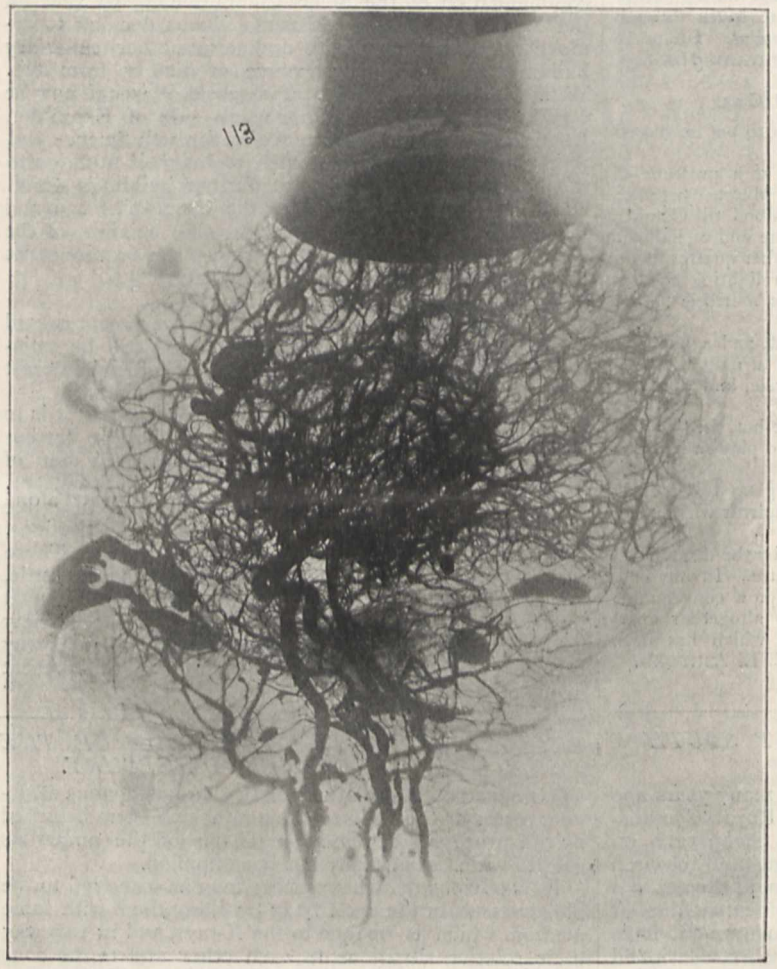

FIG. 1.—Arteries of head and brain in a child.

which the capillaries offer to its advance will be overcome, and the veins will be filled as well as the arteries. One very important detail is that the injected specimen should be moved as little as possible after the injection has been effected, as any shaking or change of position is apt to cause breaks to occur in the column of mercury, and thus to interfere with the success of the skiagraph.

We have also found that if the specimen has to be kept for some time before the injection is made, one can preserve it very satisfactorily by filling the blood vessels with a 5 per cent. solution of formalin, which in no way interferes with the subsequent injection, except that it lessens somewhat the calibre of the vessels.

The skiagraphs have been taken in the ordinary way; the authors have employed a 10-inch spark "Apps-Newton" coil, and, as a rule, ordinary focus tubes supplied by Mr. Newton, which they have found very satisfactory. Of the illustrations which accompany this paper, Fig. 1 represents the arterial system of the head of a child. The brain is *in situ* within the cranium, and the whole is injected through the carotid artery in the neck. The very abundant blood supply to the basal ganglionic masses of the brain is well shown, and it is interesting to note the great tortuosity of the internal carotid arteries as they pass through the base of the skull, by which the force of the sudden rise of blood pressure on the advent of the pulse wave is reduced so far as to prevent an undue strain being thrown on the delicate structures within the cranium. In order to prevent the escape of mercury through the several vessels in the neck, the head was placed upside down upon a small beaker, whose shadow appears in the photograph; where large vessels had been severed, clamp forceps were applied.

The other illustration (Fig. 2) shows the result of an injection of the branches of the system of the superior vena cava. The subject in this case was a young child, and the incomplete ossification of the bones, especially near the joints, may be incidentally noted.

In this instance the body was placed lying on its back on the photographic plate, whilst the Röntgen lamp was fixed in front of the chest; and therefore the anterior part of the bony skeleton is rendered indistinct, whilst the vertebral column and posterior portions of the ribs are relatively prominent. The injection has filled the main branches of the superior caval vein and the spinal veins, and it has penetrated also into the right auricle and ventricle, from which it has reached the larger divisions of the pulmonary artery.

It must be remembered, in identifying the various structures in the photograph, that when a print is taken from a negative the relations of the parts are reversed as in a mirror image, and thus what is really on the right-hand side in the specimen appears on the left in the print, and *vice versâ*. This can, when desired, be obviated either by producing the print by the single transfer carbon process, or by taking the original skiagraph with the film side of the negative furthest from the subject. In this case, since glass considerably obstructs the passage of the X-rays, the negative should be on a celluloid support, and the sensitised surface may be laid upon a fluorescent screen. When this is done, the rays after having penetrated the film are still further utilised by inducing fluorescence of the screen, which in its turn acts on the emulsion of the negative. The result of the manœuvre, though somewhat shortening the length of exposure, seems to render the resulting impression rather less sharp in its definition.

A point which must impress any one who looks at these photographs is the extraordinary vascularity of the tissues of the body, and one might reasonably wonder how comparatively small wounds, to say nothing of the large and deep incisions which are required in the course

of many surgical operations, do not inevitably lead to the death of the sufferer by hæmorrhage. The reply to this is, that did the prevention of hæmorrhage depend solely on the efforts of the surgeon, there is little doubt that even small wounds would prove inevitably fatal; but provision has been made by nature to meet the emergency, and the bleeding is largely stopped by what is known as the natural arrest of hæmorrhage.

It is not possible to describe this process in detail in the present paper, but the main elements involved are the fact that blood on escaping from the vessels tends to coagulate, and so forms a plug which prevents further escape, and that the severed vessel retracts up its sheath so that the plug is more efficiently supported, whilst the diameter of the vessel is itself greatly reduced by the contraction of the muscular elements in its walls. By these means the blood flow is temporarily checked, and as the wound gradually heals, secondary changes occur in the cut vessels which lead to their permanent occlusion.

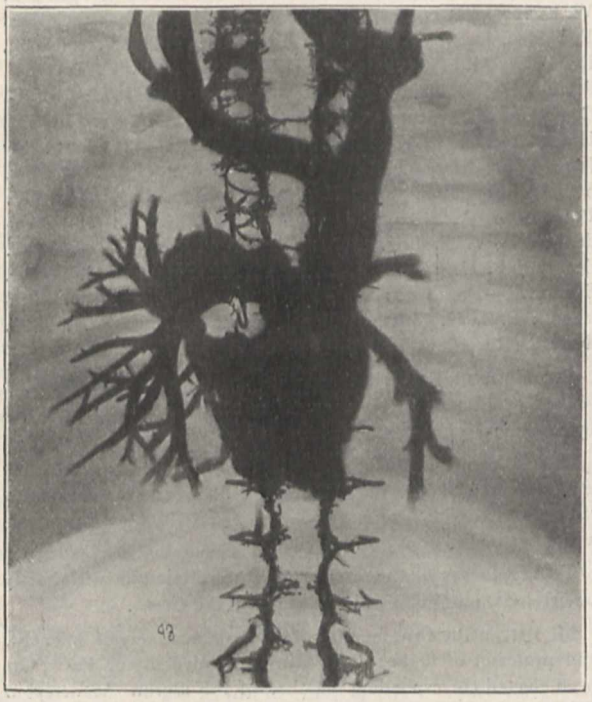

FIG. 2.—Injection of veins in chest.

Another fact that is well illustrated in such skiagrams is the extreme freedom of anastomosis between many of the smaller vessels which arise at different points of the chief arteries. It is this system of anastomosis which permits surgeons to ligature the main artery of a limb without running serious risk of mortification following the operation; as the blood, unable to pass by its ordinary channels, dilates the smaller vessels which bridge the occlusion, and thus establish an efficient collateral circulation in the course of a brief period after the ligature has been applied.

H. J. STILES.
H. RAINY.

SIR HENRY BESSEMER, F.R.S.

THE death of Sir Henry Bessemer, announced last week as we went to press, removes a leading representative of the world of applied science, and one whose inventions revolutionised a manufacturing process.

Henry Bessemer was born in 1813 at Charlton, in Herts, and was thus eighty-five years of age at the time of his death. From his father, who was an artist and a member of the French Academy of Sciences, he seemed to have inherited certain artistic tendencies, for at an early age he showed a fondness for modelling and designing patterns. He soon, however, turned his attention to other matters, and began the long series of inventions which carried him on to fortune. His success commenced with the invention of a means of manufacturing bronze powder or "gold" paint from Dutch metal. This invention laid the foundation of his fortune, and it was the profits of the manufacture of the bronze powder which enabled him to carry on experiments in the metallurgical process which bears his name.

Bessemer's first experiments to improve the quality of iron were made in 1855. He was not an iron manufacturer when he began his work, neither was he a metallurgist. But he possessed the true instincts of an investigator, for he was quick to observe and sound in his deductions; and the man who possesses and utilises these qualities is a man of science, whether he has had a systematic training in theoretical principles or not. His own account of the observations and reasoning which led to the idea of the Bessemer process is interesting. While making experiments with iron in the open-hearth furnace, the following incident occurred:—

"Some pieces of pig iron in one side of the bath attracted my attention by remaining unmelted despite the great heat of the furnace, and I turned on a little more air through the fire-bridge with the intention of increasing the combustion; on again opening the furnace door after an interval of half an hour, these two pieces of pig still remained unfused. I then took an iron bar with the intention of pushing them into the bath, when I discovered that they were merely thin shells of decarbonised iron, thus showing that atmospheric air alone was capable of wholly decarbonising grey pig iron, and converting it into malleable iron without puddling or other manipulation. It was this which gave a new turn to my thoughts, and after due consideration I became convinced that if air could be brought into contact with a sufficiently extensive surface of molten crude iron the latter could rapidly be converted into malleable iron."

On August 13, 1856, Bessemer read a paper at the Cheltenham meeting of the British Association, entitled "The Manufacture of Malleable Iron and Steel without Fuel," this being the first account that appeared shadowing forth the important manufacture since known as the Bessemer process. The paper, however, was not printed in the Association's Report for 1856, and the title, where mentioned, it may be noted, is quoted without the word "malleable." It was followed, in 1865, by a long communication, read at the Birmingham meeting, "On the Manufacture of Cast Steel; its Progress and Employment as a Substitute for Wrought Iron." Sir W. (now Lord) Armstrong, the President of the Section, in referring to it, remarked as follows:—"The paper from Mr. Bessemer upon steel cannot fail to be highly valued by the Section. The growing importance of this material, and its rapidly extending sphere of usefulness, have attracted attention in a special degree to the question of economy in its production; and certainly no one has contributed so largely as Mr. Bessemer to our advance in this direction."

The first honorary recognition of the importance of the Bessemer process in this country was made by the Institution of Civil Engineers in 1859 by the award of the Telford medal. In 1871-73 he was President of the Iron and Steel Institute, and in 1872 he received the Albert medal of the Society of Arts "for the eminent services rendered by him to Arts, Manufacture, and Commerce, in developing the manufacture of steel."

In 1874 he was a member of a Committee appointed to

consider what steps could be taken in furtherance of the use of steel for structural purposes, and signed the report, which was issued in March 1877. He was elected a Fellow of the Royal Society June 12, 1879. His certificate of claim is probably as short as any ever set forth for candidature, bearing, as it does, the single sentence, "Discoverer of the Bessemer process of making steel." In the same year he received the honour of knighthood, and in 1880 was presented with the freedom of the City of London. From abroad he received many honours. He was offered the Grand Cross of the Legion of Honour; but as permission to wear it was refused, he had to be content with a large gold medal given him by Napoleon III. He was an honorary member of the Iron and Steel Board of Sweden, a freeman of the City of Hamburg, an honorary member and gold medallist of the Society of Arts and Manufactures of Berlin, and a Grand Cross of the Order of H.I.M. Francis Joseph of Austria.

His written contributions to science were very limited. The Royal Society's "Catalogue of Scientific Papers" contains one other besides the two already given, viz. "On the Resistance of the Atmosphere to Railway Trains and on a means of lessening the same" (*Franklin Inst. Journ.*, vol. xiv., 1847). It is in connection with his metallurgical labours that his name will go down to posterity; and as an inventor who refused to be discouraged by obstacles, and pertinaciously held on to a scheme until it carried him to success.

NOTES.

A SPECIAL meeting of the Royal Society will be held in the rooms of the Society at Burlington House on Thursday, March 31, at 4.30 p.m., to receive preliminary statements as to the results of observations made during the recent total solar eclipse. Communications will be made by the Astronomer Royal, Sir Norman Lockyer, K.C.B., and other gentlemen.

MR. CHREE'S communication in another column relating to the present disturbed magnetic conditions is most interesting in relation to the recent eclipse. The remarkable association of a great number of sun-spots was connected in the telegrams from Viziadurg with the brightness of the corona, and the absence of the equatorial extensions seen at the period of minimum sun-spots. The wonderful chemistry of the spots may also be referred to recent observations, indicating chiefly the presence of scandium and vanadium. Magnetic storms and auroræ therefore are little to be wondered at. Were there any indications in January and February?

AT the meeting of the British Association held at Toronto last year, a resolution was passed by the general committee, requesting the Council to consider the desirability of approaching the Government with a view to the establishment in Britain of experimental agricultural stations similar in character to those which are producing such satisfactory results in Canada and elsewhere. This proposal was referred by the Council to a special committee, which has since made a report. The committee, while agreeing that some central institution might be of great use in the improvement of agriculture in this country, pointed out that there are already a number of independent bodies, connected with agricultural societies, colleges, and county councils, which are conducting agricultural investigations, and that it would be undesirable to approach the Government without the co-operation and support of these various bodies. The Council of the British Association has accepted this report, and has requested the committee to communicate with the various institutions interested in agriculture throughout the country, and to ascertain their views upon the subject. We are informed that the committee are now in communication with the various institutions referred to, in order to obtain a combined opinion upon the desirability of the creation by the Government of a central agricultural institution, for the purpose of undertaking agricultural research, and of acting as a centre of union for the various bodies conducting similar researches in this country, and of affording them advice and assistance when desired.

THE following officers of sections have been appointed for the Bristol meeting of the British Association:—Section A—President: Prof. W. E. Ayrton, F.R.S. Vice-Presidents: Prof. Rücker, F.R.S., Prof. S. P. Thompson, F.R.S. Secretaries: Prof. A. P. Chattock, Prof. W. H. Heaton (Recorder), J. L. Howard, W. Watson, E. T. Whittaker. Section B—President: Prof. F. R. Japp, F.R.S. Vice-President: Prof. W. Ramsay, F.R.S. Secretaries: Dr. C. A. Kohn (Recorder), Dr. T. K. Rose, F. Wallis Stoddart. Section C—President: W. H. Hudleston, F.R.S. Vice-President: E. Wethered. Secretaries: G. W. Lamplugh, Prof. H. A. Miers, F.R.S. (Recorder), E. Wilson. Section D—President: Prof. W. F. R. Weldon, F.R.S. Vice-Presidents: Prof. F. Gotch, F.R.S., Prof. L. C. Miall, F.R.S. Secretaries: W. Garstang, Dr. A. J. Harrison, W. E. Hoyle (Recorder). Section E—Vice-Presidents: Colonel F. Bailey, Dr. J. Scott Keltie. Secretaries: H. N. Dickson, Dr. H. R. Mill (Recorder), A. J. Herbertson, H. C. Trapnell. Section F—President: Dr. J. Bonar. Vice-President: Prof. E. C. K. Gonner. Secretaries: E. Cannan, Prof. A. W. Flux, H. Higgs (Recorder), W. E. Tanner. Section G—President: Sir John Wolfe-Barry, F.R.S. Vice-President: G. F. Deacon. Secretaries: Prof. T. H. Beare (Recorder), H. W. Pearson, W. A. Price, Prof. John Munro. Section H—President: E. W. Brabrook, C.B. Vice-President: C. H. Read. Secretaries: H. Balfour, J. L. Myres (Recorder), Dr. G. Parker. Section K—President: Prof. F. O. Bower, F.R.S. Vice-President: Prof. H. Marshall Ward, F.R.S. Secretaries: A. C. Seward (Recorder), Prof. J. B. Farmer, J. W. White.

SIR GEORGE KING has retired from the superintendentship of the Royal Botanical Gardens, Calcutta, and has been succeeded by Surgeon-Major David Prain.

THE Bakerian Lecture will be delivered at the Royal Society this afternoon by Dr. W. J. Russell, F.R.S., the subject being "Further experiments on the action exerted by certain metals and other bodies on a photographic plate."

THE centenary of the discovery of the voltaic pile will shortly be celebrated at Volta's birthplace on Lake Como.

