Nature

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"*To the solid ground*
Of Nature trusts the mind which builds for aye."—WORDSWORTH

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THURSDAY, MAY 3, 1900.

MOUNT ST. ELIAS.

La spedizione di sua Altezza Reale il Principe Luigi Amedeo di Savoia, Duca degli Abruzzi al Monte Sant' Elia (*Alaska*) 1897. Da Dottore Filippo de Filippi; illustrata da Vittorio Sella. Pp. xvii + 273; with 34 plates, 4 panoramic views, 2 maps and 115 figures in text. A beneficio delle Guide Alpine Italiane. (Milano: U. Hoepli, 1900.)

MOUNT ST. ELIAS, with an altitude, as now ascertained, of 18,092 feet, stands—a majestic corner-post—exactly at the angle where the Alaskan boundary-line ceases to run parallel to the coast and strikes northward along the 141st meridian, and its summit is now generally acknowledged to lie on the Canadian side of the frontier. Whether it maintain its supposed pre-eminence among the mountains of the North American continent, or whether it eventually prove to be overtopped by Mount Logan, its great neighbour on the north, or, as the most recent explorations seem to indicate, by Mount McKinley, one of the yet unvisited peaks to the westward, it must, from its commanding position on the verge of the open ocean, always impress the imagination as the grandest of the Alaskan Chain. In recalling the fact that the mountain was for long erroneously supposed to be a volcano, Mr. Douglas Freshfield has told us, on the authority of the poet himself, that Tennyson had Mount St. Elias in mind when he described the landscape of a volcano among snow as one of the pictures on the walls of "The Palace of Art" (see *The Alpine Journal*, vol. xix. p. 174).

So far as our present knowledge goes, nowhere else on the face of the globe is there so great a vertical range of snow and ice as among these Alaskan mountains. On Mount St. Elias the permanent snow-line comes down to within about 3000 feet of the sea, while the enormous glaciers nourished by the excessive humidity of the climate not only descend to sea-level, but unite and spread out in a vast plain of ice covering an estimated area of 1500 square miles between the foot of the mountain and the ocean.

Thus entrenched in ice sheets, so that even its base is defended, it is not surprising that the mountain withstood several attacks before it was conquered. The first attempt was made, in 1886, by Messrs. Libbey, Schwatka and Seton-Karr; the next, in 1888, by Messrs. Topham, Broke and Williams; the third and fourth, by Prof. I. C. Russell, in 1890 and 1891; and the fifth, by Prof. H. G. Bryant, in 1897, almost simultaneously with the successful Italian expedition. Of these explorers, Prof. Russell achieved in every way the most important results, bad weather alone preventing his complete success in 1891, after an altitude of 14,500 feet had been attained and the practicability of the ascent had been demonstrated. Prof. Russell correctly determined the height of the mountain, and carried out investigations upon its physical characteristics which proved of high scientific importance. Lieut. Seton-Karr had previously called attention to the singular condition of the glaciers at the foot of the mountain, where immense piles of morainic debris, in places overgrown with dense vegetation, hide the marginal surface of the ice; but it was not until Prof. Russell published his more adequate descriptions that geologists fully recognised the value of the phenomena of the "piedmont" ice in elucidating the conditions of ice-covered lowlands in general during the Glacial Period, and especially during its closing stages. So closely has Prof. Russell's name become associated with the mountain, that one cannot stifle a regret that the satisfaction of being first upon the summit did not fall to his lot. In the volume before us, however, we are glad to find a graceful acknowledgment of the work of previous explorers, in a chapter having for its motto this quotation, from Mr. D. Freshfield:—

> "Those who went first and opened the way are not less entitled to credit than those who came afterwards and reaped the fruit of their predecessors' labours."

The leader of the Italian expedition, H.R.H. Prince Louis of Savoy, in planning an ascent higher than the Alps could offer, had at first contemplated an attack upon one of the great peaks of the Himalayas. Forced by unfavourable circumstances to abandon this idea, he turned for consolation to Mount St. Elias. He could not have selected a more princely amusement, or a better exercise in skilful organisation and patient endurance. That he achieved his object without mishap, and that he and his little band of fellow-countrymen had the patriotic satisfaction of planting the Italian flag on a summit assuredly never before trodden by the foot of man, was due to the careful forethought with which all the preliminary arrangements of the expedition were planned.

A graphic account of the ascent was communicated by one of the party, Dr. Filippo de Filippi, to the English Alpine Club a few months afterwards, and was published in the *Alpine Journal* for May 1898. As chronicler of the expedition, Dr. Filippi has now expanded his story in the handsome and portly volume before us, in which he deals at full length with the conditions of the climb, and describes in glowing language the wild grandeur of the scenery. The beautiful photogravure plates and the illustrations in the letterpress, with which the book is so bountifully provided, are reproduced from photographs taken, for the most part, by Vittorio Sella, who was also of the party, and these are especially valuable as a faithful and permanent record of the physical characters of this seldom-visited region, and particularly of the untraversed wilderness of snow and mountain peaks to the northward of St. Elias. Among many that are excellent, there is one plate (p. 136), showing the snowy eastern spurs of St. Elias delicately fluted by innumerable avalanches, which seems to us peculiarly impressive.

Of the ten chapters of the book, only five deal with the actual ascent; the first three, and also the final chapter, are devoted to the outward and homeward journeys; the fourth to the previous history of the mountain; and appendices, covering seventy-four pages, to the equipment and scientific results of the expedition.

As Russell had foretold, the mountaineering difficulties encountered during the climb were slight, and the adventure resolved itself into a long, arduous struggle upward for thirty days, usually in wretched weather, over interminable snow-fields and glaciers. The character of the climb was pithily given by one of the guides, in answer to inquiries after his return:—"C'est comme le Breithorn, seulement beaucoup plus haut." The expedition, consisting of the Prince with four compatriots, five Italian guides, and ten Americans who acted as porters, landed safely near Point Manby, at the foot of the moraine of the Malaspina ice-field, on the evening of June 23, and on July 1 started forward across the ice, all subsequent encampments being upon snow. Traversing the Malaspina in three days, partly in dense fog, the party struck upward along the eastern flank of its great tributary the Seward Glacier, which was afterwards crossed, and the Agassiz Glacier gained, at an altitude of only 3480 feet, by Russell's previous route through the Dome Pass, on July 13. Thence the explorers forced their way slowly up the Newton Glacier, through labyrinths of crevasses and ice-falls, for thirteen days, of which only three were fine. Fortunately the fog and snow which fell to their lot were unaccompanied by either wind or electrical disturbance; nor did the party suffer from cold, the temperature ranging steadily between 25° and 35° F. Their progress along this glacier averaged only about 1 mile 500 yards daily. At this stage they received news that the expedition led by Prof. Bryant, which had set out a few days ahead of them, had been compelled to return to the coast owing to the illness of one of its members, after having reached the foot of the Newton Glacier.