M. ÉMILE PICARD, member of the Paris Academy of Sciences, and professor of higher algebra in the University of Paris, has been elected corresponding member of the Berlin Academy of Sciences.

DR. LUDWIG MOND, F.R.S., has been elected a member of the Athenæum Club, under the rule which empowers the Committee to elect annually nine persons "of distinguished eminence in science, literature, the arts, or for public services."

THE annual meeting of the Iron and Steel Institute of Great Britain will be held in London on Thursday and Friday, May 5 and 6. At this meeting the Council will present their annual report for 1897, and a number of papers will be read and discussed. The autumn meeting of the Institute will be held at Stockholm, under the auspices of the Swedish Association of Ironmasters, on Friday and Saturday, August 26 and 27.

THE Academy of Mathematical and Physical Sciences of Naples offers a prize of 500 lire for the best memoir on some subject connected with stereo-chemistry. The essays, which must be in Italian, Latin or French, must be sent in to the Secretary of the Academy not later than June 30, 1899. A prize of 1000 lire has just been awarded by the Academy to Prof. Giuseppe de Lorenzo for his essay on the pleistocene lakes of Southern Italy.

THE Royal Academy of Sciences of Bologna announces that a gold medal in memory of Aldini will be awarded in 1899 for the best essay on galvanism (animal electricity). The essays may be either in Italian, French or Latin, or may be in any other language, provided the author sends in a translation in one of these languages. They may either be in manuscript or printed, provided that in the latter case their publication has taken place within the two years preceding the award. Papers competing for the prize are to be sent before May 29, 1899, addressed to the Secretary of the Royal Academy of Sciences of the Institute of Bologna.

PROF. B. BRAUNER, of Prague, addressed an extraordinary meeting of the Chemical and Physical Society of University College, London, on Friday, March 18, and gave an account of his investigations with regard to the elements thorium, praseodymium and neodymium, his revision of the atomic weights of the latter elements, and their probable positions in the periodic table. In concluding his address, Prof. Brauner drew attention to the scientific importance of further investigation among the rare earths, and expressed a hope that more chemists would enter this field of research, which promised results of the highest value. In proposing a vote of thanks, Prof. Ramsay pointed out that the work, of which an account had been given, was a monument of careful experiment and extraordinary industry. Although it might appear to many present that an enormous amount of labour had been expended on an obscure corner of chemistry, it must be remembered that it was precisely such work which bore on the whole of chemical theory; and, indeed, which might be expected to influence chemical manufactures at a future date. It was possible that in the middle of the next century these researches of Prof. Brauner might bear fruit in extensive industrial application, and that these researches might become household words in the mouths of future generations of chemists. Prof. Tilden, in seconding the vote of thanks, desired in the first place to offer to the Society his own thanks, and those of his colleagues and students who were present, for the courteous invitation which had been extended to them. He congratulated Prof. Brauner on the success which so far had attended his labours, to which he had brought so large a supply of patience and perseverance, and in framing his hypotheses so much of the inspiration of the poet. In regard to the origin of these strange elements, the choice seemed to lie between the notion that they represented the ruins of a former state of things, or they might stand for those "old worn particles" referred to by Descartes, and on the other hand the idea that they resulted from the condensation of the original protyl, though in some way the process differed from that which gave rise to the rest of the elements. With regard to cobalt and nickel, which had been mentioned, he thought it probable that their atomic weights would ultimately turn out to be not quite so nearly identical as sometimes supposed. At the close of the meeting Prof. Brauner exhibited the absorption spectra of salts of praseodymium and neodymium, and a number of specimens of the pure salts.

AT a meeting of the Associated Chamber of Commerce, on March 17, Sir H. Stafford Northcote, Bart., M.P., in the chair, the following resolution was carried unanimously:—"That, in the opinion of this Association, the compulsory adoption within some limited period of the metric system of weights and measures legalised by the Act of last Session be advocated by every possible means, with the view of inducing Her Majesty's Government to afford facilities for the amendment of the law in this respect, and that a copy of this resolution be sent to the President of the Board of Trade and to the First Lord of the Treasury. This Association urges the Government meanwhile to adopt the metric system of weights and measures, as far as possible, in all Government contracts and returns, so as to make it familiar to the people; and recommends individual Chambers of Commerce to press the matter upon the attention of local governing bodies, to the end that these also may employ the system in all public contracts, and thus facilitate its general adoption."

WORK has just been begun upon a new building—the Horniman Free Museum—which Mr. F. J. Horniman, M.P., intends to present to the inhabitants of Dulwich and the neighbourhood. Several years ago Mr. Horniman filled a house at Forest Hill, London, with curios and objects of natural history, and made this museum free to the public. He now proposes to house the collections more elaborately, and it is for this purpose that the new building is to be erected. The building will contain two lofty galleries, each 100 feet long, lighted from the top. In addition, there will be a large lecture theatre capable of seating 300 people. The galleries will be divided into various courts, each devoted to a separate class of objects. Special provision will be made for the zoological and entomological specimens. Around the site of the new museum Mr. Horniman has purchased fifteen acres of ground, which he intends to convert into a public park and recreation ground. One of the mansions at present occuping the site is to be fitted up as a free library and club house, separate rooms being devoted to the free use of the scientific and other clubs in the neighbourhood.

THE *Athenæum* announces that the Accademia dei Lincei has chosen Prof. Eugenio Beltrami as president, in place of the late Prof. Brioschi. The new president of the most important scientific society in Italy, like his predecessor, is a mathematician. He is a native of Cremona, sixty-three years old, and has enriched his special branch of literature with a series of works on differential geometry, electricity, and magnetism. He is at present occupied with the editing of Leonardo da Vinci's "Codice Atlantico."

SOME few years ago the attention of readers of NATURE was directed to the then very remarkable utterance of an Oxford theological tutor on the subject of evolution. We refer to the late Canon Aubrey Moore. We now quote a striking passage by another Oxford teacher, whose sincerity and philosophic acumen are becoming generally recognised—the Rev. Charles Gore, Fellow of Trinity College, Oxford, and Canon of Westminster. The lecturer, after referring to the extraordinarily free way in which St. Paul quotes the Old Testament, says that: "Thereby we learn a lesson which we have got to learn, that Divine revelation does not include critical methods. God leaves us to the critical methods natural to every age, and each age must readjust its criticism. What God does give us is a moral and spiritual revelation of His own being and of our being, of our destiny and of our sin, and a revelation of the Divine means that God has taken for our recovery; and we have got to learn that lesson. Divine revelation is in the things of faith and morals—as we say, is of spiritual things; and we only bewilder our intelligences and cause stumbling-blocks if we try to assert that Divine revelation is given on these matters of natural science which progress from age to age by human investigation." The passage is quoted from a verbatim report in the *Guardian*, as it was delivered in Westminster Abbey to a crowded audience of thoughtful men on March 11, during Canon Gore's third Lent lecture on the epistle to the Romans.

IN *Annalen der Hydrographie und maritimen Meteorologie* for February, Dr. W. J. van Bebber has an article on weather prediction, with especial reference to the storm signal service on the German coasts. The author lays stress upon the difficulty of obtaining a clear idea of the success of weather predictions in different countries owing to the various methods of checking them, and thinks that the only safe criterion is the opinion of the public most interested in them. He makes various proposals

for the improvement of the forecast, most of which have been previously considered, *e.g.* : (1) The extension of telegraphic communication to islands in the North Atlantic. (2) The introduction of the so-called circular system of communication, by placing the principal stations and central offices throughout Europe in direct telegraphic correspondence with each other, immediately after the observations are taken. (3) More frequent telegrams, and where possible the establishment of telemeteorographs, or instruments reporting the chief meteorological elements continuously to the central offices. This arrangement already exists at a few places on the continent. (4) A direct exchange of telegrams between various signal stations. (5) The adoption of means for more generally disseminating the principles of weather conditions among the public, and the publication of an atlas containing types of weather, by means of which telegraphic reference to conditions similar to those actually existing might be made, without waiting for the publication of weather charts, as at present. The serious question of expense underlies the adoption of any of these suggestions.

THE Industrial Commission, appointed by the Lieutenant-Governor of the Isle of Man, to consider the best means of promoting new Manx industries, received from Prof. Herdman, at a meeting held last week, some important evidence relative to encouraging Manx sea fisheries, spawning beds, and hatcheries. Prof. Herdman expressed the opinion that the failure of the herring fisheries was more due to natural causes, such as the absence of food or changed meteorological conditions, than to overfishing or other cause that could be controlled. He did not think that fish were scared away, because the herring was a most tenacious fish, and would go where it wanted in spite of great difficulties. He did not think that steam trawlers did much harm by destroying spawn. On the contrary, they rather did good by catching the fish (haddock) that lived on herring spawn. He agreed that the three-mile limit was a good rough and ready method of preserving young fish. To obtain any other method of protection would require international law. With regard to hatcheries, he favoured the establishment of hatcheries for cod, plaice, and white sole at Port Erin, and oyster beds at Derbyhaven.

AN interesting report has been made to the Essex Technical Instruction Committee by Mr. T. S. Dymond, the Staff Lecturer on Chemistry, on the damage done to the land by the salt-water flood due to the injury of the sea-banks by the gale and high tide of November last. From this report it appears that round the coast of Essex alone about 50,000 acres of land were flooded by the overflowing of the salt water. Upon some of the farms the water only remained a few hours ; other land was flooded for six or eight days ; and in some cases the sea walls have not been repaired, and the water flows over the land during spring tides. This land in its ordinary condition contains only '01 per cent. of salt, whereas the flooded land is found by analysis to contain '20 per cent., equal to two tons an acre in the top six inches of soil. This excess of salt is injurious to vegetation. Peas and tares have suffered severely, wheat has been damaged to a less extent, and where the seed had not germinated does not seem to have been affected. The most serious and more permanent effect, however, is due to the effect of the salt on the earthworms, which after the flood were found strewn upon the surface of the ground, whence they were carried off by the gulls. The use of worms in assisting the drainage and promoting aeration of the soil is universally recognised, and their extermination in the heavy flooded land is therefore a serious matter. The sea salt also, owing to its power of absorbing moisture, renders the soil moist and difficult to work, and also prevents the aeration which is necessary to the roots of the plants, and for promoting fermentation of humus, and nitrification. The injury to the land by the destruction of the earthworms was a fact generally accepted as correct in the inundation due to an exceptionally high tide which covered a large area of the Lincolnshire Fens with salt water at the beginning of the present century.

A SPECIMEN copy of a new French scientific journal has been sent to us, entitled *Archives de Parasitologie*. As its name implies, it is hoped it may become the organ of researches dealing with parasites capable of provoking disease in both man and animals. The editor is Raphael Blanchard, Professor at the Faculty of Medicine of Paris, and he hopes by admitting memoirs in German, English, Spanish and Italian, to encourage foreigners to send their work for publication in his journal. It will appear quarterly, and no pains, it is stated, will be spared to ensure the printing and illustrations being of the best possible character. In connection with the subject of parasitic disease, there is an interesting little article—"Notes on the life-history and microscopic appearances of the parasite of Malaria," by A. E. Griffin —in the current number of the *Middlesex Hospital Journal*. Although the parasite of malaria was discovered and described by Laveran as long ago as the year 1880, its life-history has by no means been yet thoroughly worked out. It is, however, supposed that mosquitos may play an important part in the evolution of this parasite, and that, present as an encysted form in the eggs of these insects, the germs may be introduced through the medium of air or water into the human body ; or a mosquito which has become infected with the blood of a malarial patient may attack and infect a human being directly. The medium of infection is generally supposed to be through the air ; but there is strong evidence that water may also convey the disease, and Mr. Griffin cites cases of malaria contracted on a ship which, touching at Colombo, took in water there, and twelve days later, the usual incubation period, the disease manifested itself on board. Arsenic in large doses, it appears, proved a more valuable remedy than quinine in the late Ashanti war.

DR. F. VON KERNER contributes a paper on the geography of the middle course of the river Kerka to the *Mittheilungen* of the Vienna Geographical Society. The Kerka ceases to be navigable at the falls of Scardona, and above that point its course is impeded by many falls and rapids. Dr. Kerner's paper is illustrated by six excellent photographs of this picturesque region.

THE third of the *Münchener geographische Studien*, edited by Herr Siegmund Günther, consists of a paper on the structure and distribution of earth pyramids and pillars, by Dr. Christian Kittler. The nature of the deposits in which these structures are formed, and of the erosive action which produces them, is discussed in detail. A noteworthy point is the conclusion that the crowning stone is by no means an essential feature.

DR. GIOVANNI DE AGOSTINI publishes in the *Bollettino* of the Italian Geographical Society a preliminary note on some results of exploration of the lakes of the Roman province. Soundings and temperature observations at various depths, made during 1896 and 1897 in the lakes Bolsena, Mezzano, Vico, Monterosi, Bracciano, Martignano, Albano, and Nemi are discussed, and contour maps are appended.

AT the meeting of the Vienna Academy of Sciences on February 10, the President read a letter from Prof. J. Luksch, of the *Pola* expedition, dated from Suakim on January 23. On January 10 the *Pola* anchored at Ras Tarfu, and a boat was sent to Geishan to obtain a pilot for El Wasm and Kunfida. Next day a party was landed to make observations, but the observers were attacked by Bedouins, and only escaped after some sharp fighting under cover of the guns of the ship. Fortunately there was no loss in killed or wounded ; even the instruments were

brought off safely. Since leaving Mocha, the *Pola* has made valuable observations, chiefly geological, at a number of points along the coast, and amongst the islands.

AN instance of the service which the Department of Scientific and Technical Research of the Imperial Institute is able to render appears in the number of the *British Central Africa Gazette*, which has just reached this country. A specimen of limestone found on Kilwa Island, Lake Shirwa, was sent to the Institute for an opinion as to its value, and Mr. Wyndham R. Dunstan sent the following report upon it:—"The sample of limestone from Kilwa Island, which is used at Zomba for making lime, turns out to be calcium carbonate—Iceland spar. It contains small quantities of iron and magnesium, and also of phosphate. This last constituent, though minute (0·1 per cent.), should be borne in mind in connection with the possible use of the mineral, either burnt or in its natural state, as a manure. Another point, to which I think it would be well to direct attention, is the value of large, well-formed, colourless *transparent*, rhombohedral masses of the spar. These are employed in the construction of certain optical instruments, and I was informed by one of the principal manufacturers not long ago that the supply of these crystals is now very scarce." The *Gazette* states that, on receipt of this information, the Acting Commissioner took steps to procure and send home for valuation transparent specimens of this crystal.

IN a presidential address to the Conchological Society, published in the January number of the *Journal of Conchology*, Prof. Hickson offers a suggestion to explain the untwisting of the body which has admittedly taken place in certain groups of Gastropod Mollusca. The asymmetry of the Gastropod body was clearly brought about by the acquisition of a spire-like shell, into which its possessor could completely withdraw. Such a shell, however, though advantageous as a protection, is an obstacle to locomotion; therefore, if the Gastropod body could be protected in another way, the *raison d'être* for a spiral shell would disappear. Any increase in the size of the foot, bringing about increased powers of locomotion, would be an advantage to the species in giving it a wider range; and, to obviate the disadvantage of exposing the body to the possible attacks of enemies, an obnoxious or poisonous fluid might be secreted. In support of this view, Prof. Hickson states that among Opisthobranchs there is actually a series of forms showing a gradual diminution in the twist of the shell and a corresponding increase in the size of the foot; and, in addition, points out that some Nudibranchs have been shown to be distasteful to fishes.

IN *Bulletin* 11, new series, of the U.S. Department of Agriculture (Division of Entomology), Mr. L. O. Howard describes the introduction and spread of the Gipsy Moth (*Porthetria dispar*, *L.*) in Massachusetts, and the means employed for its extermination. This species, injurious on the Continent, but now apparently extinct in Great Britain, was introduced into Massachusetts in 1869 by the escape of examples imported for experiments in silk-growing. Becoming acclimatised in scrub-undergrowth, it multiplied slowly in spite of efforts made to check it, becoming a serious pest by 1889. Since that time its range has extended to about 220 square miles, within which area it has done enormous destruction by the defoliation of deciduous trees. The State has fought it energetically, expending in the the last eight years as much as 725,000 dollars, in addition to 40,000 dollars allowed by Congress. In some years, however, the grants have been made too late to allow the work of destruction to be adequately proceeded with. The chief measures relied on are spraying the foliage with lead arsenate, destruction of the eggs with creosote, grease-banding the trunks to prevent caterpillar ascent, or tying them round with strips of coarse canvas (burlap), under which the caterpillars assemble, and whence they can be collected. Mr. Howard, who claims that this will rank as "one of the great experiments in economic entomology in the history of the world," estimates that more than nine tenths of the colonies, large and small, existing in 1891, have been exterminated; and, except for the difficulty of dealing with woodlands, there appears to be no reason why continuance of the present treatment should not ultimately achieve the total extirpation of the insect.

PROF. PUTNAM has called our attention to an error in the summary of his paper on the magnetic survey of Greenland (NATURE, February 10, p. 347). He points out that the balancing ring employed was of appreciable width, and that, therefore, the formula used in computing the moment of inertia was correct. In this Prof. Putnam is quite right, and the writer of the notice regrets that he did not follow the description of the instrument with sufficient care. As stated in the article, the numerical results are in no way affected.