The Italians were greatly impressed with the vivid colouring of the névé and ice even in the thickest weather, the tints ranging from brilliant turquoise and azure to the deepest blue, without the greenish tinge familiar to them in the Alps. This and the weird atmospheric effects in these mountain solitudes are eloquently described by Dr. Filippi.

Having left the American porters behind, and established their advance camp on the col at the head of the Newton valley, at an altitude of 12,287 feet, the success of the mountaineers depended solely upon the weather. Fortunately this proved more favourable than at the lower elevations, and they were able, without delay, to attack the summit. It was absolutely calm and clear on July 31, when after a heavy climb of 5800 feet from their last bivouac, during which the majority of the party were more or less affected by mountain-sickness, the Prince and his comrades reached the crest just before noon. The thermometer registered a temperature of 10·5° F., and the barometer stood at 15 inches 15 lines. The height of the mountain as determined by the barometer was 18,092 feet, which is in remarkably close agreement with Russell's figures, 18,100 feet, obtained by triangulation.

From the summit they saw the majestic mass of Mount Logan to the north-eastward, sinking north-westward into a very intricate lower chain, while to the westward was a chaos of low ridges, névés and glaciers, overtopped at a distance of some hundred miles or so by three great snowy giants as yet unexplored, which proffer substantial work for the future.

Then came the descent and the return to the coast, which was safely reached in ten days. Some of the lower ridges overlooking the Malaspina Glacier, where they had previously found snow, were now knee-deep in blossoming plants.

The appendices to the volume are, from a scientific standpoint, not particularly important. The first describes the equipment of the expedition in detail, and should be of service to explorers of similar regions. The excellent plan was adopted of packing the supplies in tin boxes, each containing sufficient material of every kind for twenty-four hours. The second appendix consists of meteorological tables, giving the simultaneous observations made daily between June 25 and August 3 by the expedition, and by the Rev. C. J. Hendricksen, of the Swedish Mission at Yakutat, at the foot of the mountain. The third deals with the health of the party. The absence of colds, rheumatism, or other ill results from the trying conditions of the journey is made the subject of comment; and the symptoms which effected most of the explorers during the final stages of the ascent are fully discussed, but it is thought that these might be in part attributed to excitement and want of sleep. The only case of real illness was that of one of the American porters, who, after having passed a night, during the return, on ground covered by vegetation, on the Hitchcock Hills, was seized with an attack of malaria while crossing the Malaspina Glacier. The terrible plague of mosquitoes on the coastal strip of forest is especially mentioned. Another appendix, on the zoological material, is principally devoted to the description of a new arachnid and of a new oligochæte annelid collected on the snow. An appendix on the rocks and minerals is for the most part a discussion of Russell's previous work, but contains the information that the outcrops near the summit of the mountain consist of typical diorite passing locally into hornblendite.

The ascent of Mount St. Elias was an achievement worthy of a prince, and this handsome volume is worthy of the achievement. Beautifully printed, magnificently illustrated and tastefully bound, it reflects credit upon all concerned in its production. But (alas! the inevitable but!) it has no index. G. W. L.

A HYDRODYNAMICAL THEORY OF ACTION AT A DISTANCE.

Vorlesungen über hydrodynamische Fernkräfte nach C. A. Bjerknes' Theorie. Von V. Bjerknes. Band i. Pp. 338; with 40 figures. (Leipzig: Johann Ambrosius Barth, 1900.)

THEORIES of matter—or should we not rather call them theories of *force*, since, in "explaining" the properties of matter, we are mainly concerned with those manifestations which we say are due to "force"—naturally fall into two distinct classes. The first class includes those hypotheses which regard continuous matter as being built up of discrete particles, and the direct action of finite portions of matter as being due to action at a distance of these particles. The second class includes those hypotheses which regard these particles as singularities in a continuous medium, and which attribute their action at a distance to the direct agency of the medium. In a certain sense, these two theories are reciprocal. In both, certain attributes are localised at points, and it is necessary to bridge over the distance between these points. According to the first hypothesis, a field of force pervades the intervening gaps; according to the second, they are filled with a distribution of mass. The belief that both hypotheses are possible, enables us to imagine that there may be no limit to the smallness of the scale on which Nature conducts her operations, the phenomena occurring in any region being made to depend in their turn on others occurring in the far more minute regions which are regarded as constituting its ultimate elements, and these elements being in turn capable of further subdivision, and so on indefinitely.

In 1852, Lejeune-Dirichlet, being unacquainted with the works of Green and Stokes on this subject, published a paper containing the solution of the problem of the motion of a sphere in an incompressible fluid. In a course of lectures given at Göttingen in 1855–56, Dirichlet gave the corresponding solution for a sphere fixed in a steady current, and invited his pupils to attempt the solution for an ellipsoid. Among these pupils were Schering, who solved the problem, and C. A. Bjerknes, who gave a generalisation for space of n dimensions. At this time the doctrine of action at a distance may have been said to be at its zenith, and Göttingen had given birth only a few years previously to the last brilliant product of that doctrine, Weber's Law. As a foreigner, Bjerknes was, however, less influenced by the views then prevailing in the Göttingen school, and a volume of Euler's correspondence falling into his hands caused him to oppose the doctrine of action at a distance. A fresh light was thrown on the hypothesis of a continuous all-pervading medium by Dirichlet's discovery that a sphere moving in an incompressible perfect fluid experiences no retardation from the fluid, and an impetus was given to Bjerknes to develop Dirichlet's investigations in a direction widely differing from anything then contemplated by his professor.