A NEW periodical—*The Wide World Magazine*—has just been commenced by Messrs. Geo. Newnes, Ltd. The first number contains several instructive articles, all of which are illustrated by striking photographs. Probably no more remarkable collection of pictures have ever appeared than are reproduced in this new magazine. Among the contents we notice a number of pictures of scenes and people in New Guinea, contributed by Prof. A. C. Haddon; photographs of various devotees; an article by Dr. Nansen, entitled "How the North Pole will be reached"; a number of interesting photographs of scenes in China, by Mr. J. Thomson; reproductions of several of Mr. Saville-Kent's curious photographs; and some memories of Navarino, by Admiral Sir Erasmus Ommanney. The magazine is distinctly in advance of the general type of popular periodical, and its contents bear out its motto that "Truth is stranger than fiction."

THE additions to the Zoological Society's Gardens during the past week include a Mexican Deer (*Cariacus mexicanus*, ♂), a Reddish Brocket (*Cariacus rufinus*, ♂), a Globose Curassow (*Crox globicera*, ♀) from British Honduras, presented by H.E. Colonel Wilson, C.M.G.; two Zebus (*Bos indicus*, ♂ ♀) from India, presented by Commander George Stevenson; a Macaque Monkey (*Macacus cynomolgus*, ♀) from India, presented by Mr. M. Lyons; a Senegal Parrot (*Pæocephalus senegalus*) from West Africa, presented by Miss L. Firmin, a Common Fox (*Canis vulpes*, ♂), British, presented by Miss Heard; a Malayan Paradoxure (*Paradoxurus hermaphroditus*) from Singapore, a Hairy Armadillo (*Dasypus villosus*) from La Plata, a Grand Eclectus (*Eclectus roratus*) from Moluccas, deposited; a Manchurian Crane (*Grus joponensis*), four Gold Pheasants (*Thaumalea picta*, ♂ ♂ ♀ ♀) from China, two Argus Pheasants (*Argus giganteus*, ♂ ♀) from Malacca, two Horned Tragopans (*Ceriornis satyra*, ♂ ♀) from South-east Himalayas, two Lineated Pheasants (*Euplocamus lineatus*) from Tenasserim, two Somali Ostriches (*Struthio molybdophanes*, ♂ ♀) from Somali-land, two Many-coloured Parrakeets (*Psophotus multicolor*), four Spotted-sided Finches (*Amadina lathami*) from Australia, a Snow Bunting (*Plectrophanes nivalis*), European; two Lapwings (*Vanellus cristatus*), British, purchased; seven Baer's Ducks (*Fuligula baeri*) from India, received in exchange.

OUR ASTRONOMICAL COLUMN.

MAGNITUDES OF 1081 SOUTHERN STARS.—During a voyage to Australia (1885-86), round the Cape of Good Hope and back by the Red Sea, including a stay of two months in Australia, Mr. Stanley Williams was able to make a very useful catalogue of 1081 stars lying between 30° south declination and the South Pole.

This catalogue has recently been published, so a few words about the method employed in making the observations may be opportune. Before setting out on this journey Mr. Stanley Williams made several hundreds of observations to make himself familiar with this class of work, so that his estimations have considerable weight. He adopted the usual method of making variable star observations by using an opera-glass, and bringing each star and its comparison stars into the centre of the field consecutively. The star undergoing comparison was usually compared with two others of known magnitude, one of which was brighter and the other dimmer than the star to be observed. Instead, however, of estimating the difference of brightness between the comparison star and the star under examination in steps or grades, the magnitude of a step being usually different for nearly every observer, he employed another method. This was to mentally divide the interval between the two comparison stars into as many parts as there were tenths of a magnitude between them, the adopted magnitudes of the comparison stars being, of course, known, and then estimate how many of these tenths the star under observation was dimmer and brighter than the comparison stars.

A step in this case thus corresponded to a tenth of a magnitude on the scale of the "Harvard Photometry." A comparison of the resulting magnitudes of some of the stars observed, which have also appeared in the "Southern Meridian Photometry," shows that "the present catalogue, on the whole, accords exactly with the 'Harvard Photometry,' though the number of stars is too small for absolute certainty." A similar comparison with the "Uranometria Argentina" shows more considerable differences, excepting between 2·8 and 3·4 magnitudes; but it must be remembered that the scale of the "Uranometria Argentina" differs largely from that of the "Harvard Photometry."

In the course of this work one variable, V Puppis, was discovered, and thirteen other stars were found to be probably variable.

THE VARIABLES S CASSIOPEIÆ AND S URSÆ MAJORIS.—Some time ago, in this column (December 2, 1897, p. 105), we had the pleasure of saying a few words about the variable stars S Cephei and T Ursæ Majoris, which Mr. Peek, of the Rousdon Observatory, had so energetically observed and recorded during the years 1887 to 1896. We are now able to refer our readers to another small, valuable pamphlet (No. 3) containing the observations, extending over the same years, of the two variable stars S Cassiopeiæ and S Ursæ Majoris. Each of the observations here recorded is the mean of five visual comparisons with stars whose magnitudes have been previously determined either by Mr. Peek himself or some other observer. Further, the comparisons are all made with stars in the same field of view as the variable under observation, the instrument employed being a 6·4-inch equatorial refractor by Merz. The observations are recorded in a uniform way throughout, in which the date of observation, the magnitude, and remarks as to colour and magnifying power used are given. As in the previous publication, Mr. Peek adds a graphical study of the light changes of these stars throughout each year, and a perusal of these curves is of great interest. We hope Mr. Peek has some more observations of other variables which he will publish in like manner, as it is just such observations that will throw light on the changes which these stars undergo.

OCCULTATIONS PHOTOGRAPHICALLY OBSERVED.—Prof. E. C. Pickering records, in a Circular (No. 26) of the *Harvard College Observatory*, the result of the occultation of 26 Arietis as observed photographically at that observatory. The instrument used was an improved form of that constructed for photographing the eclipses of Jupiter's satellites, and previously described. The phenomenon of this occultation was satisfactorily photographed by Mr. Edward S. King on February 25 of this year. The apparatus was connected with a standard clock, and the photographic plate was moved about 0·03 cm. every time the circuit was closed or opened, two images alternately faint and bright being obtained every second, the duration of exposures being 0·06 and 0·94 seconds. An examination of the series of images showed that the time of occultation could be fixed to within one-tenth of a second. Prof. Pickering adds that by using shorter exposures the uncertainty of the time of disappearance can be still further greatly reduced, especially in the case of brighter stars. 26 Arietis is a star of magnitude 6·1; since satisfactory images were produced in 0·06 seconds, stars probably down to the ninth magnitude can be thus photographically observed. The stellar images were further examined to inquire whether any lunar atmosphere could be detected by noting any change in the intensity of these images; but none was discovered. *A propos* of occultations, it is interesting to draw attention to the fact that Prof. G. P. Bond, more than forty years ago, took a number of photographs of the moon and α Virginis shortly before the occultation of the latter, to determine photographically the position of the moon.

COMET PERRINE.—A telegram from Kiel, dated March 21, informs us that the position of Perrine's Comet at 19h. 7m. Mount Hamilton mean time was R.A. 21h 16m., and Declination 26° 44′ north, the movement in these two coordinates being 14 and 37 seconds respectively.

A MAGNETIC STORM.

SINCE August 1894 no magnetic storm has occurred in England at all equal to one experienced during the last few days. Its first indication at Kew Observatory occurred about 8.55 p.m. on the 14th, when a noticeable increase took place in the horizontal force. This element then oscillated about its normal value to a moderate extent until 4 p.m. on the 15th, when there commenced a large decrease superposed on large oscillatory movements. The minimum was reached about 10.48 p.m. on the 15th. During the subsequent rise, which was very rapid at first, there were some further large oscillations, and the element remained somewhat disturbed until 5 p.m. on the 16th. The vertical force was only slightly disturbed until 2 p.m. on the 15th. After increasing to a maximum about 5 p.m. it decreased rapidly with large oscillations, attaining a minimum about 10.48 p.m. It then reapproached its normal value, the oscillations being large at first, but becoming small early in the morning of the 16th.

The declination disturbance commenced at the same time as that of the horizontal force, but was small until midnight on the 14th. After a general easterly movement, lasting for some hours, the needle reversed its direction, attaining its extreme westerly position about 2′48 p.m. on the 15th. It then recommenced a very conspicuous movement to the east, with various large oscillations. After attaining an extreme easterly position about 11.18 p.m. on the 15th, the needle moved once more to the west, the motion remaining oscillatory. The disturbance did not disappear until about 5 p.m. on the 16th.

The extreme amplitude of the disturbance was: horizontal force, ·0050 C.G.S. units; vertical force, ·0057 C.G.S. units; declination, 1° 26′. In eight minutes, from 10.40 to 10.48 p.m. on the 15th, the horizontal and vertical components exhibited falls of ·002 and ·003 C.G.S. units respectively. The most rapid change of declination occurred some thirty minutes later. Speaking generally, the most salient features were the large falls in both the horizontal and vertical components, and the movement of the declination needle to nearly 1° east of its normal position. The storm was presumably associated with the brilliant aurora visible on the night of the 15th in the northern half of the kingdom and in Denmark (*Daily Weather Report*, March 16). CHARLES CHREE.

THE AUSTRALASIAN ASSOCIATION.

THE meeting of the Australasian Association for the Advancement of Science, held at Sydney in the beginning of January, appears to have been a very successful one. From the reports which came to hand a few days ago it appears that the meeting was attended by the foremost men of science in the various Australasian Colonies, and that a large number of papers were read in the different sections. The Association now numbers more than six hundred members.

The meeting was opened on Friday, January 6, and on the evening of that day Prof. Liversidge delivered his address as president of the Association. Saturday, January 7, and succeeding days in the following week were largely taken up with the sectional meetings. Papers were read in connection with astronomy, mathematics and physics; chemistry, geology and mineralogy, biology, geography, ethnology and anthropology, economic science and agriculture, engineering and architecture,

sanitary science and hygiene, mental science and education. Reports of some of these papers appeared in the *Sydney Daily Telegraph*, and from a large number of cuttings which Prof. Liversidge has sent us the following abstracts have been obtained.

PRESIDENT'S ADDRESS.

Prof. A. Liversidge, F.R.S., the Secretary and newly-elected President of the Association, delivered an inaugural address on the evening of January 6. The address was a survey of the objects and work of the Association, and a brief statement of the more important questions with which chemists have lately been concerned. The work of the International Catalogue of Scientific Literature was referred to, and the hope was expressed that Australasia would do something to assist the cataloguing of scientific publications. Reference was made to the fact that the Imperial Institute in London was becoming an institution for the advancement of science. It was now fulfilling its intended objects, and was becoming a most valuable means of disseminating a knowledge of the products and manufactures of the Indian Empire and the Colonies; not only of a commercial, but of a scientific value. Dealing with the chemistry of the ancients, Prof. Liversidge said they might include amongst the recent advancements of science the six important volumes recently published by Prof. Berthelot, of Paris (Perpetual Secretary of the Academy of Science and sometime Minister for Foreign Affairs). Referring to the report of the Committee appointed by the London County Council to inquire into the teaching of chemistry, Prof. Liversidge remarked that Australia at present imported most of its scientific men, but it was time it set about educating its own in greater numbers, and providing greater facilities and better equipped laboratories than the existing ones. The prosperity of a country very largely depended upon the advance of science amongst the people and the more or less practical application they made of each science. Students required to be taught not only the principles of science, but also how to observe, how to use their hands, and to reason and think accurately, and to gather their information from various sources; for there were but few, if any, text-books so well written as to be of equal value in all parts. And especially should they have time and opportunity for some original or research work, in order that they might enlarge the borders of knowledge, and contribute something, however small, to the common stock. Mere training and teaching for a degree was not sufficient; post-graduate work was essential if they wished to turn out scientific men, who would be able to advance Australia by developing its resources and improving the conditions of life. It was not sufficient to merely instruct in the facts and principles of scientific knowledge. It was most important also to impart scientific habits of thought and methods, especially with the object of making new investigations or researches, so that the student might in turn be able to teach something more than he himself was taught or learnt from books. With regard to recent work in chemistry, Prof. Liversidge referred to the discovery of argon and helium, and recent work on the liquefaction of gases. He also made brief references to the manufacture of artificial diamonds and other gems, the diffusion of metals, the phenomena of Röntgen radiation, agricultural chemistry, and other subjects of interest.

ASTRONOMY, MATHEMATICS AND PHYSICS.

Astronomy and Terrestrial Physics.

Mr. P. Baracchi (Government Astronomer of Victoria) selected the subject of "Astronomy and Terrestrial Physics" for his presidential address. He pointed out certain branches of astronomy and terrestrial physics which, in his opinion, had the strongest claim to the immediate consideration of the scientific workers of the Australasian Colonies, and in some cases to the encouragement and support of their Governments. After referring to the present observatories in Australia, Mr. Baracchi said it was very necessary for their observatories to be extremely careful with their available astronomical energy in order to turn it to the best possible account, and it should be employed solely in the preparation of data, which were demanded of them, as the most valuable contribution they could give to astronomy at the close of the present and commencement of the next century. Sidereal astronomy was well advanced in the Southern Hemisphere; indeed, it was said ten years ago that they were ahead of the Northern Hemisphere in point of exact star catalogues. In all other respects, however, their knowledge of the Southern Hemisphere was deficient. The course before them was clear. Celestial photography, astronomy of position, and fundamental investigations for the improvement of both these branches should be the chief objects of their endeavours in the present and immediate future. Other branches of astronomical research must be left, and recommended to the amateur astronomers of the Colonies. The best service that could be rendered to astronomy by the amateurs would be to direct their efforts to a class or classes of observations which could not be made by observers in the Northern Hemisphere. With regard to terrestrial physics, there were certain subjects which derived their great importance not only from purely scientific considerations, but from their more or less direct bearing upon material interests, from the fact that in very recent years and at the present time they had been taken up with renewed vigour and determination in the hope of improving our knowledge on many points which still remained unexplained. Prominent amongst these was terrestrial magnetism, from a knowledge of which it was hoped would be gained a solution of some of the riddles which were now unexplained. It was recognised that the main question to which future efforts should be directed was to expand and coordinate magnetic work done all over the world for obtaining a more correct and complete knowledge of the distribution of terrestrial magnetism and of its variations. The establishment of an observatory in the interests of this science was a duty which New Zealand owed to the scientific world.

Cloud Heights and Velocity

A paper on "The Measurement of Cloud Heights and Velocity" was read by Mr. P. Baracchi. The year 1897 had been called by some writers on meteorological subjects "the cloud year," on account of the systematic observations of clouds which were carried on in nearly all the civilised countries during that period under a scheme laid out and finally agreed upon in all its detail by the International Meteorological Committee at its Upsala meeting in 1894. The object of the scheme was to obtain more uniform and comprehensive data to serve as the basis for the further study of atmospheric conditions, as indicated by the forms and movements of clouds. After a brief reference to the methods adopted in Victoria for securing results anticipated by the scheme, Mr. Baracchi said there were now some 20,000 observations ready. For the determination of absolute height and velocity a pair of stations for simultaneous observations were established, one being on the grounds of the Melbourne Observatory and the other on the roof of Parliament House at a distance of 6820 feet bearing. After consideration he adopted the photographic method, which had been successfully employed at the Kew Observatory some years ago. The absolute height and velocity of a cloud could, provided it was suitably situated, be determined from two photographs of it taken simultaneously with two cameras placed at a distance of from a few hundred yards to one or two miles from each other, the cameras being in all respects equal and rigidly mounted, so as to point accurately to their respective zenith, namely, having their collimation axes truly vertical. Under good conditions the highest clouds could be measured within 500 feet and the lower within 50 feet.

The Source of Periodic Waves.

Mr. H. C. Russell, F.R.S., Government Astronomer of New South Wales, read a paper on "The Source of the Periodic Waves, sometimes called Earthquake Waves, which reach Sydney from time to time." He stated that these waves were recorded very frequently in Sydney, and had the same period as the waves known to be caused by earthquakes—that was about twenty-six minutes from crest to crest; but it was shown that only about 1 per cent of them originated in earth movements, and that 60 per cent originated in Bass' Straits, when the meteorological condition known as a low pressure arrived at that part of Australia. The effect of low barometers was to cause a rise in the sea level, to provide for which currents set in along the south and east coasts of Australia, which, meeting in Bass' Straits, produced waves, and set them going in Tasman Sea, whence they were recorded on the Sydney and Newcastle tide gauges. It was also shown that at least another 10 per cent. of these waves originated in Tasman Sea by the action of heavy gales. That was, in all, 70 per cent. of the periodic waves originated from meteorological disturbances, and probably the remainder were due to these causes, although the connec-

tion had not yet been actually traced. Reference was made to Lake George, where somewhat similar periodic waves were frequent, and all were traced to meteorological causes.

Seismological Report.