From the effects of purely translational motions of two spheres, Bjerknes was led on to consider the mutual actions of two pulsating spheres, and discovered that such spheres attract or repel one another according as their phases are the same or opposite, the law of force being that of the inverse square. Bjerknes found, moreover, that the expressions for the forces acting on a sphere moving in liquid consisted of two terms, which he distinguished as "inductional forces" and "energy forces," a result which he arrived at by considering the expressions for the pressures on the spheres, but which might have been found more readily had Thomson and Tait's application of Hamilton's principle been then known to him. About 1875, Bjerknes published a paper in which he established the hydrodynamical law of action and reaction, and the analogy with electric and magnetic action at a distance; and in the following year he gave an independent investigation based on the Hamiltonian principle.

From 1875 onwards, Bjerknes appears to have occupied himself chiefly with the terms of lowest order in the expressions for the forces; and in 1878 he discovered the law of rotation for oscillating spheres. Since then he seems to have devoted his attention mainly to electric and magnetic analogies, and in the middle of his eightieth year he completed the discussion of the "inductional forces," and by this means pushed the analogy between hydrodynamic action at a distance and electromagnetic phenomena as far as it could be pushed without departing from the fundamental hypotheses.

A complete account of these investigations was never published, and it remained for his son, Prof. V. Bjerknes, to embody them in the present volume. For three years Prof. V. Bjerknes has delivered courses of lectures on the subject at the University of Stockholm, and the book is practically based on these lectures. It is divided into four parts: the first, an introductory part, dealing with the general principles of vector fields and hydrodynamical equations; the second, dealing with the motion of the liquid surrounding a system of moving spheres treated from a kinematical standpoint; the third, dealing with the influence of the pressures on the motion of the spheres themselves; and the fourth, with the theory c apparent actions at a distance, of hydrodynamical oı In the second part, the diagrams of the stream lines due to a moving, oscillating or pulsating sphere in various fields of force are noticeable for their elegance.

It is to be wished that the courses of lectures which Prof. V. Bjerknes delivered on the work of his father could be taken as models of what university lectures should be, for the development of a theory such as the present affords an excellent and not difficult insight into the methods of mathematical analysis. So long as our English university colleges are, to a great extent, in the hands of oligarchies, who attach more importance to such trifles as the handwriting and spelling of matriculation or medical preliminary students than to higher scientific study, such courses of training will only be accessible to those who seek them in countries more enlightened in the matter of scientific education than Great Britain. We can readily imagine that Bjerknes' theories may find their way into many transatlantic universities among the "classics of science." They have, indeed, no small claim to be regarded as classical. It is true, as Prof. V. Bjerknes points out, that his father's and Kirchhoff's work in several cases somewhat overlapped, but it would appear that in developing the theory of motion of spheres in liquids as a basis for explaining the properties of matter, Bjerknes stood entirely on ground of his own making. Other theories involving the conception of a continuous medium have sprung up; we have had the vortex-atom theory before us, and we now find it necessary to postulate the existence of an ether, whose attributes resemble those of an elastic solid rather than a fluid. At the present time few will regard the hypothesis of pulsating spheres as of more than classical interest. As having been first developed in the face of a prevalent belief in the doctrine of action at a distance, and as ingenious methods of replacing this action at a distance by the action of an intervening medium, the application of the term "classical" to these investigations of C. A. Bjerknes may not be altogether without justification.

G. H. BRYAN.

PHOTO-MICROGRAPHY.

Photo-micrography. By Dr. Edmund J. Spitta. Pp. xi + 163. (London: The Scientific Press, Ltd., 1899.)

A QUARTER of a century has now elapsed since the renaissance of the art and science of photomicrography. Up to that time much of the best work in this direction was accomplished in America by Lieut.-Colonel Woodward, of Washington, whose successful photographs of diatoms excited the admiration of all microscopists who saw in his productions the faithful delineations of those "markings" on them, on which many hours of microscopical manipulation had been spent in bringing their delicate tracery to a correct definition. From that time to the present the fascination of transferring the minutest details of histological and biological science to the photographic plate has found many ardent votaries, with the result of improved apparatus and lenses corrected to such a degree of accuracy for this work that sharp and well-defined images can now be obtained in a manner that would have been a boon and a revelation to workers twenty-five years ago.

Amongst the latest exponents of this branch of microscopical science we must name that of the author of the book under consideration.

Dr. Spitta in this work on photo-micrography has dealt with the subject very fully and from a scientific standpoint, so that the student who takes up this branch of the photographic art is thoroughly furnished with all the information necessary to the accomplishment of perfect work, leaving, however, only that amount of *personal experience* to be obtained and which will be demanded of every one who first embarks on this art, and without which he is liable to be landed in many difficulties.

In Chapter i. the author deals with illuminants, a by no means unimportant point for consideration; for although we have several good illuminants for low power work, it is when we come to work with the highest power objectives that either the lime-light or that of the electric arc lamp must be employed to produce the best possible results. These lights are not always readily accessible; but as the aspiring student most probably will try his 'prentice hand on low power work, the single wick lamp burning the best paraffin oil will furnish him with a light sufficiently rich in actinic rays that, provided the proper length of exposure be given, will result in a very successful negative. Dr. Spitta in Chapter ii. proceeds to give directions for obtaining photo-micrographs by low power objectives, dealing with this in such a lucid manner that the student who closely follows his clear description cannot fail in being rewarded by satisfactory results, being assisted in his work by algebraical formulæ and illustrations of simple but effective apparatus.

Chapter iii. deals with medium power photo-micrography, and contains some very necessary cautions relative to the avoidance of vibrations in the apparatus, for, as the author observes, "when photographing at 1000 diameters, 1/1000 of an inch shake in the specimen makes a shift of one inch in the photographic plate," or he might have said in the photographic *image;* therefore the absolute necessity of the most perfect stability, not only in the apparatus but even in the studio, can be readily understood and provided for—even a heavy tread on the floor of an adjoining room being sufficient to disturb the steadiness of the optical arrangement. Dr. Spitta describes different methods whereby this difficulty may be overcome. Allowance must also be made for the expansion of the metal of the microscope from the heat of the illuminant, for even in low power work, say of 250 diameters, the heat from the oil lamp must not be considered a negligible quantity, and must be considered so far that no photographic exposure should be attempted till the metal has had time to become fully expanded.

Chapter iv. is overloaded with woodcuts of different makes of microscopes valuable as affording the student a choice of various instruments, but by no means necessary to his work, as any one of these is sufficient for attaining good medium power work. This chapter also deals with the subject of lenses and eyepieces and the accessory fittings of the microscope generally; but there is one point that must have the greatest attention, and that is the fine adjustment, and Dr. Spitta does well in laying great stress upon its importance; nothing is more embarrassing to the operator, when perhaps everything else in the apparatus is working well, to find that the fine adjustment by which he hopes to obtain that sharp definition without which his work is valueless, is altogether useless from faulty construction, and Dr. Spitta describes the various forms of this all-important addition to the photo-micrographic installation.

The remaining three chapters of this work treat of such subjects as substage fittings, coloured screens, and the various subsidiary apparatus useful in high power or "critical" photo-micrography. These particulars do not bear the condensation that is necessitated by the space allotted to this report, but are full of information for the guidance of the photo-micrographic student and will materially assist him in his work. A valuable feature is included in the appendices, and is headed "25 common faults in photo-micrography; their causes and means of cure"; by a reference to p. 152 every error that may present itself in the beginner's work is described, the reason for it given, and the remedy indicated. Added at the end of the book are five plates of representative work in photo-micrography, the work of the author, while a copious index brings the work to a conclusion.

GEORGE KINGSLEY'S LIFE AND WRITINGS.

Notes on Sport and Travel. By George Henry Kingsley. With a memoir by his daughter, Mary H. Kingsley. Pp. viii + 544. (London: Macmillan and Co., Ltd., 1900.)

THIS is a book, we venture to think, that most readers will lay down with deep regret—regret that a very talented writer, an acute observer, and an ardent sportsman (in the best sense of the word) should have bequeathed so little of his experiences to the world. For George Kingsley, a member of a clever family (or, as his biographer will have it, a member of a clever generation of an ancient family), was evidently a man far above the ordinary intellectual level, and enjoyed unrivalled opportunities of adding to our store of knowledge by travel in distant lands at a time when they were still, to a great extent, populated by their native denizens and unspoiled by the march of civilisation. Unfortunately, however, he seems to have been devoid of those regular and methodical habits of work by which alone the results of a life of exploration and travel can be properly recorded, and we have consequently to be content with mere scraps and fragments of a vast store of information.

From such scraps and fragments as the editor, who is to a great extent also the author, of the present volume has been able to save from oblivion, we glean how keen an observer and how true a lover of nature was Dr. Kingsley. Whether among the coral-girt isles of the South Pacific, when they were yet in great part free from the "beach-comber," or on the prairies of the "wild west," at a time when the bison were still to be numbered by hundreds, if not by thousands, his descriptions of scenery and animals are life-like pictures.

The greater part of the account of the author's travels is given in the memoir by his daughter, which occupies more than a third of the whole volume, and is, in great measure, in the form of letters or of extracts from the same. And here we take the opportunity of expressing our sense of the excellent manner in which Miss Kingsley—herself a traveller and writer of world-wide repute—has discharged what must evidently have been a task of no ordinary difficulty.

Kingsley (in company with the late Lord Pembroke) visited the South Seas in the late "sixties"—a time when yachting in those latitudes had not come into vogue; and such descriptions as he has left of the natives and natural products only make us regret that they were not fuller. Fish seem especially to have attracted his attention; but when he states that he disbelieves the story of a *Chaetodon*[1] shooting water at a fly, the editor should have added that the only fish which performs this feat is a species of *Toxotes*, whose southern range only extends to North Australia, so that it could not have come under the ken of the author.

The travels in Canada and the United States were undertaken in company with Lord Dunraven, between 1870 and 1875; parts of them being described by the latter in "The Great Divide."

Of the various collected papers of Dr. Kingsley, perhaps the most interesting to the naturalist is the one entitled "Among the Sharks and Whales." Here the author graphically describes, as an eye-witness, certain encounters between the larger Cetaceans and smaller members of the same order, together, perhaps, with other denizens of the deep. We are told, for instance, how some of these creatures, of thirty feet or so in length, were seen to leap clean out of the water, and then to fall with a sounding "smack" that could be heard half a mile off. But whether the creatures in question were attacking a whale, or leaping for mere fun, the author was unable to determine. Neither could he say definitely whether or no they were "killers." And he seems, indeed, to be somewhat confused between "killers" and "threshers"; although, as to the sharks commonly called by the latter name, he denies that they ever attack whales, adding that he has never even known a shark of any kind throw itself out of the water. R. L.

OUR BOOK SHELF.

Irrigation and Drainage, Principles and Practice of their Cultural Phases. By F. H. King, Professor of Agricultural Physics in the University of Wisconsin, author of "The Soil." The Rural Science Series. Pp. xxi + 502. (New York: The Macmillan Company. London: Macmillan and Co., Ltd., 1899.)

THE object of this book, as stated in its preface, is "to present, in a broad yet specific way, the fundamental principles which underlie the methods of culture by irrigation and drainage," and we may say that we consider the author successfully does this.

The introductory chapter treats of the importance of water in cultivation, and in it a number of interesting experiments on the amount of water absorbed by cereals and other plants, and the weight of dry matter produced are described, from which it appears that with cereals the amount of water used varies from about 300 to 500 lbs. per pound of dry matter produced. The general result of these experiments is considered to show "that well-drained lands in Wisconsin, and in other countries having similar climatic conditions, are not supplied naturally with as much water during the growing season as most crops are capable of utilising, and hence that all methods of tillage which are wasteful of soil moisture detract by so much from the yield per acre."

[1] The editor avows a difficulty in deciphering some of the MS. which came into her hands, and therefore suggests the possibility of a certain amount of mis-spelling. Some naturalist friend would, however, doubtless have corrected the following errors, viz.:—P. 61, *Chetadons* for *Chaetodons*; p. 222, *Haroldus* for *Harelda*; p. 414, *Megaptera australis* for *Balaena australis*; p. 421, *Ovules* and *Mutras* for *Olives* and *Mitras*; and p. 424, *Orcus* for *Orca*.