In presenting the report of the Seismological Committee, the Secretary, Mr. George Hogben, of Timaru, New Zealand, referred to the work already done in his own Colony through the officers of the Telegraph Department, who, on the occurrence of any earthquake shock, filled up certain forms, stating the exact time and duration and such other details of the earthquake as might enable the seismologist to determine the origin of the disturbance, the velocity with which the waves were propagated through the earth's crust, and sometimes to make a very good guess as to the nature of the subterranean causes that gave rise to the earthquake. By means of these observations the sources of many of the earthquakes had been accurately found, their velocity of propagation determined, as in general rather under twenty miles a minute; in a few cases the depth of the origin was also ascertained, the deepest one found so far coming from a point about twenty-four miles below the earth's surface. This work had been done in New Zealand since 1889, and the other Colonies had been asked to follow suit. This they had done to a certain extent, but the Committee was anxious that the system should be developed, and made uniform throughout. Of recent work the most interesting item was probably the fact, based upon rough calculations from returns sent by Sir Charles Todd, and others, that the great South Australian earthquake of May 10, 1897, proceeded from a line parallel to the coast near Beachport and Kingston, and was possibly due to a sliding of one part of the crust upon another, such as forms what was called in geology a "fault." This was probably deep, but the later and slighter shocks were surface ones, caused by readjustments of the immediate crust. The subject was still under investigation by the Secretary. But Mr. Hogben pointed out that it was as part of a world-system of seismological observations that the work of the Committee might be most useful. An International Seismological Committee had been set up embracing all the ablest workers in every part of the world, and in co-operation with that Committee were Committees of the British Association and of the Royal Society. They desire especially to be able to track the microseismic vibrations of minute earthquake waves, which travelled from the sources of disturbance all round the earth's surface, or it might be right through the solid mass of our world (if it was solid). The speed of these finer waves was many times greater than that of the larger waves felt by us, reaching a velocity as great as twelve miles per second, or even more. For the purpose of observing them the International Committee had agreed upon a certain type of instrument, the horizontal pendulum to be used by all stations alike, as it was important that instruments of the same kind and of the same degree of sensitiveness should be employed for purposes of comparison.

Mr. Hogben stated in answer to questions that, at the suggestion of Sir James Hector, the New Zealand Government had ordered two instruments—improved forms of the horizontal pendulum. He asked for the moral and financial support of the Association in this object. Unless instruments were procured at once for Sydney, Melbourne and Timaru (the three stations in Australasia named by the International Committee), the chain of world-stations would be interrupted.

CHEMISTRY.

Constitution of the Matter in the Universe.

The New South Wales Government Analyst, Mr. William M. Hamlet, delivered the presidential address in this section, the subject being "The molecular mechanism of an electrolyte." He defined an electrolyte as a body in solution or state of fusion, capable of being instantaneously decomposed by a current of electricity, and he claimed that if the explanation he offered was adequate for the electrolyte, it must hold good for the constitution of the matter in the universe, so that the treatise on the electrolyte has a most important scientific bearing. The method of investigating the action of one body upon another, he reminded his audience, was brought to a high degree of accuracy by the immortal work of Sir Isaac Newton. He alluded to some observations of the late Prof. Clifford, made over twenty years ago, this authority remarking, almost prophetically, "We can look forward to the time when the structure and motions in the inside of a molecule will be so well known that some future Kant or Laplace will be able to make an hypothesis about the history and formation of matter."

Red Rain Dust.

Much interest was manifested in a paper read by Mr. Thomas Steel on "Red Rain Dust," in the section devoted to chemistry and chemical research. The author remarked that from time to time records of the fall of dust, either alone or accompanied by rain, have been reported from various parts of the Australian Colonies, in common with the rest of the world. Although it was extremely probable that in the great bulk of the cases the dust was merely of terrestrial origin, it was interesting when positive facts regarding the source of the material could be ascertained. On December 27, 1896, an unusually heavy fall of dust of a red colour occurred in Melbourne and was carried down by rain.

An analysis of a clean sample of this dust gave the following results:—Organic matter, 10·70; sand, insoluble and undetermined, 66·21; soluble silica, ·75; ferric oxide, 4·68; ferrous oxide, ·50; alumina, 15·16; lime, 1·36; sulphuric anhydride, ·62. The dust may therefore be regarded as a characteristic example of ordinary surface soil, such as is derived from the weathering of volcanic rocks. Both in appearance and composition it agreed closely with several samples of such soil from widely separated localities. Under the microscope, in addition to the diatoms noticed by other observers, the dust was seen to contain a few lepidopterous scales.

GEOLOGY AND METEOROLOGY.

Early Life on the Earth.

In this section the President, Prof. F. W. Hutton, F.R.S., delivered an address on the subject of "Early Life on the Earth." After describing the various periods through which the earth has passed, Prof. Hutton presented some speculations regarding pre-Ordovician life. Speaking of the origin of life, he said it was highly probable that the first living organisms were evolved near the surface of a warm ocean. They might safely assume that the first protoplasm was not so complicated a substance as it had since become. Ordovician and Silurian life followed, and the lecturer said, in conclusion: "We have thus arrived at the conclusion that the ocean was the mother of life; that on its surface floated the first organisms whose descendants, but little changed during all the millions of years that have since passed away, still float and multiply. Presently some of these animals found their way down to the bottom, where all the débris from the floating organisms collected, and here in still water they lived and increased for a long time. Slowly they invaded the rough waters of the coastline, and at last gained a footing on the land. It was plants which formed the army of invasion that conquered the land."

Coral-boring Expedition to the South Seas.

Considerable interest was manifested in the section devoted to geology and mineralogy, owing to the fact that Prof. David was announced to read a paper on "The Coral-boring Expedition of 1897 to the Island of Funafuti in the South Seas." The funds for the expedition were found chiefly by Miss E. Walker, of Yaralla, the late Mr. Ralph Abercrombie, and the Royal Society of London, while the New South Wales Government lent a diamond drill and the workmen. The method of working the drill and simultaneously attacking the great coral cliff which bounds the atoll seawards was explained, and an account given of some of the manners and customs of the natives. Special reference was made to the nature of the last part of the boring done while Mr. Sweet was in charge. The last 30 feet of core were particularly interesting, being formed of a soft chalky rock, with numerous foraminifera, and showing that the coral formation proper had been all but completely penetrated. Had it been possible to bore a little deeper, Prof. David thinks that the foundation rock would have been reached. Mr. Sweet had done all that he judged would most conduce to attaining this end, and when the boring had to be stopped had left the bore in such a condition that it was possible in resuming the bore to utilise the old borehole, now 698 feet deep. Prof. David urged that this meeting might use its influence with the Council of the Association to have a recommendation made to the Government of New South Wales to extend the loan of the diamond drill so as to admit of the boring being continued till bedrock was

reached. A letter received from the Royal Society of London, stated that the Society was so pleased with the results already attained at the Funafuti bore, that it had voted a further sum to meet the expenses, making their total subscription up to the present 500*l*. Opinions amongst scientific men in Great Britain as to the conclusions to be drawn from the evidence of the Funafuti bore were at present divided. While the advocates of the Darwinian theory were inclined to congratulate themselves upon the results, Dr. Murray's supporters say that the evidence substantiates their views. Prof. David considered that the last portion of the core obtained weakened the subsidence theory.

Glacial Research.

The report of the Glacial Research Committee, South Australia, was submitted by Prof. T. W. E. David and Mr. Walter Howchin. The localities dealt with were comprised within the peninsula which formed the southern limits of the Mount Lofty Range. In 1859 Mr. Alfred Selwyn, at that time Government Geologist of Victoria, whilst travelling through the Inman Valley, discovered a polished rock surface which, to the practised eye, exhibited clear proof of glacial action. This was the earliest discovery of its kind in Australia, but the position was lost sight of until re-discovered by the authors of the paper in March last. This polished pavement, which measured over 20 feet in length and 6 feet in breadth, occurred in the bed of the Inman River, a little past the seventh mile-post from Port Victor. The glacial beds of the Inman River have at present an elevation of over 600 feet above sea level. If, therefore, the agency of shore-ice as the means of distribution were admitted they must assume that there had been an elevation of the land since the days of glaciation. The facts were, perhaps, best explained by a reference to a combination of agencies, rather than to a single form of ice action.

A paper "On the Occurrence of Glacial Boulders at Yellow Cliff, Crown Point Station, Fincke Valley, Central Australia," dealt with a recent discovery by Prof. Baldwin Spencer, of Melbourne University, and Mr. P. M. Byrne, of Alice Springs telegraph station, of large glaciated pebbles at a level of about 1000 feet above the sea. This is the nearest point to the tropics in Australia at which traces of glacial action have been observed, and the discovery is therefore of great interest. The pebbles are from 2 inches up to 1 foot in diameter, and form a layer about 3 feet in thickness, overlying a soft grey sandstone, the geological age of which is unknown. It is not known at what period of geological time the ice existed which produced these markings. The only other instance of possible evidence of ice action in Australia near to the equator than Yellow Cliff is that mentioned by Mr. R. L. Jack, viz. the Bowen River coalfield of Queensland. At that locality small boulders of rock foreign to the district are found embedded in the marine permo-carboniferous strata. It is just possible that these boulders were rafted to their present resting-place by floating trees, but the glacial explanation is thought to be the more probable one.

A paper entitled "Further Evidence of Glacial Action in the Bacchus Marsh District," by C. C. Brittlebank, G. Sweet, and Prof. David, dealt specially with the deep preglacial valleys bounded by steep sides, 500 to 600 feet high, which had been choked with glacial drift, and powerfully glaciated at their bottoms and sides, as well as on the summits of the intervening ridges. The fact was commented on that very few rocks of local origin were observable in the glacial beds, and that all the glacial beds were more or less stratified, in which respect they differed markedly from the glacial till of Northern Europe.

Geology and Mineral Deposits of Portions of West Australia.

The New South Wales Government Geologist (Mr. E. L. Pittman), read a paper "On the Geology and Mineral Deposits of certain portions of West Australia." The geology of the Perth artesian water basin was first dealt with, and it was stated that the water occurred in a porous rock, consisting of calcareous sandstone of æolian origin. The basin was about fifteen miles wide, but extended along the coast for several hundred miles in a north and south direction. The chief peculiarity of this artesian basin was that it was not covered by any continuous impervious beds, such as had hitherto been regarded as essential for the occurrence of artesian water. Reference was next made to the Collie coalfield, and the opinion was expressed by the author that it was of Mesozoic age, like the Victorian coalfields, and that of the Clarence River. The Coolgardie goldfield was then briefly alluded to. The gold here occurred in some of the reefs in phenomenally rich "chutes," separated by intervals of barren material. The "cement deposits" of the 25-Mile were described as alluvial deposits, containing very angular gold, in fairly-defined channels. The Kalgoorlie goldfield was described at considerable length, and particular reference was made to the famous telluride deposits of the Boulder. These, in Mr. Pittman's opinion, consisted of igneous dykes of quartz, felspar, porphyry, which had been subjected to an enormous amount of crushing, and this had induced a schistose or foliated structure in them.

General Geology.

The Rev. J. Milne Curran read a paper on "Artesian Water in New South Wales." He concluded that the artesian water of the north-west and west of New South Wales was derived from Triassic beds, and, in his opinion, there was no evidence to show that a single artesian well in the Colony derived its waters from Cretaceous rocks. Photographs were exhibited of artesian flows, Cretaceous and Silurian country in the far west.

In the discussion that followed, Mr. R. L. Jack stated that artesian water had just been struck in Queensland, on the central line of railway at Maria Creek, west of the Dawson River, in rocks of permo-carboniferous age. These were the oldest rocks in Australia in which artesian water has as yet been discovered, and they were not known previously to be water-bearing.

The Rev. J. Milne Curran, in laying before members of the section some "Notes of a Geological Reconnaissance on the Mount Kosciusko Plateau," said that his conclusions were (1) that there was no satisfactory evidence of extensive glaciers having existed in the present valleys, under the highest peaks of Mount Kosciusko; (2) that there was no evidence of extensive glaciation on the Kosciusko plateau; (3) that the "glacial epoch of Australia" in post-Tertiary times, as described by Dr. Lendenfeld, had no foundation in fact.

BIOLOGY.

Relations of Morphology and Physiology.

The President of this section, Prof. C. J. Martin, dealt, in his opening address, with the growth of the science of morphology, which was now a separate science from physiology; the scope of research in both directions having, within the last fifty years, become greatly widened. Morphology deals with the structural conformation and anatomy of animals; physiology, with the functional workings of the animal system. During the last half-century the discoveries in both these sister sciences have been of a most beneficial character to mankind, and the future was full of possibilities. Prof. Martin did not let the occasion pass without bearing testimony to the ungrudging and valuable services of the late Prof. Jeffery Parker, during his term of the presidency of the section.

GEOGRAPHY.

Submarine Geography.

The President, Sir James Hector, K.C.M.G., F.R.S., in his presidential address, dealt at length with the subject of "Submarine Geography." Since their last meeting, Sir James said, the results of the exploring expeditions equipped by the munificence of the late Sir Thomas Elder and Mr. Horn had been made public, and the wonderful expansion of our knowledge of the central and western parts of the continent obtained through the intrepid journeys would greatly assist the material development of the vastly rich but hitherto neglected interior area of Westralia. Another feature of great promise to the future advance of geographical discovery in the more difficult parts of the Australian continent was the steady extension of the "artesian well" system into the arid areas of the interior, where the absence of water had not only prevented the settlement of the country, but even its exploration, and had caused the loss of many brave and enthusiastic pioneers under circumstances of intense personal suffering. When the sources of underground water circulation were fully comprehended and utilised, both exploration and occupation of large and almost unknown areas would become possible. After dealing with geographical researches conducted in different parts of the world, the President said the crowning event that had absorbed the interest of geographers since the last meeting was the successful achievement of Nansen. The scientific results of this wonderful venture had not yet been published, but two remarkable advances in geographical science

were announced: (1) that the North Polar Ocean was not a shallow sea, with scattered islands, distributing icebergs, but a profound ocean basin; (2) that there were definite movements of the great ice cakes, and that they crossed, and did not merely circulate round the pole.

Antarctica.

"Antarctica" was the subject of a lecture delivered by Sir James Hector, the president of the geographical section. The Antarctic Continent, or Antarctica, as it had been recently called, was an immense area of about 4,000,000 square miles; but they knew very little about it. There had been a number of expeditions to the North Pole, but very little had been done in the way of obtaining knowledge with regard to the South Pole. The last expedition by Nansen had proved that the North Polar region was a great cavity, nearly two miles deep, instead of being, as hitherto supposed, an island with half-open seas. The Antarctic regions, on the other hand, consisted of a great solid mass of land, extending far beyond the area explored by Nansen at the North Pole. Captain Cook, in 1776, furnished the first information with regard to the Antarctic regions; but it was not until Ross' expedition in 1841, followed by the *Challenger* in 1874, that any accurate information was obtained in regard to this continent. By means of his sounding apparatus, Ross made the discovery that there was a belt of water two miles in depth right round the Antarctic regions. In some places it showed a depth of 2000 fathoms, and in other places 4000 fathoms, without any bottom. Ross discovered Victoria Land, a mountain promontory stretching for 500 miles north and south, during which he passed through a belt of ice over 100 miles in width into calm, beautiful water beyond. Ross sailed south to latitude 78°, where he found volcanic mountains from 12,000 to 15,000 feet high, towering above a vast range of snowy mountains, and vomiting forth flames and lava. Huge glaciers descended for miles into the sea; but along the rocky shore no landing-place could be found, there being no harbour or indentation of any kind. A landing was, however, effected on Possession Island, which lay a short distance off the mainland. He attempted to reach the mainland from this island, but failed, and, turning eastward, he found a perpendicular wall of ice 200 feet high, and he traced it for 300 miles without a break. On some days the sun shone out with great brilliancy from a perfectly serene and clear sky of intense blue. Reference was made to the atmospheric conditions and currents of the Antarctic region, and then Sir James pointed out that within this circle no living thing had yet been found which belonged to the land. The life-history of the birds was most remarkable, because they could not breed within the Antarctic circle owing to there being no place for them to build their nests, except ice that was melting. In concluding, Sir James expressed the hope that the exploration of Antarctica would be continued. One of the most important things to be done in this direction was to settle the exact position and intensity of the magnetic pole, especially in the interests of navigation. Until they had established by survey the magnetic conditions of the southern end of the globe, careful and scientific provision could not be made for the safety of iron ships steaming upon different courses.

Australian Oceanography.

"A Contribution to Australian Oceanography" was the title of a paper by Mr. T. W. Fowler. The paper was suggested by the reports of the *Challenger* expedition, which seemed to leave room for much further investigation. An attempt had been made by the writer to get additional information, and with this end in view he had obtained from the captains or officers of various intercolonial steamships proceeding at regular intervals, samples of water passed through by them, together with the temperature of the sea at the time the sample was obtained. The samples were taken as near the vessels' bows as possible, and placed in well-cleaned bottles, which were tightly corked and forwarded to Mr. Walker for examination at the Melbourne University. Mr. Buchanan's method of conducting the examination was adopted. Two hydrometers were used, and the results were checked by testing the instruments in solutions of known densities. Tables were given showing the densities of waters obtained between Fremantle and Melbourne; between Melbourne and Brisbane; on the east coast of Australia generally; between Melbourne and the Bluff; on the Sorrento Back Beach, Bass Strait, and a number of other places.