Similar experiments have been made with other crops, as, for instance, potatoes, and the importance of such experiments is, as stated further on in the book, "because only such knowledge as this can show how economical or how wasteful our methods of tillage may be, and how nearly we are realising the largest profits which are possible to the business."

The conditions of rainfall under which irrigation is practised in different parts of the world are discussed, and the means of "conserving the moisture of the subsoil" by proper tillage pointed out. An excellent account is given of the depth of root penetration in the soil, which is illustrated, as is the rest of the book, by some very good and instructive engravings. A short account is given of sewage irrigation; and the idea that the milk of cows fed on sewage produce is in any way detrimental is disposed of by quotations from Sir Henry Littlejohn, and from Mr. Spier, the Scottish Dairy Commissioner. Methods of diverting streams for irrigation are carefully described and fully illustrated, as also are the methods of applying the water to the ground. In Part ii. (a small portion at the end of the book) the necessity for soil drainage is insisted on, and the methods of carrying it out are described.

The book altogether is very readable, although the spelling of some of the words seems curious to an English reader. It is also well printed, and the only misprint noticed is on p. 403, where the word "denitrification" is used instead of "nitrification." W. H. C.

The Refraction of the Eye, including a Complete Treatise on Ophthalmometry. A Clinical Text-book for Students and Practitioners. By A. Edward Davis, A.M., M.D. Pp. 431. (New York: The Macmillan Co., 1900.)

THIS volume should prove a valuable addition to the library of the ophthalmic surgeon, for though several books on retinoscopy have been published, this is the only work on ophthalmometry yet written in English.

It comprises a description of Javal and Schiötz's modification of Helmholtz's ophthalmometer, together with full instructions in the use of the instrument; the necessity of forming a clear mental picture of the state of the eye from the results of an experiment being rightly insisted upon.

One hundred and fifty illustrative cases are included in the text, and a comprehensive index has been appended, so that the student can readily find a parallel to any case which may give him trouble. One hundred and nineteen diagrams, including a clear and well-drawn woodcut of the ophthalmometer of Javal and Schiötz, are distributed throughout the text.

Although the advantages which may be gained by the use of the ophthalmometer are insisted upon, the author has taken great pains to indicate the limitations of its usefulness. By its aid we may determine with accuracy the radii of curvature of the cornea in various meridians; but the author endorses the generally accepted opinion that there is no definite relation between the curvature of the cornea and the refractive condition of the eye, as far as hypermetropia or myopia are concerned. Myopia usually depends upon an elongation, and hypermetropia upon a shortening of the axis of vision. Strangely enough, in cases of extreme myopia, a somewhat flattened cornea is generally met with. Nevertheless, in cases of simple hypermetropia and myopia, the ophthalmometer eliminates the question of corneal astigmatism. The routine of examination followed by the author is (1) use the ophthalmometer; (2) use trial lenses and test cards; (3) use the ophthalmoscope; (4) if after two tests on different days the result is still unsatisfactory, employ a mydriatic and use the retinoscope in addition to the other tests. It is stated that (1) to (3) suffice for 99 per cent. of uncomplicated cases.

In the use of test glasses, it is recommended that a series of positive lenses, gradually increasing in power, should first be employed. By this means spasmodic accommodation is avoided. The fact that the use of atropine can so often be dispensed with is of great importance, since many men might hesitate to have their eyes examined if this necessitated a temporary cessation of their business duties.

A number of instructive cases are included, showing the serious results which may follow on the prescription of unsuitable glasses for a patient. Not only severe pain and inability to use the eyes for any length of time, but even personal disfigurement may be produced. Thus a case is recorded (p. 307) of a patient whose eyes were being forced into a divergent squint by the use of prismatic glasses. After a careful examination, the prisms were discarded and suitable lenses were ordered, with the result that, after two weeks, complete comfort and the possibility of working with satisfaction were enjoyed for the first time for many years.

Altogether this book gives us a good idea of the vast advantages to the human race which have resulted from the optical researches of Helmholtz, culminating in the invention of the ophthalmometer and the ophthalmoscope.

E. E.

A Key to the Birds of Australia and Tasmania, with their Geographical Distribution in Australia. By R. Hall. Pp. xii + 116; plate and map. (Melbourne: Mullen and Slade; London: Dulau and Co., 1899.)

WERE it nothing more than a synopsis of Australian birds, with just sufficient in the way of description to enable the different species to be easily recognised, this well-printed little "Key" would be to a great extent of merely local interest. But since the author has very wisely made geographical distribution its leading feature, the work appeals to a much wider circle of students than would otherwise have been the case.

In his Report on the Zoology of the Horn Expedition, Prof. Baldwin Spencer recently divided Australia into three zoological sub-regions; namely, (1) the Torresian, embracing the northern and eastern districts as far as South Queensland; (2) the Barsian, comprising eastern New South Wales, Victoria and Tasmania; and (3) the Eyrean, including the remainder of the mainland. These sub-regions are further split up into "areas," and the fact that bird-distribution accords with such a parcelling-out of the continent from other lines of evidence affords important testimony in support of Prof. Spencer's views. It is noteworthy that the South Queensland area forms the headquarters of the Australian Passeres, a fact for which there must surely be some adequate physical reason, if only it could be discovered. The total number of species recorded is 767, among which the black emu is believed to be extinct; and, so far as we have been able to verify them, the diagnoses of the various groups and species seem well adapted to their purpose. The work appears singularly free from errors and misprints, and ought to be in the hands of every Australian bird-lover. R. L.

Pages Choisies des Savants Modernes. By A. Rebière. Pp. viii + 620. (Paris: Nony et Cie, 1900.)

THIS is a series of extracts (translated into French when not written in that language) from the works of eminent men of science. It appeals mainly to the general reader, and the best that can be hoped of it is that it may induce some members of this class to study the works of one or other man of science seriously. A scientific writer does not appear to the best advantage in "tit-bits" selected from his works; and, except as a possible stimulus, the value of such a miscellany as this cannot be reckoned very high. The portraits, of which there is a considerable number, will probably be found, by scientific readers, the most interesting feature of M. Rebière's compilation.