Remarks on Central Australia.

"Notwithstanding the labours of the past, the last volume of Australian discovery is still incomplete," was the opening remark of the paper by Mr. W. H. Tietkins, who in 1889 led an expedition, which was fitted out under the auspices of the South Australian branch of the Royal Geographical Society, one of the objects of which was to determine the outline of Lake Asmodeus in Central Australia. Mr. Tietkins suggested that attention should be directed to the Rawlinson and Peterman Ranges, which lie to the north of the Mann and Tomkinson Ranges, and which were bounded on all sides by barren and inhospitable sandy wastes. To the best of his belief these ranges had not been visited, except by Giles, whose party was much reduced. These ranges formed an extensive and fertile field for systematic and scientific examination. It was suggested that a party might leave the settlements at Giles Range or Erldunda, and proceed from there to Mount Olga, where the first depôt would be formed, pending the discovery of suitable water being found further west and nearer the scene of operations. No difficulty would be experienced in reaching Sladen Water. It might be almost taken for granted that valuable waters would be found before reaching so far west. From the western end of the Rawlinson Range the party could return by a slightly different route, and if time and circumstances allowed before leaving Sladen Water. The conviction was forced upon him that no pasture lands of sufficient extent might be looked for that would develop the western interior, but the hope might reasonably be entertained that the mining industry in that latitude would challenge the enterprise of the Australian people.

ETHNOLOGY AND ANTHROPOLOGY.

The Origin of the Aborigines of Tasmania and Australia.

This was the subject chosen by Mr. A. W. Howitt, President of the ethnological and anthropological section, for his presidential address. He was of opinion that, in spite of the contention of many writers to the effect that the primitive Australians and Tasmanians had come from other lands in ships or canoes, there were but little evidences to show that they had any knowledge of navigation or of sea-going vessels. In any solution of the origin of the natives of Australia one fundamental element must be that the ancestors of these savages reached Australia or Tasmania by land; or if the land connection was not continuous, the intervening channels were such as could be traversed by vessels no better than the catamarans or canoes above mentioned. The lecturer quoted many geological facts, all of which tended to show that an immense period of time was one of the elements of any solution of the problem, and that during that period the Australians had been isolated from outside influence, having at the same time a continental area in which to develop their institutions. The level of culture of the Tasmanian had been termed the eolithic, and that of the Australians might fairly be termed neolithic, or even as regards some of the tribes of Central Australia bordering on the palæolithic. The social organisation of the Tasmanians was also below the level of that of the Australians. Finally he came to the conclusion that the Australians reached the continent by a land bridge connecting with the Indo-Asiatic continent or by a land extension of the Austral continents to the north-west or over some shallow channels separating Australia from these lands.

A lecture on "Native Life in Central Australia" was delivered by Prof. W. Baldwin Spencer. After describing the difficulties of travelling, the lecturer remarked that the country was divided into the lower steppes, the desert country, and the higher steppes, where the James and Macdonell Ranges rear their lofty summits sometimes to a height of 5000 feet. Lake Amadeus in the dry season is a mere sheet of salt. Ayers Rock, another remarkable formation of this distant and mysterious land, rises abruptly from the surface of the desert country. It is about one mile long and five miles in circumference. Formerly there were vast rivers here, and animals, such as the diprotodoton, a wombat-like creature about four times as large as a kangaroo, flourished on the plains. Now animal life was scarcely noticeable. The fish lived in the waterholes in the hills until the wet season came and washed them down the foaming gorges of the mountain to the lower lands. In the dry season the water-frog fills himself up with water, and, rolling himself into the mud, exists there until the next rains, which may not come for two years. In

the meantime the frog may have the misfortune to provide a drink for a thirsty native. The natives also obtain water from the roots of trees. They all believed that each one was under the ægis of the spirit of some animal or plant, which they revered almost as gods. In connection with the tokens, they held all sorts of weird ceremonies, bedecking themselves with great elaborateness, and going through all sorts of antics, such as imitating frogs, emus, kangaroos, or whatever it was they held in veneration. Group marriage prevails; that is, men in one group can only marry the women in another single group. The Engwurra, or the fire ceremony, through which a youth has to pass before being entitled to be considered a man, seems to be peculiarly exacting to the candidate for manhood.

RESOLUTIONS OF COUNCIL.

At the final meeting of the General Council on January 13, the following suggestions from the Recommendation Committee were agreed to:—(1) That the New South Wales Government acquire the quarry of prismatic sandstone at Bondi, with a view to its preservation as a remarkable geological occurrence. (2) The re-appointment of the Committee on "The Systematic Conduct of the Photographic Work of Geological Surveys." (3) The appointment of a Seismological Committee for 1900. The Government of New Zealand to equip Timaru with approved seismological instruments, in charge of Mr. George Hogben. A contribution of 25*l.* was voted towards the preceding object. (4) The appointment of a Committee to secure magnetic surveys at the extreme south of New Zealand. (5) Expressing the opinion that the publication of Victorian continuous magnetic records is desirable. (6) That the Committee be re-appointed to continue the investigation of the mineral waters of Australasia. (7) That the New South Wales Government be recommended to complete the borings at Funafuti while the bore apparatus remains on the island, and the bore remains open. (8) A Committee be appointed to draw up a list of works and papers relating to Australian flora.

The report from the Baron von Mueller Memorial Committee, embodying a resolution, "That the Association places on record its sense of the deep loss sustained by it owing to the death of the late Baron von Mueller, and its high appreciation both of his personal character and the distinguished services rendered by him to science," was adoped.

On the motion of Prof. Kernot, of Melbourne, seconded by Prof. Baldwin Spencer, Mr. R. L. J. Ellery, late Government Astronomer of Victoria, was elected to be President of the Science Congress to be held in Melbourne in the year 1900. Mr. C. R. Blackett, Government Analyst of Victoria, was elected treasurer, and Prof. Baldwin Spencer and Mr. E. F. J. Love were elected joint secretaries for the same Congress. It was decided that the next meeting of the Asssociation after the one to be held in Melbourne will take place at Hobart.

FORTHCOMING BOOKS OF SCIENCE.

IN Messrs. Baillière, Tindall, and Cox's list are to be found:—"A Manual of Surgery," by Drs. William Rose and Albert Carless; "Atlas of Traumatic Fractures and Dislocations," by Prof. H. Helferich (vol. vi. "Hand-Atlas" Series); "English-French and French-English Dictionary of Medical Terms," by H. de Méric, two parts; "Minor Surgery and Bandaging," by Dr. W. G. Spencer, illustrated; "Respiratory Exercises," by Dr. Harry Campbell; "Diagnostic Signs in Women," by Dr. T. W. Eden; "The Clinical Diagnosis of Lameness in the Horse," by W. E. A. Wyman, illustrated; "Practical Toxicology for Physicians and Students," by Prof. Dr. Kobert, translated and edited by Dr. L. H. Friedberg; "Chronic Nasal Obstruction, and Deformities of the Upper Jaw, Teeth, and Palate," by Dr. Mayo Collier; "Atlas of Pathological Anatomy," by Prof. O. Bollinger (vol. vii. "Hand-Atlas" Series), illustrated; "Idiopathic Ulcerative Colitis (Dysentery)," by J. F. Gemmel, illustrated; "Water" (Part ii. of the "Analysis of Food and Drugs"), by T. H. Pearmain and C. G. Moor; and new editions of "A Guide to the Examinations of the Conjoint Board in England and for the Fellowship of the College of Surgeons, with Examination Papers," by F. J. Gant; "Heart Disease, with special reference to Prognosis and Treatment," by Sir William Broadbent, Bart., and Dr. J. F. H. Broadbent; "Diseases of the Throat and Nose," by Lennox Brown, illustrated; "Applied Bacteriology," by T. H. Pearmain and C. G. Moor; "The Practical Guide to the Public Health Acts and Correlated Acts for Officers of Health and Inspectors of Nuisances," by Dr. Thomas Whiteside Hime; "Latin Grammar of Pharmacy," by Joseph Ince; "A Manual of Artistic Anatomy for the Use of Students in Art," by John C. L. Sparkes, with plates; "Handbook for Attendants on the Insane"; "The Register of the Royal College of Veterinary Surgeons."

Messrs. Wm. Blackwood and Sons' list includes:—"A Text-book of Modern Geometry," by J. A. Third; "Lower Geometrical Exercises," by the same author; "Higher Geometrical Exercises," by the same author; "The Elements of Physical Education, a Teacher's Manual," by Dr. David Lennox and Alexander Sturrock, with Original Musical Accompaniments to the Drill by Harry Everitt Loseby, illustrated; "A Manual of Agricultural Botany," from the German of Dr. A. B. Frank, translated by Dr. John W. Paterson, illustrated; and new editions of Sir John Skelton's "The Handbook of Public Health," revised by James Patten MacDougall and Abijah Murray, Part ii. containing other Acts bearing on Public Health, with Notes, Forms, &c.; "Introductory Text-book of Zoology," by Prof. Henry Alleyne Nicholson, F.R.S., and Dr. Alexander Brown, illustrated; "Page's Introductory Text-book of Geology," revised and enlarged by Prof. Lapworth, F.R.S.; "Page's Advanced Text-book of Geology," Descriptive and Industrial, with engravings, and Glossary of Scientific Terms, revised and enlarged by Prof. Lapworth, F.R.S.; "Introductory Text-book of Meteorology," by Dr. Alexander Buchan, illustrated; "Dr. Mackay's Elements of Physiography," illustrated.

Messrs. Bliss, Sands, and Co. announce:—The Progressive Science Series: "Earth Structure," by Prof. Geikie, F.R.S., illustrated; "Volcanoes," by Prof. Bonney, F.R.S., illustrated; "The Groundwork of Science," by Dr. St. George Mivart, F.R.S.; "Vertebrate Palæontology," by Prof. Cope, illustrated; "Science and Ethics," by M. Berthelot; "The Animal Ovum," by F. E. Beddard, F.R.S., illustrated; "The Reproduction of Living Beings: a Comparative Study," by Prof. Marcus Hartog, illustrated; "The Study of Man: an Introduction to Ethnology," by Prof. A. C. Haddon, illustrated; "Man and the Higher Apes," by Dr. Keith, illustrated; "Heredity," by J. Arthur Thomson, illustrated.

Messrs. Burns and Oates, Ltd., promise:—"Genesis and Science," by John Smyth.

The list of the Cambridge University Press includes:—Cambridge Natural Science Manuals, *Biological* Series: "Fossil Plants, a Manual for Students of Botany and Geology," by A. C. Seward; "Vertebrate Palæontology," by A. S. Woodward.

Messrs. Cassell and Co., Ltd., announce:—The "Century Science" Series: "Michael Faraday, his Life and Work," by Prof. Silvanus P. Thompson, F.R.S.; "Cassell's Family Doctor," by a Medical Man; and new editions of "The Story of Our Planet," by Prof. Bonney, F.R.S., with coloured plates and maps, and illustrated: "The Story of Africa and its Explorers," by Dr. Robert Brown, 4 vols., illustrated; "The Countries of the World," by Dr. Robert Brown, vol. v., illustrated.

Messrs. Chapman and Hall, Ltd., will issue:—"Physics, Experimental and Theoretical: an Elementary Treatise Mechanics, Hydrostatics, Pneumatics, Heat and Acoustics," by Dr. R. H. Jude and H. Gossin, illustrated; "The Manufacture of Boots and Shoes," being a modern treatise of all the processes of making and manufacturing footgear, by F. Y. Golding, illustrated; "Notes on Carpentry and Joinery," adapted to the requirements of the City and Guilds of London Institute, the Worshipful Company of Carpenters, and the County Council's Scholarship Examinations, by J. T. Evans: Second Stage, Ordinary or Advanced Course, illustrated; "Chinese Porcelain," by W. E. Gulland, illustrated; "De Pontibus, a Pocket-book for Bridge Engineers," by J. A. L. Waddell; "Machine Design," Part i. "Kinematics of Machinery," by Prof. Forrest R. Jones; "Handbook of Street-Railroad Location," by Prof. John P. Brooks; a new edition of "A Text-Book of Mechanical Engineering," by W. J. Lineham, illustrated.

Messrs. Chatto and Windus promise new editions of: "Flammarion's Popular Astronomy," translated and edited by J. Ellard Gore, illustrated; "Popular Astronomy," by J. Rambossom, translated by C. B. Pitman, illustrated.

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Lazarus-Barlow; "Manual of Bacteriology," by Dr. Hewlett; "Manual of Dental Metallurgy," by Ernest A. Smith; and a new edition of "Manual of Dental Anatomy, Human and Comparative," by Charles S. Tomes, F.R.S.

The Clarendon Press will issue:—"Essays on Secondary Education," edited by C. Cookson.

In the announcements of Mr. Clive, of the University Correspondence College Press, we find:—"A Manual of Psychology," by G. F. Stout; "The Tutorial Algebra," by W. Briggs and Prof. G. H. Bryan, F.R.S., Part i., Elementary Course, Part ii. Advanced Course; "Properties of Matter," by E. Catchpool; "Advanced Sound, Advanced Light, First Stage Magnetism and Electricity," by Dr. R. H. Jude; "Advanced Magnetism and Electricity"; "Text-book of Zoology," by A. M. Davies; "Text-book of Botany," by J. M. Lowson; "Advanced Chemistry: First Stage Practical Inorganic Chemistry, Practical Organic Chemistry," by George George; "First Stage Mathematics, Stage ii. Mathematics," by J. H. Grace; "Key to First Stage Mechanics of Solids"; "Co-ordinate Geometry, Part ii."; "Tutorial Dynamics," by W. Briggs and Prof. G. H. Bryan, F.R.S.; Supplement (on Metals) to Tutorial Chemistry, Part i.. "An Introduction to Carbon Compounds," by Dr. F. Beddow; "Quantitative Analysis, a Sequel to the Analysis of a Simple Salt"; "First Stage Physiology"; "Advanced Physiology"; "First Stage Geology"; "Advanced Geology"; "First Stage General Biology"; "Advanced General Biology"; First Stage Botany"; "Advanced Botany"; "First Stage Agriculture"; "Advanced Agriculture"; "First Stage Hygiene"; "Advanced Hygiene"; and new editions of "Matriculation Mathematics" and "First Stage Mechanics of Fluids."

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Messrs. Friedländer and Sohn (Berlin) will publish:—Britzelmayr's "Zur Hymenomyceten-Kunde," vol. iii. (and last), illustrated; Gerberte's (Papae Silvestri II.) "Opera Mathematica," illustrated; A. Bolles Lee's "The Microtomist's Vademecum," German translation, with many additions by the author and Prof. P. Mayer; A. B. Meyer and L. W. Wiglesworth, "The Birds of Celebes and the Neighbouring Island, 2 vols., illustrated; Das Tierreich (the publication of the German Zoological Society), next part, Rothschild's "Paradiseidae"; Trouessart's "Catalogus Mammalium," vol. iv. (and last).

Messrs. Gauthier-Villars et Fils (Paris) announce:—"Eléments de la Théorie des Fonctions elliptiques, by Tannery et Molk," Tome iii.; "Leçons sur la Théorie des marées fluviales et terrestres," by Maurice Lévy.—"Œuvres de Laplace," Tome xii.; "Recueil de données numériques publié par la Société Française de Physique, Optique," by H. Dufet, 1er fascicule; "Œuvres mathématiques de Riemann, traduites," by L. Laugel; "Traité d'algèbre supérieure," by Weber, traduction de Griess; "Leçons nouvelles sur l'analyse infinitésimale et ses applications géométriques," by Méray, Tome iv.; "Distribution de l'énergie par courants polyphasés," by J. Rodet; "Traité pratique de photogravure," by Léon Vidal; "Les Eléments d'une photographie artistique," by Robinson, traduction de H. Colard.

Mr. Heinemann announces:—"A translation of Prof. Müller's work on Krupp's Steel Works," illustrated.

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Mr. H. K. Lewis's list is as follows:—"A Handbook of Diseases of the Nervous System," by Dr. C. E. Beevor; "Prof. Furbringer's Diseases of the Kidneys and Genito-Urinary Organs," vol. ii.; "Inflammation of the Bladder," by Dr. Mansell Moullin; "Yellow Fever in the West Indies," by Dr. Izett Anderson; and new editions of Prof. Corfield's "Dwelling Houses; their Sanitary Construction and Arrangements"; Dr. Dudley Buxton's "Anæsthetics"; Dr. Samuel Rideal's "Practical Organic Chemistry."