Les Vieux Arbres de La Normandie. By Henri Gadeau de Kerville. Fasc. iv. Pp. 219 + 352. (Paris: J. B. Baillière et fils, 1899.)

THIS instalment of M. de Kerville's careful monograph contains twenty views of trees from photographs by the author, accompanied by detailed descriptions and historical notes. The work is well and conscientiously done, whilst the illustrations are well selected and admirably reproduced in collotype. The trees here shown include ten oaks, six yews, two beeches, a lime and a poplar. As the photographs of the deciduous trees have been taken in very early spring, before the opening of the buds, their ramification and general architecture are shown to the greatest advantage. With this volume, *à propos* of a notable oak-tree growing at Isigny-le-Buat, the author includes an interesting account of recorded cases of mistletoe upon oaks in Normandy. He is able to produce evidence in support of some twenty-seven recorded instances. The book will appeal to all tree-lovers; may it stimulate some to similar studies. We remember to have seen something of the kind for Northumberland nearly thirty years ago in the *Transactions* of the Tyneside Naturalists' Field Club.

LETTERS TO THE EDITOR.

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

The Nature of the Solar Corona.

I SEE in the recenty-published number of *Science Abstracts*, No. 802, that there is every reason to think that the corona line is not represented by any dark line in the solar spectrum. I write to call attention to the way this confirms the suggestion that the corona is an aurora round the sun. In the March number of the *Annalen der Physik* for this year, p. 462, Herr Cantor describes experiments from which he concludes that there is no absorption corresponding to the emission of light by a gas which is caused to radiate by an electric discharge. He makes certain deductions as to the temperature of the gas which emphasise the difficulty of defining "temperature" in the case of a non-steady state; but, whatever is to be deduced from his observation, it certainly lends weight to the suggestion that the corona is due to an emission of a similar character to that of a gas transmitting an electric discharge.

April 30. GEO. FRAS. FITZGERALD.

Rock-structures in the Isle of Man and in South Tyrol.

MR. LAMPLUGH's recent paper referred to in his letter in NATURE of April 26 (p. 612) is devoted to an elucidation of the "relations of the Carboniferous limestone to the Carboniferous volcanic rocks" in the Isle of Man (*Q.J.G.S.* 1900, p. 11). From Mr. Lamplugh's description, these relations are very similar to the relations which I described as subsisting between the Mid-Triassic dolomitic limestone ("Mendola Dolomite") and the tufaceous "Wengen" beds of Enneberg. The "Buchenstein Agglomerate" of Enneberg, which I mentioned in my letter (NATURE, March 22), had been described in geological literature as a "Middle Triassic agglomerate" of local occurrence above "Mendola Dolomite," in the neighbourhood of eruptive outbursts of that age. My map and sections showed that the agglomerate had a limited occurrence in fault-zones and overthrust-planes where differential movement had taken place between the harder, more resisting "Mendola Dolomite" and the yielding, mixed "Wengen" series "comprising dust-tuffs and lavas, as well as fossiliferous shales and shaly limestones." I therefore explained the so-called "Triassic" agglomerate as a subsequent structure, of the nature of a shear-breccia, produced by the earth-movements of the later Alpine upheaval (*Q.J.G.S.* 1899, pp. 567, 584, Figs. 1, 4, 9, 10).

Mr. Lamplugh describes in the Carboniferous series of the Isle of Man rock-structures of brecciated limestone, tuffs with contained strips of limestone, and coarse agglomerate which had previously been referred to the effects of Carboniferous eruptive action. Mr. Lamplugh's explanation is that the various complexities in the structure of these rocks "have not been caused by the volcanic outburst, but have been brought about at a later date by the differential movement of segments of the eruptive rocks upon their original floor of limestone" (*Q.J.G.S.* pp. 15, 19, Figs. 3, 4). The parallelism between the two cases is self-evident. In 1894, I had explained on precisely the same principle of subsequent differential movement, the occurrence of certain anomalous phenomena at the *upper* limit of the Wengen-Cassian series in Enneberg, *i.e.* the limit of this plastic and compressible series against the higher horizon of Triassic calcareo-dolomitic rock, termed "Schlern Dolomite" ("Coral in the Dolomites," *Geol. Mag.* 1894, p. 55).

The parallelism in the general sequence of events in the Isle of Man and in South Tyrol is as follows:—

Isle of Man.	*Enneberg.*
Pre-Carboniferous Movement.	Pre-Triassic Movement.
Lower Carboniferous Deposition.	Triassic Deposition.
Subsequent Movement.	Subsequent Movement.

The crust-movement immediately antecedent to Triassic deposition in South Tyrol was that which accomplished the upheaval of the Permian Alps, post-Triassic crust-movement culminated in the upheaval of the present Alps (aut. *Q.J.G.S.* 1899, p. 628, and NATURE, Sept. 7, 1899, pp. 445-6).

The farther issues of my paper in showing how differential movements twist the rocks by taking place in cross-directions were not touched in my letter of March 22, for the reason that Mr. Lamplugh did not in his paper enter into the torsional results of differential movements. But, as I have elsewhere expressed, rock-torsion or "warping" goes on all the time in crust-folding, and clearly, where from any cause whatsoever there is the greatest complexity in the differential movements, there will be the greatest complexity in the torsional phenomena.

MARIA M. OGILVIE GORDON.

POMPEII AND ITS REMAINS.[1]

THE city of Pompeii is one which will ever maintain a hold upon the imagination of cultured man, as much for what it represented in the history of civilisation, as for being the victim of one of the most awful visitations of the powers of nature which have ever befallen the abiding place of a great society of men. It is not the place here to descant upon the wealth and luxury of its

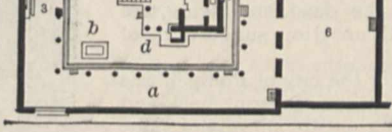


FIG. 1.—Plan of the Temple of Isis.