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Messrs. Longmans and Co.'s announcements include:—"Essentials of Practical Bacteriology," by Dr. Henry J. Curtis, illustrated; "The Diseases and Injuries of the Lungs and Pleura," by Dr. James Kingston Fowler and Dr. Rickman J. Godlee, illustrated; the Memorial Edition of the late Mr. John Ball's "Alpine Guide," issued by the Alpine Club: vol. i. "The Western Alps," vol. ii. "The Central Alps, North of the Rhone Valley, from the Simplon Pass to the Adige Valley"; "The Training of Young Children," by Ennis Richmond (Mrs. Wilfrid Richmond); "Outlines of Descriptive Psychology: a Text-book of Mental Science for Colleges and Normal Schools," by Prof. George Trumbull Ladd.

Messrs. Sampson Low and Co., Ltd., give notice of:—"Twentieth Century Practice, an International Encyclopædia of Modern Medical Science by Leading Authorities of Europe and America," edited by Dr. Thomas L. Stedman, in 20 vols.: vol. xii. "Mental Diseases, Childhood and Old Age," vol. xiii. "Introduction to Infectious Diseases"; "A Complete System of Nursing," written by various contributors, and edited by Honnor Morten; "Petroleum Motor-cars," translated from the French of Louis Lockert; "Twenty-five Years in British Guiana," by Henry Kirke, illustrated, and a new edition of "The Care of the Sick at Home and in the Hospital," by Dr. Th. Billroth, translated by J. Bentall Endean, illustrated.

Among the announcements of Messrs. Macmillan and Co., Ltd., we notice:—"The Scientific Papers of Thomas Henry Huxley," reprinted from the journals of scientific societies, edited by Profs. Michael Foster and E. Ray Lankester, F.R.S., in four vols., vol. i.; "Essays on Museums and other Subjects connected with Natural History," by Sir William Henry Flower, K.C.B., F.R.S.; "A Text-Book of Botany," by Drs. E. Strasburger, Fritz Noll, H. Schenck, A. F. W. Schimper, translated from the German by Dr. H. C. Porter, illustrated; "A System of Medicine," edited by Prof. Thomas Clifford Allbutt, F.R.S., vol. v.; "Elementary Course of Physics," edited by Rev. J. C. P. Aldous (Britannia Series), in three parts: Part i. Mechanics, Properties of Matter, Hydrostatics, Heat; Part ii. Wave Motion, Sound, Light; Part iii. Magnetism, Electricity; "Elementary General Science," by A. T. Simmons and Lionel M. Jones, illustrated; "Electro-Physiology," by Prof. W. Biedermann, translated by Frances A. Welby, vol. ii.; "Notes on Observations, being an outline of the methods used for determining the meaning and value of quantitative observations and experiments in physics and chemistry, and for reducing the results obtained," by Sydney Lupton; "The Cambridge Natural History," edited by S. F. Harmer and A. E. Shipley, vol. ix. "Birds," by A. H. Evans, illustrated.

Messrs. Methuen and Co. call attention to:—"Three Years in Savage Africa," by Lionel Decle, illustrated; "Exploration and Hunting in Central Africa," by Major A. St. H. Gibbons, illustrated; "The Niger Sources," by Colonel J. Trotter, illustrated.

Mr. Murray promises:—Mr. Arthur Berry's "Manual of Astronomy," illustrated; "Early Chapters in Science," by Mrs. Awdry (wife of the Bishop of Japan); "Five Years in Siam," by H. Warington Smyth.

Messrs. George Newnes, Ltd., will issue:—"The Story of Life in the Seas," by Prof. Sydney J. Hickson, F.R.S., illustrated; "The Story of Photography," by Alfred T. Story; "The Story of Geographical Discovery," by Joseph Jacobs, with maps.

Mr. J. C. Nimmo announces the completion, in parts, of Morris's Works on Natural History.

Messrs. C. Arthur Pearson, Ltd., give notice of:—"Exercise for Health, its Science and Practice," by H. H. Hulbert; "With Peary near the Pole," by E. Astrup.

Mr. Young J. Pentland's list is as follows:—"Diseases of the Heart," by Dr. G. A. Gibson; "Text-book of Medicine," by British authors, edited by Dr. G. A. Gibson; "The Principles of Treatment," by Dr. J. Mitchell Bruce; "Text-book of Physiology," edited by Prof. E. A. Schäfer, F.R.S., vol. ii.; "Renal Growths," by Dr. T. N. Kelynack; "Diabetes Mellitus," by Dr. R. T. Williamson; and a new edition of "Handbook of Obstetric Nursing," by Drs. F. W. N. Haultain and J. Haig Ferguson.

In the announcements of Messrs. Swan Sonnenschein and Co., Ltd., we find:—"The Wonderful Century: its Successes and its Failures," by Dr. Alfred Russel Wallace, F.R.S.; "Aristotle's Psychology," including the Parva Naturalia, translated and edited with commentary and introduction by Prof. William A. Hammond; "Ethics," by Prof. W. Wundt, translated with the author's permission from the second German edition by Prof. E. B. Titchener, vol. iii. "The Principles of Morality and the Sphere of their Validity"; "Physiological Psychology," by Prof. W. Wundt, translated by Prof. E. B. Titchener, two vols., illustrated; "History of Contemporary Philosophy," by Prof. Friedrich Ueberweg, edited by Prof. Max Heinze, translated by Prof. W. A. Hammond (forming a supplement to Erdmann's "History of Philosophy," three vols.); "Student's Text-book of Zoology," by Adam Sedgwick, F.R.S., vol. i. Protozoa to Polyzoa (inclusive), illustrated; "Text-book of Palæontology for Zoological Students," by Theodore T. Groom, illustrated; "Text-book of Embryology: Invertebrates," by Profs. Korschelt and Heider, vol. ii. "Crustacea and Arachnoids," translated by Mrs. Bernard, illustrated; "Practical Plant Physiology," by Prof. W. Detmer, translated by Prof. S. A. Moor; "Elementary Text-book of Botany," based on "A Student's Text-book of Botany," by Prof. Sydney H. Vines, F.R.S., illustrated; "Radiation: an Elementary Treatise on Electro-magnetic Radiation and on Röntgen and Cathode Rays," by H. H. Francis Hyndman, with diagrams; "Pocket Electrical Dictionary: Electrical Words, Terms and Phrases," by Dr. Edwin J. Houston; "Cataphoresis, or Elective Medicamental Diffusion, as applied in Medicine, Surgery and Dentistry," by Dr. William James Morton, illustrated; "Eclipses of the Moon from A.D. 300 to 1900," by Robert Sewell; "Fishes," by the Rev. H. A. Macpherson (Young Collector Series); "Handbook of Grasses," by W. Hutchinson, illustrated (Young Collector Series); "Mammalia," by the Rev. H. A. Macpherson (Young Collector Series); "Birds' Eggs and Nests," by W. C. J. Ruskin Butterfield (Young Collector Series); and a new edition of "Handbook of Practical Botany, for the Botanical Laboratory and Private Student," by Prof. E. Strasburger, edited by Prof. W. Hillhouse, illustrated.

Messrs. Sotheran and Co. will publish, in 12 parts, "A Monograph of the Turdidæ, or Family of Thrushes," by the late Henry Seebohm, illustrated.

Mr. B. G. Teubner (Leipzig) announces:—"Vorlesungen über Geschichte der Mathematik," Moritz Cantor, Dritter (Schlufs-) Band, Dritte Abteilung; "Vorlesungen über Technische Mechanik," A. Föppl, Band III.; "Vorlesungen über Synthetische Geometrie," Jacob Steiner, Zweiter Teil, Dritte Auflage, herausgegeben von Rudolf Sturm; "Das Gesetz der Kleinen Zahlen," Dr. L. von Bortkewitsch; Joh. Kepler's "Weiland Kaiserlichen Mathematikers, Traum oder nachgelassenes Werk über die Astronomie des Mondes," Übersetzt und Kommentiert, Ludwig Günther.

Mr. T. Fisher Unwin promises:—"Through Unknown Tibet," by Captain M. S Wellby, illustrated; "Across the Sub-Arctics of Canada: 3200 miles by Canoe and Snowshoe through the Barren Lands," by J. W. Tyrrell, with list of plants collected *en route*, a vocabulary of Eskimo words and phrases, and a route map and full classified index, illustrated; "British Guiana; or, Work and Wanderings among the Creoles and Coolies, the Africans and Indians of the Wild Country," by the Rev. I.. Crookall, illustrated; *Masters of Medicine*—"William Stokes: his Life and Work (1804-1878)," by his son, William Stokes; "Life of Sir Benjamin C. Brodie," by Timothy Holmes.

Messrs. Whittaker and Co.'s announcements are:—"Alternate Currents in Practice," translated from the French of Loppé and Bouquets by F. J. Moffett: "Electrolytic Methods of Analysis," translated and adapted from the German of Dr. B. Neumann by J. B. C. Kershaw; a volume on "Radiography," by S. Bottone; "A Popular Guide to Commercial Telephony," by M. Byng and F. G. Bell; "Alternating Currents of Electricity, and the Theory of Transformers," by Alfred Still; "Electro-Mechanical Series," adapted from the French by A. G. Elliott: vol. i. "Industrial Chemistry"; "A Text-book of Geography," by Charles Bird; "Electric Wiring Switches and Lamps," by W. Perren Maycock; "Electric Wiring and Fitting Details Book," by the same author.

Messrs. J. Wright and Co. (Bristol) will publish:—"Examination of the Ocular Muscles," by Dr. Ernest E. Maddox, illustrated; "Lectures on Massage and Electricity in the Treatment of Disease (Masso-Electrotherapeutics)," by Drs. Thomas Stretch Dowse and Arthur G. Haydon, illustrated; and a new edition of "Diseases of the Upper Respiratory Tract, the Nose, Pharynx, and Larynx," by Dr. P. Watson Williams, illustrated.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The Graces for the establishment of Readerships in Surgery and in Geography having passed the Senate, the General Board will proceed to elect the new Readers early in May.

IN the House of Lords on Friday the London University Commission Bill was read a third time and passed.

THE chair of Veterinary Surgery at the Royal Agricultural College, Cirencester, rendered vacant by the recent resignation of Prof. Wilson, has been accepted by Mr. J. W. Brittlebank.

MR. J. MONTGOMERY, B.A., Assistant Master at Parmiter's School, and Honorary Secretary of the Assistant Masters' Association, has been appointed Head Master of Uckfield Grammar School, Sussex.

DR. R. ANSCHÜTZ, assistant professor of chemistry at Bonn, and Dr. Askenasy, assistant professor of botany at Heidelberg, have been promoted to professorships; Dr. W. J. Simpson, late health officer of Calcutta, has been appointed professor of hygiene in King's College, London; and Dr. H. Ebert, of Kiel, has been appointed professor of physics at Munich.

SIR WILLIAM FRASER, formerly Deputy-Keeper of the Records of Scotland, who died on March 13, has by his will left to the University of Edinburgh 25,000*l.* for the foundation of a chair to be called the Sir William Fraser Professorship of Ancient History and Palæography, 10,000*l.* for the purpose of the library, and one half of the residue of his estate, which is expected to amount to between 9,000*l.* and 10,000*l.*, for general requirements, bursaries, research, publications, &c.

THE educational interests of the State of New York are under the general supervision of the Board of Regents of the University, which is appointed by the legislature, and makes an annual report of the general condition of educational institutions throughout the State. It appears from their annual report of the Board, just published, that the first university in the State, in the number of professors and students, and in the amount of endowment, is Columbia University, with 289 instructors and 1921 students in all departments, and an endowment exceeding 17,800,000 dollars in value. Cornell University is a good second in all these particulars; then follow New York University and Syracuse University.

THE Duc de Loubat has given to Columbia University a deed of a large block of buildings on Broadway, New York, valued at more than 1,100,000 dollars, and probably worth fully a million and a quarter. The gift is subject to an annuity of 60,000 dollars to the Duke during his lifetime. Upon his death the property or its proceeds, less any excess of income advanced by the University, is to constitute an endowment fund for the support and maintenance of the University library. The fund will be named, in honour of the Duke's parents, the Gaillard-Loubat Endowment Fund. This gift, added to previous endowments, will make the library one of the world's great libraries. The building is the gift of President Seth Low. It now holds 250,000 volumes, and has accommodation for a million. Th

main reading-rooms seat 400 or 500 readers; and the rooms of the Avery Collection and seminary rooms will accommodate several hundred more. The Duc de Loubat has made many other generous gifts to educational institutions, having founded professorships and scholarships in Berlin, Stockholm, Madrid, and the Universities of France and Italy. In America he has given valuable books and manuscripts to the University of Washington, University of Pennsylvania and Columbia; and at Columbia he founded the Loubat prizes of 1000 and 400 dollars, which are given annually for original work in various branches of science and art.

IN the House of Commons, on Tuesday, Sir John Lubbock called attention to the new Education Code, and the need of extending its provisions so that elementary science might be more widely taught in elementary schools. He moved: "That it is desirable to assimilate the provisions of the English Education Code, as regards class and special subjects, to those in the Scotch Code of 1897." Under the Code the subjects taught in elementary schools fall into three categories—the obligatory subjects, the class subjects, and the so-called specific subjects. The obligatory subjects are, in the case of boys, reading, writing, and arithmetic. The specific subjects comprise various sciences, domestic economy, and one or two languages. With the exception of domestic economy, however, they are not largely taken up. The class subjects are English, geography, elementary science, and history. Sir John Lubbock submitted that all these four subjects are essential. He did not propose to make them obligatory, but thought schools should be encouraged to take them up. So far from this, however, schools are actually precluded from doing so. The Code provides that no child shall be presented in more than two class subjects. If, therefore, a class took geography and elementary science, they must omit history and English. If they took history and English, then elementary science and geography must be omitted. Sir John Lubbock's contention was that this is a radically wrong system of education; that English, geography, elementary science, and history are all important subjects; and that the influence of the Education Department should be exercised not to prevent, but to encourage these being taken up in elementary schools. After a discussion, in the course of which it was pointed out that the whole difficulty is one of time, Sir John Lubbock withdrew his motion.

SCIENTIFIC SERIALS.

American Journal of Science, March.—Geothermal data from deep artesian wells in the Dakotas, by N. H. Darton. Nearly all the waters in the great artesian basin of the Dakotas are perceptibly warm. The author gives a chart showing the distribution of the wells according to temperature, which shows remarkable regional regularities. As regards the cause of the subterranean heat, the suggestion as to the oxidation of pyrites by underground waters is probably untenable on account of the depth. A collection of all available data will be necessary before a theory is attempted.—Examination of some triclinic minerals by means of etching figures, by T. L. Walker. Experiments may be made with etching figures to determine the equivalence of pairs of parallel faces. If parallel faces give different etching figures, the faces do not belong to the same crystal form. This thesis was proved by etching tourmaline with a red-hot mixture of potassium bisulphate and powdered fluorspar, and by etching axinite, cyanite, albite, and other crystals.—Some new Jurassic vertebrates from Wyoming, by W. C. Knight. The new species are called *Ceratodus robustus* and *Ceratodus americanus*.—Auriferous conglomerate of the Transvaal, by G. F. Becker. The workable area of the Witwatersrand is a strip of country a couple of miles in width and about thirty miles in length. The banket skirts the southerly edge of a large area dotted over with proclaimed gold-fields, in which ordinary veins are associated for the most part with crystalline schists. This area includes the northern part of the Transvaal and portions of Mashonaland and Matabeleland. Its extent is approximately 130,000 square miles. The banket is a highly siliceous mass, consisting of quartz pebbles embedded in a matrix composed of sand, pyrite, and other minerals, all cemented by secondary silica. The free gold in the matrix, like the pyrite, occurs in minute crystals or in irregular, sharp-cornered, hackly aggregates. The author inclines to the marine placer origin of the deposit, and believes that until the Lower Cape formation has been traced across the continent of Africa other spots as rich as the Rand may be hoped for.—A spectroscope without prisms or gratings, by A. A. Michelson. A kind of transmission grating may be made of plates of glass a few mm. thick, arranged with their edges in a step-by-step order. The results are comparable with those of the best gratings.

Annalen der Physik und Chemie, No. 1.—Canal rays, by E. Goldstein. The canal rays are so called from the manner of obtaining them by perforating the kathode. They form the yellow layer next the kathode, and when the latter is perforated straight yellow streamers pass through and fill the tube on the side away from the anode. These rays produce no phosphorescence, and are not in themselves deflected by a magnet. They form the prolongation of the kathode rays backwards, and converge when the latter diverge, and *vice versâ*.—Potential gradients in vacuum tubes, by W. P. Graham. The gradient along the tube was investigated chiefly by means of two electrodes mounted on a glass rod a small fixed distance apart. The glass rod was introduced into the tube through the Torricellian mercury column, and could be moved up and down. Maximum and minimum gradients were observed to correspond with the bright and dark strata of the positive light. But such fluctuations were also observed in the dark space itself. Minimum gradients were found to adjoin the two electrodes.—Coloured alkaline haloids, by E. Wiedemann and G. C. Schmidt. The authors endeavour to discriminate between the various theories advanced in explanation of the coloration of alkaline haloids by the kathode rays, and show that it is due not to a physical change, but a slight chemical reduction of the salts.—Determination of relative thermal conductivities by the isothermal method, by W. Voigt. The method devised by de Sénarmont for the investigation of crystalline conductivities may be considerably improved by adding elaidinic acid to the mixture of wax and turpentine. This gives very sharp curves. The method may be extended to the comparison of conductivities of various metals by constructing a rectangle out of two adjacent triangles of the metals in question, and pressing the shorter edge of the better conducting metal against a copper block kept at a constant temperature. The method admits of an accuracy of 2 per cent.—The optical constants of sodium, by P. Drude. The refractive index of sodium, as determined from the reflective properties of the metal contained in a spherical vessel in an atmosphere of hydrogen, is smaller than 0·054, which is the smallest value yet found for any metal. The standard NaK alloy comes next; and then silver with $n = 0{\cdot}18$.—Glow-worm light, by H. Muraoka and M. Kasuya Further experiments show that the photographic effect of glow-worm light is not due entirely to radiation, but partly at least to volatile substances inseparable from animal life. Resin and coffee, and certain metallic oxides, produce a similar effect, even when not in contact with the plate.