1, Portico; 2, cella; 3, shrine of Harpocrates; 4, purgatorium; 5, hall of initiation; 6, hall of mysteries; 7, 8, 9, abodes of priests; *a*, colonnade; *b*, refuse pit; *c*, niche for statue of Bacchus; *d d*, niches; *e*, large altar.

inhabitants, on the bright and reckless lives which they led, on the splendour of its buildings, or even the fancied security wherein men and women lulled themselves, notwithstanding the violent shock of earthquake which shook the city to its very foundations on February 5, A.D. 63, for all these things are the commonplaces of history; but we are concerned with the remains left by the awful catastrophe which took place on August 24,

[1] "Pompeii, its Life and Art." By August Mau. Translated by F. W. Kelsey. Pp. xxii + 509. (New York: The Macmillan Co., 1899.)

A.D. 79, and buried the cities of Herculaneum and Pompeii in a layer of mingled mud, lava, pumice stone, dust and wet ashes. In less than thirty-six hours Vesuvius had completely blotted out these towns and had covered the ground around for miles with pumice stones, barely as large as walnuts, to the depth of ten feet. Of the twenty thousand people who are estimated to have been in Pompeii when destruction came upon the doomed country, about two thousand perished, the rest saved themselves by flight; but fortunately for the people of our own time they were compelled to leave behind them most of the things which describe to the student and antiquary the manner of their lives, and reveal the high standard in luxury and artistic civilisation to which they had attained. The blow fell so suddenly, and the overwhelming of the city was so swiftly and effectively performed, that men and animals had no time to die in the usual manner, and the ashes which caked round them have preserved forms and scenes which, though belonging to the dead and dying, are replete with unerring suggestions of life.

FIG. 2.—View of the Temple of Isis.

Soon after the city of Pompeii was buried, the survivors came back and began to dig out the objects of value belonging either to themselves or their friends which they knew to be in the houses. As the upper parts of many of the houses still stood above the pumice stone and ashes, they were able to locate them in many instances with convenient accuracy, and as a result there remained in Pompeii, when the searchers had finished work, but few houses which had not been partly or wholly explored. Anything like a systematic search, however, was never made, and the excavators worked most in the places which seemed to promise the best results. Among others, the builders' labourers made themselves very busy, for the costly stones and marble used in the construction of porticos, vestibules and baths, not to mention the pillars, were eagerly sought after for the building of new villas and houses. When such human vultures had battened on the remains of the town, they left what they could not, or would not, carry away to decay and desolation. For fifteen hundred years, Pompeii and its dead slept in peace, and certain pious folk comforted themselves with the view that its inhabitants, like those of the Cities of the Plain, richly deserved their punishment. About A.D. 1600, D. Fontana, who was occupied in bringing water from the Sarno to Torre Annunziata, cut a conduit through a part of the site of Pompeii, and two inscriptions were found in the course of the work. In 1719, Count Elbeuf's workmen sank a shaft on the site of Herculaneum, and reached a level corresponding with the stage of the theatre. In 1754, a number of tombs at Pompeii were discovered by the road-makers who were working to the south of the city, but no systematic attempt to leave what had been excavated uncovered and visible to all was made until 1763, when the discovery of the inscription of Suedius Clemens definitely proved that the site was that of Pompeii. A year later, the theatres, the Street of Tombs, and the villa of Diomedes were uncovered, and general interest in the work was at last awakened. Between 1806 and 1815, under Joseph Napoleon and Murat, the Herculaneum Gate and Forum were excavated; and between 1825 and 1848, a large number of beautiful houses were cleared out and made accessible to the curious and the learned. Up to this period, the work of excavation, though carried on with skill and zeal, was exceedingly unscientific; indeed, judged by the canons of the excavator of to-day, it would be pronounced to possess no system at all. In 1860, however, explorations and

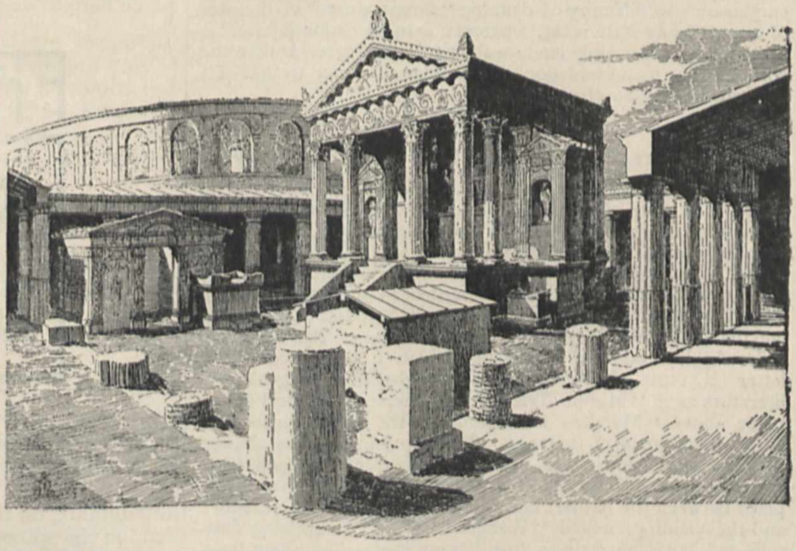


FIG. 3.—The Temple of Isis restored.

excavations on the site of Pompeii were entrusted to the hands of G. Fiorelli, and most of the excellent results which have attended the excavations made during the last forty years are due to the plan inaugurated by him. At the present time, about one-half of the site of Pompeii has been excavated, and, according to the calculations which he made as far back as 1872, the work of clearing the undisturbed parts in the western half of the ancient city, and the whole of the eastern half, will not be completed much before the year 2000. The above facts will enable the reader to grasp the magnitude of the undertaking, and to appreciate the help which is forthcoming from Prof. Mau's exhaustive work, of which we must now speak briefly.