SOCIETIES AND ACADEMIES

LONDON.

Royal Society, February 17.—"On the Connection between the Electrical Properties and the Chemical Composition of different kinds of glass." By Prof. Andrew Gray, LL.D., F.R.S., and Prof. J. J. Dobbie, M.A., D.Sc.

In order to finally determine if possible the circumstances which affect the conductivity and specific inductive capacity of glass, several specimens of glass of special composition have been made up for the experimenters by Messrs. Schott and Co., of Jena, and by Messrs. Powell and Sons, of London. It had been previously found, by Prof. T. Gray, that potash and soda lime glasses had a higher conductivity than flint glasses—a result also arrived at by Dr. Hopkinson. Accordingly glasses richer in lead oxide than any formerly available, and in some cases practically free from soda, were made, so as to test whether diminution of the amount of soda and increase of lead oxide would still further diminish the conductivity. Specimens of glass used by Messrs. Schott, mainly in the manufacture of thermometers, were also obtained, as well as of a barium crown glass, not hitherto experimented on.

The conductivities were measured by the direct deflection method by placing the specimen (in some cases the bulb of a long-stemmed flask, filled up to the bottom of the stem with mercury, and immersed in a mercury bath; in others a plate silvered on its two faces) in series with a battery and a very sensitive high resistance galvanometer. The method of loss of

charge was tried, but found for various reasons to be less suitable for the comparison immediately in view than that adopted. It is, however, the only method by which, for several of the specimens, results at ordinary temperatures can be obtained. Special care was taken to ensure that no disturbing film of moisture existed on the surface of the glass, and that the conduction was entirely through the plate or the walls of the flask experimented on.

The specific inductive capacities were determined by connecting the condenser formed by the specimen, for about 1/30,000 of a second, with one of Lord Kelvin's air leydens, which had been previously charged, and observing the potential of the leyden before and after the contact.

After the electrical determinations had been made the specimens were very carefully analysed, and the results are given in the paper, which contains, therefore, full information as to the precise composition of the glasses.

The anticipation mentioned above was fully borne out. The specific resistance of the lead potash glasses was for one certainly above $18{,}000 \times 10^{10}$ ohms at 100° C., for another above $35{,}000 \times 10^{10}$ ohms at all temperatures up to 135° C. The specific resistance of the barium glass was also very high; and, what was remarkable in this glass, there was hardly any trace of dielectric polarisation. The authors are pursuing experiments on the electrical and mechanical properties of this glass.

It was found, after the communication of the paper, that the almost complete replacement of the potash in a lead glass by soda diminishes the specific resistance.

The research is being continued with a view to settling a large number of interesting points which have arisen in the course of the work. For this purpose special glasses of as nearly as possible prescribed composition are being made by Messrs. Powell and Sons.

March 3.—"On Apogamy and the Development of Sporangia upon Fern Prothalli." By William H. Lang, M.B., B.Sc.

In this paper the results obtained from a series of cultures of ten species of ferns, the prothalli of which were grown for more than two years, are described. The conditions of cultivation differed from those under which prothalli usually occur in nature, in that fertilisation was prevented by avoiding watering from above; the prothalli were also exposed to direct sunlight. To these causes the results, which in the main agree for the various species, may be ascribed. The most important were the change in form and structure of the prothallus to a fleshy cylindrical process, which sometimes proceeded from the apical region, sometimes from the under surface just behind the latter; the development of conical projections around or in place of archegonia, and the occurrence of more or less numerous cases of apogamy in every one of the species. The latter phenomenon was manifested by the presence of tracheides in the tissue of the prothallus, by the development of isolated members of the sporophyte upon it, and, in every case but one, of complete vegetative buds. On prothalli of *Scolopendrium vulgare* and *Nephrodium dilatatum* sporangia, which sometimes attained almost perfect development, were found. In conclusion the bearing of the results on the nature of the alternation of generations seen in archegoniate plants is considered, and a provisional hypothesis is suggested to explain how the definite alternation of sexual and asexual forms might have originated by modification of individuals of the ancestral algal organisms under the conditions to which they would presumably have been exposed on their assumption of a terrestial mode of life.

"Experimental Observations on the early Degenerative Changes in the Sensory End Organs of Muscles." By F. E. Batten, M.D. Communicated by Prof. Victor Horsley, F.R.S.

The experiments described in the following paper were undertaken in order to show, firstly, that degeneration occurred in the first place in that part of the neuron most remote from the cell, and secondly, to reproduce within the muscle-spindle, if possible, certain changes which had been shown by the author to be present in the case of tabes dorsalis in man.

The results of the research have been to show:

(1) That within the muscle-spindle a spiral form of nerve termination exists surrounding a fine muscular fibre, in the centre of which are large, clear, non-nucleated cells.

(2) That changes take place in the spiral in twenty-four hours after section of the nerve, and that such changes become marked in forty-eight hours.

(3) That degeneration of the medullated sheath of the nerve takes place in the whole course of the nerve at the same time after section of the nerve.

(4) That no fatty change could be demonstrated in the intramuscular cells by the Marchi method similar to those found in the case of tabes dorsalis in man.

Entomological Society, March 2.—Mr. G. H. Verrall, Vice-President, in the chair.—Lord Walsingham exhibited a series of the larger and more striking species of Xyloryctinæ, a subfamily of the Gelechiidæ, especially characteristic of the Australian fauna. The series illustrated the life-histories and the great disparity in colour and form between the sexes of many species. He also gave an account of the family, chiefly from notes by Mr. Dodd (of Queensland), with especial reference to the habits of the larvæ, which live in holes in tree-trunks, to which they drag leaves in the night for the next day's consumption.—Mr. Gahan exhibited a locust, *Acrydium ægyptium* (= *tartaricum*), taken in a house in Hanover Square, and probably imported in vegetables.—Mr. Kirkaldy exhibited species of water-bugs, including *Enicocephalus culicis* and *Gerris robustus*, both taken for the first time in Mexico.—A discussion arose on the reported occurrence of the San José scale, *Aspidiotus perniciosus*, in Great Britain.

Linnean Society, March 3.—Dr. St. George Mivart, F.R.S., Vice-President, in the chair.—Mr. Thomas Christy exhibited specimens of the Mora Nut of British Guiana (*Dimorphandra Mora*, Schomb.), of which some had been lately introduced into London by Colonial brokers as the Kola Nut (*Cola acuminata*). It appeared, however, on analysis, that the former contains no caffeine, a product for which the latter is of definite commercial value. It remained to be ascertained whether the Mora Nut has any economic value.—Prof. W. A. Herdman, F.R.S., read a paper by Mr. F. J. Cole, entitled "Observations on the structure and Morphology of the cranial nerves and lateral sense organs of fishes, with especial reference to the genus *Gadus*." It contains the first description of the lateral-line organs of *Gadus*, and pit-organs were shown to be present. The author concludes that the lateral-line system of fishes was not originally metameric, and that it has nothing to do with the branchial sense-organs. He regards it and the auditory organ as parts of a system, and their nerves (viz. the superficial ophthalmic, buccal, external mandibular, lateralis, and lateral-line nerves), together with the auditory, as of a series *sui generis*, and shows that the so called lateral-line nerve of *Petromyzon* really belongs to the lateralis accessorius system (ramus lateralis trigemini, auct.), the morphology of which he fully describes. The paper deals exhaustively both with the afore-mentioned and the subsidiary branches of the subject, which is treated in detail and historically, with an accompanying exhaustive bibliography.—Prof. Howes, discussing the paper at some length, drew attention to some observations of the Cousins Sarasin, and to the experimental work of Sewall, Steiner, Lee and others upon the auditory apparatus of fishes, which he believed lent support to the author's conclusions.—Mr. G. Claridge Druce read a paper on the occurrence of *Carex helvola*, Blytt, in Britain, in which he gave an account of his discovery of this plant on Ben Lawers, Perthshire, in August 1897. He found it growing in some abundance at an elevation of about 3200 feet. Prof. Blytt and Dr. Christ, to whom specimens had been submitted, both agreed in naming it *C. helvola*, which by many botanists is considered to be a hybrid.—A report by the Rev. O. P. Cambridge, F.R.S., upon the spiders collected by Mr. Fisher, of the Jackson-Harmsworth Polar Expedition, was read by Mr. A. D. Michael. They consisted of three species, all belonging to the genus *Erigone*, one of which had been previously described, though not figured by Thorell; and another was new, but closely allied: the author proposes to call the latter *E. Fisheri*.

Geological Society, March 9.—W. Whitaker, F.R.S. President, in the chair.—Prof. J. W. Judd exhibited, on behal of the Coral Reef Committee of the Royal Society, the lowest core (698 feet) from the boring at Funafuti (Ellice Island), and drew attention to the remarkable changes exhibited by the rocks obtained at this depth. The core from this boring (a mass of material more than a ton in weight) had been sent to this country by Prof. Edgeworth David, and was now being submitted to careful study. The last 20 or 30 feet of the boring was carried on in a rock which was of a very soft character, and highly but minutely crystalline. Microscopic examination shows that the

rock is almost completely converted into a mass of very small rhombohedra, the organic structures being nearly obliterated; while a preliminary chemical examination seems to indicate that magnesia has been introduced into the rock to a considerable extent. The complete study, microscopical and chemical, of all the stages of the change which has taken place in this rock—a study which will be undertaken by Mr. C. G. Cullis—promises to throw much light on processes of rock-formation of very great interest to the geologist.—Note on Clipperton atoll, by Rear-Admiral Sir W. J. Wharton, K.C.B., F.R.S. This atoll, 600 miles from North America, in lat. 10° 17′ N., long. 109° 13′ W., possesses a lagoon which is now completely cut off from the sea. In this is a perfectly round hole where soundings of 20 fathoms or more are reported, on the authority of Mr. Arundel, and even deeper ones on that of the captain of a merchant-vessel. On the coral ring there rises a mass of modified trachyte, the subject of the following communication, about 60 feet in height. The great depth of the lagoon and the rock-mass on the ring are not compatible with the origin of the reef by subsidence or outward growth; and the possible hypothesis is put forth that this reef had grown on the lip of a volcanic crater, or on an island, such as Krakatao, in which the interior has been enlarged and deepened by volcanic explosion.—A phosphatised trachyte from Clipperton atoll, by J. J. H. Teall, F.R.S. Specimens from the projecting rock described in the preceding communication are dark brown, white, or cream-coloured. The brown specimens are trachytes, composed of glassy phenocrysts of sanidine set in a groundmass of microlitic felspars with brown interstitial matter. The light-coloured rocks are more or less altered trachytes, in some of which the glassy phenocrysts of sanidine may still be recognised. Analyses of several specimens show that the rocks all contain varying amounts of phosphoric acid.—The Pliocene deposits of the East of England, Part i. the Lenham Beds and the Coralline Crag, by F. W. Harmer. From the discussion of lists of fossils, a large number of sections, and a series of borings, the author endeavours to establish a number of propositions with regard to the Lenham Beds, the Coralline Crag, and the Red Crag. His evidence indicates that the Lenham Beds are older, perhaps considerably so, than the Coralline Crag.

Mathematical Society, March 10.—Prof. Elliott, F.R.S. President, in the chair.—Mr. A. N. Whitehead read a paper on the geodesic geometry of surfaces in non-Euclidean space.—Prof. W. Burnside followed with a paper on linear homogeneous continuous groups whose operations are permutable.—Mr. T. I. Dewar, in the absence of Prof. Greenhill, F.R.S., exhibited, with the aid of stereoscopes, some stereoscopic diagrams of pseudo-elliptic catenaries and geodesics.—Lieut.-Colonel Cunningham, R.E., contributed a supplementary note on Aurifeuillians.—The President briefly brought before the meeting a paper, by Mr. W. F. Sheppard, on the calculation of the sum of the mth powers of a large number of magnitudes, and then (Lieut.-Colonel Cunningham in the chair) read a paper by himself, on the transformation of linear partial differential operators by extended linear continuous groups.

Zoological Society, March 15.—Dr. Albert Günther, F.R.S., Vice-President, in the chair.—A communication from Sir Edmund Loder, Bart., contained copies of some photographs of the Beaver-pond at Leonardslea, Horsham, and gave a short account of the habits of the animals as there observed.—Mr. R. E. Holding exhibited a pair of horns of the Sunga or Galla Ox of Abyssinia, and made some remarks on the horns of this and other varieties of the humped cattle of India and Africa.—A communication from Dr. G. Stewardson Brady, F.R.S., on new or imperfectly-known species of Ostracoda, chiefly from New Zealand, was read. It contained descriptions of the Ostracoda collected in New Zealand by Mr. H. Suter, for the Zoological Museum of Copenhagen, and by Mr. G. M. Thomson, of Dunedin. It also included a description of an Ostracod from the Bay of Bengal, presenting some remarkable peculiarities of the mouth-organs, and constituting the type of a new genus, which was proposed to be called *Eupathistonia*. Of the New Zealand species treated of sixteen were described as new, and the new generic term *Trachyleberis* was proposed for the reception of *Cythere scabrocuneata*, Brady.—Mr. E. H. J. Schuster described a new species of flagellate Protozoan, which he proposed to name *Lophomonas sulcata*. This species occurred as an endo-parasite in the upper part of the colon of *Blatta americana*, Linn.—Mr. J. T. Cunningham read a paper on the early post-larval stages of the Common Crab (*Cancer pagurus*), and pointed out the affinity of that species with the Circular Crab (*Atelecyclus heterodon*).—Mr. Oldfield Thomas read a paper on some mammals collected by the late Mr. Henry Durnford in 1877-8 in Chubut, Patagonia.—Mr. Martin Jacoby contributed an addition to our knowledge of the phytophagous Coleoptera of Africa by describing forty-three new species of the groups *Halticinæ* and *Galerucinæ*, specimens of which had been collected by Mr. Guy A. K. Marshall in Mashonaland and West Africa. Two new genera, viz. *Cheiridisia* and *Pseudedusia*, were characterised.

Royal Meteorological Society, March 16.—Mr. F. C. Bayard, President, in the chair.—A lecture on photographing meteorological phenomena was delivered by Mr. A. W. Clayden, who gave details of his experiences as Secretary of a Committee of the British Association. After referring to the extreme value of photographic methods of recording the movements of instruments, the lecturer spoke of the real importance of preserving photographic records of all sorts of unusual meteorological phenomena, and emphasised the necessity of companion photographs showing the same scene under normal conditions. It was suggested that meteorologists throughout the country should co-operate with the Royal Meteorological Society in securing such records. The phenomena of the lightning discharge, as distinguished from those of a single flash, were next described and illustrated by a number of lantern slides. Some of the puzzles offered by lightning photographs were next alluded to, and the lecturer stated that he had repeatedly found that a single discharge lasted several seconds. Mr. Clayden then spoke of the "black" flashes shown in photographs, and described the steps by which, some years ago, he was led to the proof that they were merely a photographic phenomenon, but one which still remains unexplained. Passing on to a consideration of cloud photography, the various methods in use were explained and a large number of lantern slides were exhibited, in some of which the clouds were shown on a background of blue sky in nearly their natural colours, a result obtained by the employment of suitable developers on a specially prepared plate. The method employed at Exeter by the lecturer for the measurement of cloud altitudes was fully described. This differs from all other methods in using the sun as a reference point. Mr. Clayden then spoke of the difficulty in getting good pictures of cirrus clouds, and described the methods dependent on the polarisation of the blue light of the sky, but expressed a conviction that polarisation had nothing to do with their efficiency, which was really due to a general lessening of brightness which enabled the exposure to be properly judged.

CAMBRIDGE.

Philosophical Society, February 7.—Prof. Newton, Vice-President, in the chair.—"The coral reefs of Funafuti, Rotuma, and Fiji, together with some notes on the structure and formation of coral reefs in general," J. Stanley Gardiner. The author had accompanied Prof. Sollas' expedition to Funafuti in 1896. Funafuti cannot be regarded as a typical atoll, as it shows an elevation of at least 10 feet. Its islands are the remains of the original reef, and are rapidly being washed away; while the present reef is extending outwards by nullipore growth, forming masses outside and joining them on to the *rim*. In Viti Levu, Fiji, soft limestone attains an elevation of 900 feet and alternates with "soapstone," which the author regards as a shallow water deposit analogous to the sand covering the inner reefs round Viti Levu. Many of the islands of Lau are of hard limestone, and represent raised atolls. In the case of Vatu Vara a vertical thickness of 1030 is attained. Evidence is given to show that the Fiji Group has been stationary for a long period, and that the conditions and formation of its reefs strongly oppose the subsidence theory. It is also contended that reefs spread outwards on their own talus, while lagoons are formed by solution. Evidence for the latter is given from the washing away of the limestone islands of Lau, the atoll-reefs of which are considered to have been formed by this means. The formation of coral reefs is due rather to nullipore than coral growth, and depends largely on the depth to which light can penetrate sea water.—"Methods for the demonstration of 'connecting threads' in the cell-wall," Walter Gardiner. The author gives further details of his "Kolossow-Safranin" method, and describes a modification of Meyer's method, which he calls the "iodine-acid violet" method. The paper also deals with the theory of both of the above modes of investigation.

February 21.—Mr. F. Darwin in the chair.—On some differential equations in the theory of symmetric algebra, Prof. Forsyth.—Discharge of electrification by ultra-violet light, E. Rutherford. In this paper the general phenomena of conduction under ultra-violet light were considered, especially from the point of view of the nature and velocity of the carrier of the negative electrification. By directing a blast of air against a plate on which ultra-violet light fell, it was shown that the whole or portion of the carriers could be removed with the current of air. The charged gas so obtained shows properties similar to the charged gas obtained in Röntgen conduction. A general method of determining the velocity of the carrier was given. By its means the velocity of the carrier for air was found to be about 1·4 cms per sec. for a potential gradient of one volt per cm. The velocity of the carrier is independent of the metal on which the light falls, but depends on the gas surrounding the plates. The velocity of the carrier was found to be inversely proportional to the pressure, a result which shows the carrier is of molecular dimensions. The results of the experiments are simply explained on the hypothesis that gaseous ions are produced at the surface of the negatively electrified plate. The theory previously advanced that the discharge was due to the disintegration of metallic particles under the action of ultra-violet light does not sufficiently explain the facts.—Röntgen photographs of metallic alloys, C. T. Heycock and F. H. Neville. The authors exhibited and described photographs taken by means of the Röntgen rays through plates of alloy. As the two metals forming the alloy possess different degrees of transparency to these rays, the photographs show the separation of the metals that has taken place during the solidification of the alloy. For example, alloys of gold and sodium containing less than 30 per cent. of gold are seen to consist of well-developed, very transparent crystals, which must be pure, or nearly pure, sodium, imbedded in a mother substance which solidified last, and which, from its comparative opacity, evidently contains the gold. On the other hand, alloys containing more gold show very opaque needles of gold imbedded in a less opaque mother substance. This mother substance was the same as that in the first-mentioned alloy; it solidified after the needles of gold had been formed. Photographs of alloys of aluminium and gold, and of aluminium and copper, were shown, which exhibited similar phenomena. The crystals of aluminium in the alloy with copper were perfect rectangular crosses several millimetres in diameter. The gold-aluminium alloys showed a precipitate of Roberts-Austen's compound of the formula $AuAl_2$; the crystals were well-marked tubes and octahedra.

MANCHESTER.

Literary and Philosophical Society, March 8.—Mr. J. Cosmo Melvill, President, in the chair.—The President announced that the title of the Wilde Lecture to be delivered by Prof. Michael Foster on March 29, would be "On the physical meaning of psychical events."—Mr. Thomas Thorp exhibited some celluloid films taken from Rowland's gratings of 14,438 lines to the inch.—"On the velocity of sound in a tube, as affected by the elasticity of the walls," by Prof. H. Lamb, F.R.S. The paper consisted in an application of the known theory of the vibrations of thin cylindrical shells to the calculation of the velocity of sound in a tube filled with liquid. This subject has already been treated by Korteweg, but the author's method is somewhat different, and one or two collateral results of interest are obtained. The paper included, further, an approximate investigation of the effect in a *thick* tube.

EDINBURGH.

Royal Society, January 31.—Prof. Chrystal in the chair.—An obituary notice of the late Edmund Chisholm Batten was read.—Dr. J. K. Talmage, a delegate to the Geological Congress of 1897, gave in a report of the meetings.—Papers by Dr. Thomas Muir, on the relations between the co-axial minors of a determinant of the fourth order, and by Prof. Nanson on the Ellipse-Glissette elimination problem, being purely technical, were laid on the table.—Mr. W. L. Calderwood read a paper on the migratory movements of Salmonidæ during the spawning season. After distinguishing between spring and summer runs of fish and calling attention to the dissimilarity between such runs and the autumn runs to the head waters for the express purpose of spawning, the author showed that these last runs could alone be considered as analogous to the runs in connection with the spawning habit of *Clupea allosa*, *C. finta*, or *Petromyzon marinus*. As to the conditions of water flow which seemed most favourable for Salmonidæ entering a tributary from a main river, Mr. Calderwood submitted several tables of data collected by daily observations in the spawning season of 1896-97. The results showed that most fish entered the particular tributary under consideration when the water was in quarter-flood; that temperature had apparently no influence upon the runs of fish; that a limited number of fish ascended during normal flow of the stream; that the sea trout commenced to ascend later than salmon, but remained a much shorter period, completing their spawning two months before the last salmon redd was observed. The author exhibited a diagram-chart of the spawning grounds, showing the distribution of salmon and sea trout redds, and the dates on which the redds were constructed.

PARIS.

Academy of Sciences, March 14.—M. Wolf in the chair.—Chemical actions of the silent discharge. Nitrogen compounds in presence of free nitrogen, by M. Berthelot. A continuation of similar work published in preceding numbers of the *Comptes rendus*. The substances dealt with included methylamine, dimethylamine, ethylamine, propylamine, isopropylamine, allylamine, aniline, methylaniline, benzylamine, toluidine, pyridine, piperidine, ethylenediamine, propylenediamine, phenylenediamine, benzidine, nicotine, acetamide, thiourea, acetonitrile, benzonitrile, aldoxime, phenylhydrazine, some nitro-derivatives, pyrol and indol.—On the estimation of carbon monoxide diluted with large quantities of air, by M. Armand Gautier. Remarks on the use of iodic anhydride for the estimation of minute quantities of carbonic oxide (1 in 20,000). The reaction is complete at 60°, the iodine being collected upon a roll of reduced copper and weighed. Better results are obtained by determining the carbon dioxide produced. Acetylene also reacts with iodic anhydride, and ethylene, although not reacting itself at 60°, possesses the peculiar property of completely preventing the oxidation of carbon monoxide.—On the importance of sugar considered as a food; new demonstration of the superior nutritive value of sugar compared with that of fat, taking the respective thermogenic values of the two foods into account, by M. A. Chauveau. Two series of experiments were carried out upon the same animal (a dog), one with a sugar and the other with a fatty diet; the results showed that sugar possesses great advantage over the dynamically equivalent proportion of fat. It is, then, erroneous to consider the nutritive value of a food as measured by its heat of combustion.—The development of the sponges, by M. Edmond Perrier. A controversial reply to a paper on the same subject by M. Yves Delage.—The expedition to Greenland of the Geographical Society of Berlin, by M. Marcel Bertrand. The present note deals only with that part of the work which concerns the structure of the ice and the movements of glaciers. The explanation given for the latter, which satisfactorily accounts for all the observed facts, is practically identical with that proposed by Thomsen, the arguments now added by M. de Drygalski rendering these views more precise.—On the theory of numbers, by M. H. Laurent.—Integral invariants and optics, by M. Hadamard.—On the laws of reciprocity, by M. X. Stouff.—On the transformation of Abelian functions, by M. G. Humbert.—The energy of an electrified system, considered as distributed in the dielectric, by MM. H. Pellat and P. Sacerdote.—On the electric conductivity of thin plates of silver, by M. G. Vincent. The films were deposited on glass, and the thickness, which varied between 38μ and 170μ, measured by the methods of Wiener and Fizeau. The results of the measurements fell practically upon a straight line for thicknesses down to 50μ, below which an inflexion of the line took place. This critical thickness agrees well with the number obtained by Quincke in his capillarity experiments.—Some properties of electric discharges produced in a magnetic field. Assimilation to the Zeeman phenomenon, by M. André Broca. The hypothesis of the existence of ions in incandescent gases is sufficient to coordinate all known facts relating to the radiation of incandescent gases and also those relating to the electric discharge in gaseous media.—On the barometric formula, by M. Alfred Angot. The assumptions necessary for the accuracy of the Laplace formula are not strictly fulfilled in actual practice, so that the heights of an experimental balloon determined by the barometer and by triangulation respectively, may differ by as much as 500 metres in a height of 11,000 metres.—On the

haracters of the seasons of successive years, by M. P. Garrigou-Lagrange.—On the causes of the reciprocal replacement of two acids, by M. Albert Colson. An experimental study of the action of hydrogen sulphide upon the dry silver salts of orthophosphoric and pyrophosphoric acids.—On a new silicide of chromium, by M. Ch. Zettel. This silicide has the composition $SiCr_3$, and is obtained by strongly igniting in a Perrot gas furnace a mixture of copper, aluminium and chromic oxide. It is a well crystallised, very stable substance, which resists the action of all acids except hydrofluoric.—On a new method of fractionating the yttrium earths, by M. G. Urbain. The method consists of the fractional crystallisation of the ethyl sulphates. The results are similar to those obtained by the use of the acetylacetonates, the sulphates, and by the fusion of the nitrates.—On two modes of decomposition of some thiocyanic ethers, by M. Œschner de Coninck.—On some oxyethers of β-naphthol, by M. F. Bodroux. The ethyl, propyl, isopropyl, isobutyl, and isoamyl ethers are described.—On the product of oxidation of glycerine by the bacterium of sorbose, by M. Gabriel Bertrand. Dioxyacetone, $CH_2OH.CO.CH_2OH$, is the chief product; it was identified by means of its oxime.—On the sterilisation of liquids by filtration, by M. J. Hausser. Infusorial earth, calcined at 800° to 1000° C., powdered, and made into an emulsion with water deposits on any suitable filter support as a fine compact layer, which is capable of retaining the most minute suspended particles or micro-organisms. A thickness of ·4 to ·5 mm. is sufficient for sterilisation, and the velocity of filtration may be many times greater than with Chamberland filters.—The different modes of eliminating lime in rickets at different stages of the disease, by M. J. Babeau.—Embryogeny of the double larva of the Diplosomidæ, by M. Antoine Pizon. The results of Salensky concerning the development of the branchio intestinal apparatus are confirmed, and it in addition the function of the epicardial tubes is established.—On the splitting of the cuticle, by M. P. Pautel.—The culture of *Trichotoma nudum*, by MM. J. Constantin and L. Matruchot.—Action of different salts upon the structure of plants, by M. Charles Dassonville. The structure of true plants varies greatly according to the chemical composition of the medium in which they grow, those solutions which are most favourable to the development of the plant being also those which produce in it the greatest differentiation.—On a new generic type of Schizomycetes, the *Chatinella*, by M. E. Roze.

DIARY OF SOCIETIES.

THURSDAY, MARCH 24.

ROYAL SOCIETY, at 4.30.—The Bakerian Lecture will be delivered by Dr. W. J. Russell, F.R.S. Subject: Further Experiments on the Action exerted by certain Metals and other Bodies on a Photographic Plate.
ROYAL INSTITUTION, at 3.—Recent Researches in Electricity and Magnetism: Prof. J. A. Fleming, F.R.S.
INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—Cost of Generation and Distribution of Electrical Energy: R. Hammond.
INSTITUTION OF CIVIL ENGINEERS, at 4.—Prof. Boyd Dawkins will repeat the Sixth "James Forrest" Lecture on Geology in Relation to Engineering.
CAMERA CLUB, at 8.15.—Photographic Engraving in Intaglio: Colonel Waterhouse.

FRIDAY, MARCH 25.

PHYSICAL SOCIETY, at 5.—On the Circulation of the Residual Gaseous Matter in a Crookes' Tube: A. A. Campbell Swinton.—On some Improvements in the Roberts-Austen Recording Pyrometer, and Notes on Thermo-electric Pyrometers: A. Stansfield.
INSTITUTION OF CIVIL ENGINEERS, at 8.—Internal Governor Friction: H. O. Eurich.

MONDAY, MARCH 28.

SOCIETY OF ARTS, at 8.—The Thermo-Chemistry of the Bessemer Process: Prof. W. N. Hartley, F.R.S.
ROYAL GEOGRAPHICAL SOCIETY, at 8.30.—Exploration on and around Mount Aconcagua: E. A. Fitzgerald.
INSTITUTE OF ACTUARIES, at 5.30.—Industrial Assurance: C. H. E. Rea.

TUESDAY, MARCH 29.

ROYAL INSTITUTION, at 3.—Simplest Living Things: Prof. E. Ray Lankester, F.R.S.
INSTITUTION OF CIVIL ENGINEERS, at 8.—Extraordinary Floods in Southern India: their Causes, and Destructive Effects on Railway Works: E. W. Stoney.
ANTHROPOLOGICAL INSTITUTE, at 8.30.—On the Natives of the Upper Welle District of the Belgian Congo: Captain Guy Burrows. (Illustrated with Lantern Slides and Objects of Ethnological Interest.)

WEDNESDAY, MARCH 30.

SOCIETY OF ARTS, at 8.—Telegraphy across Space: Prof. Silvanus P. Thompson, F.R.S.

THURSDAY, MARCH 31.

SOCIETY OF ARTS (Indian Section), at 4.30.—The Earthquake in Assam: Henry Luttman-Johnson.
ROYAL INSTITUTION, at 3.—Recent Researches in Magnetism and Diamagnetism: Prof. J. A. Fleming, F.R.S.
CHEMICAL SOCIETY, at 3.—Annual General Meeting.
CAMERA CLUB, at 8.15.—Prof. Joly's System of Colour Photography: Captain Abney, C.B., F.R.S.

FRIDAY, APRIL 1.

ROYAL INSTITUTION, at 9.—Liquid Air as an Analytic Agent: Prof. Dewar, F.R.S.

BOOKS AND SERIALS RECEIVED.

BOOKS.—Results of Rain River, and Evaporation Observations made in New South Wales during 1896: H. C. Russell (Sydney).—The Mines of New South Wales, 1897: C. W. Carpenter (G. Robertson).—Fisiologia Vegetale: L. Montemartin (Milano, Hoepli).—Anatomia Vegetale. Dr. F. Tognini (Milano, Hoepli).—Navigazione Aerea: G. N. Da Pra (Milano, Hoepli).—Storia Naturale: Dr. A. Griffini (Milano, Hoepli).—Marriage Customs in many Lands: Rev. H. N. Hutchinson (Seeley).—Canada's Metals: Prof. Roberts-Austen (Macmillan).—Practical Guide to Photography: Marion and Co., 6th edition (Marion).—A New Astronomy: Prof. D. P. Todd (New York, American Book Company).—Théories de L'Electrolyse: A. Minet (Paris, Gauthier-Villars).—Recherches sur les Origines de l'Égypte, Ethnographie Préhistorique et Tombeau Royal de Négadah: J. De Morgan (Paris, Leroux).—Laboratory Experiments on the Class Reactions and Identification of Organic Substances: Drs. Noyes and Mulliken, 2nd edition (Easton, Pa., Chemical Publishing Company).—The Freezing-Point, Boiling-Point, and Conductivity Methods: H. C. Jones (Easton, Pa., Chemical Publishing Company).—An Arithmetic for Schools: S. L. Loney (Macmillan).—Spectrum Analysis: Dr. J. Landauer, translated by Dr. J. B. Tingle (Chapman).—Sitzungsberichte der K.B. Gesellschaft der Wissenschaften, Math.-Naturw. Classe 1897, 2 Vols. (Prag).—The Linacre Reports, edited by Prof. E. Ray Lankester, Vol. 3 (Adlard).

SERIALS.—American Journal of Science, March (New Haven).—Psychological Review, March (Macmillan).—History of Mankind: F. Ratzel, translated, Part 24 (Macmillan).—Zoologist, March (West).—Bulletin de l'Académie Royale des Sciences, &c., de Belgique, 1898, No. 2 (Bruxelles).—Journal of the Franklin Institute, March (Philadelphia).—Transactions of the Leicester Literary and Philosophical Society, January (Leicester).—Quarterly Journal of the Royal Meteorological Society, January (Stanford).—Bulletin of the Essex Institute, July-December, 1896 (Salem).—Board of Trade Journal, March (Eyre).—Timehri, December (Stanford).—Among British Birds in their Nesting Haunts: O. A. J. Lee. Part x. (Edinburgh, Douglas).—Proceedings of the Society for Psychical Research, February (Paul).—Wide World Magazine, April (Newnes).—Archives of the Roentgen Ray, February (Rebman).—Transactions of the Institution of Engineers and Shipbuilders in Scotland, March (Glasgow).—Morphologisches Jahrbuch, 25 Band, 4 Heft (Leipzig).

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