It is well known that Prof. Mau has for more than a score of years devoted all his winters to the study of the antiquities of Pompeii, and there is little doubt that he is *facile princeps* among the experts in this special branch of Roman archæology. His articles and papers in the scientific periodicals have secured for him a high position among savants, even in his own country, and his "Mittheilungen" are at once the product of good scholarship and enthusiasm. The volume before us is not a mere translation of one previously issued, but is to all intents and purposes a new work, now published for the first time in English. Mr. Kelsey, who is responsible for the English work bearing Prof. Mau's name, is more than the translator, for he has abridged the German manuscript which he had to work from in many places, and a number of additions to the text are due to him. He has done his part of the work faithfully, and the English visitor to Pompeii has now available in his own tongue a volume in which lucidity of treatment goes hand in hand with erudition and scholarship. The English text is accompanied by twelve plates, six plans, and two hundred and sixty-three cuts, which are inserted as near as possible to the subject-matter illustrated by them. We have only one fault to find with the book—it is a little heavy to carry about. Thus having said our worst, we proceed to describe very briefly its contents. The six first chapters really form the introduction, which they are actually called, and they treat of the early history and general situation of Pompeii, the overwhelming of the city, and the excavations undertaken during the last hundred and fifty years. The last chapter of the section on building materials and architectural periods is particularly instructive, and will be read by more than the tourist. Part i. contains twenty-five chapters, which deal exhaustively with the public buildings and places of Pompeii, including the Forum, the Basilica, the Comitium, the theatres, the temples of Jupiter, Apollo, Zeus Milichius, and, strangest of all, the temple of the Egyptian goddess Isis. It will be remembered that the Ptolemies, by the help of Manetho, an Egyptian priest, and of Timotheus, a man who had peculiarly perfect knowledge of the Eleusinian Mysteries, associated certain Egyptian religious ceremonies with those of the Mysteries, in the hope of binding his Greek and Egyptian slaves together in the bonds of a common form of worship. The new cult, though it was abominated by the philosophers, was very popular, and it spread from Alexandria by way of the Delta into Syria, and from the same centre to Rome. As a result, we find that a college of priests of Isis, or Pastophori, was founded at Rome in the time of Sulla, about B.C. 80. The Romans objected to the introduction of the Egyptian gods, and three times in the space of eleven years was their temple destroyed. Oddly enough, a temple in honour of Osiris and Isis was built in Rome about B.C. 44, and before the end of the century their festival was recognised by the public calendar. But other cities of Italy were more tolerant than Rome, for a temple in honour of Serapis was standing at Puteoli B.C. 105, and not long after this date the temple to Isis was built at Pompeii. In the earthquake which took place A.D. 63 this temple suffered greatly, but it was rebuilt by Numerius Popidius Celsinus at his own expense "from the foundation." From the view given by Prof. Mau on p. 166, we see enough to show us that although the building bore slight resemblance to an Egyptian temple, there was, notwithstanding, a wish on the part of the architect to produce an unwonted effect on the mind of the beholder. The deities Osiris, Isis, Anubis and Harpocrates were represented by statues, and as they have never been found, it is probable they were carried off by the faithful on that awful day in August, A.D. 79. We know little of the ceremonies connected with the initiation into the Mysteries, but two skulls, a marble hand, two small boxes, a gold cup, a small glass vessel, and a statuette of the god nearly one inch in height seem to have played a prominent part in them. We have not space to follow Prof. Mau through his description of all the various parts of this interesting temple, but we may note that the existence of the hieroglyphic sepulchral inscription, set up for the scribe Hat on a pillar to the right of the altar, indicates the adoption in Pompeii of a widespread Egyptian custom. The

FIG. 4.—The adoration of the holy water of the Nile during the worship of Isis.

worship of Isis attracted large numbers to her temple, and the principal services took place before daybreak. The curtains were drawn aside and the statue of the goddess was presented to her worshippers, who straightway prayed to her; an hour after sunrise a hymn was sung to the rising sun, typified by Harpocrates, and the service was over. The second service of the day was held two hours after noon, and it seems to have consisted in the adoration of water in a vessel which was supposed to have been taken from the Nile. Whatever the details may have been, the services certainly had reference to scenes connected with the finding of the dead body of Osiris by his wife Isis, and they were intended to urge the beholder to renounce the present life and to prepare for a second birth into a purified and beatified state ot existence in a new world. The temple of Isis at Pompeii is a remarkable relic of the adoption of a remarkable religion by the Romans, and we hope that Prof. Mau will add any new facts which he may glean from subsequent researches to the future editions of his work. The second part of Prof. Mau's volume deals with the houses of Pompeii, and it seems to us to be the best in the book, for it recalls the scenes and occurrences in the daily household life of the Pompeians in a most realistic fashion. The mind's eye has so many facts supplied to it with such lucid explanations that a street of houses appears before it without fatigue, and as the result of but little effort. Parts iii.–vi. deal with trades and occupations, the tombs, Pompeian art and inscriptions; the chapters of these sections are written in the same easy style, but at the same time the reader feels that he is being led along an interesting path by the hand of a master of his craft.

THE UNVEILING OF THE HUXLEY MEMORIAL STATUE.

THE statue, by Mr. Onslow Ford, R.A., of the late Right Hon. Thomas Henry Huxley, now placed in the first right-hand recess of the Great Hall of the Natural History Museum, was unveiled by H.R.H. the Prince of Wales on Saturday last, April 28, the ceremony being performed, by his Royal Highness's desire, immediately after the meeting of the Trustees appointed for that day.

Seating accommodation had been provided for the Huxley family, the Trustees of the British Museum, the members of the Memorial Committee, and other distinguished guests and chief subscribers to the Memorial Fund, in front of the statue; and a still greater number of persons, most of whom were subscribers also, assembled in the corridors overlooking the Great Hall, and on the staircases.

There were from 700 to 800 persons present, adequately representative of all branches of science, art, law, music, and politics, and of several foreign nations. The following is a classified list of the persons more directly concerned in the ceremony:—

Trustees of the British Museum.

H.R.H. the Prince of Wales.
Earl of Elgin, K.G.
Earl of Hopetoun.
Viscount Cross.
The Bishop of Winchester.
The Lord Walsingham.
The Right Hon. Sir George Trevelyan, Bart.
The Right Hon. John Morley, M.P.
Sir Nathaniel Lindley, Master of the Rolis.
Dr. W. S. Church, President of the Royal College of Physicians.
The Rev. F. H. Annesley.
Mr. Cavendish-Bentinck.
The Duke of Devonshire, K.G.
Lord Russell of Killowen.
Lord Avebury.
Viscount Peel.
Viscount Dillon.
Sir John Evans, K.C.B.
Sir Richard Webster.

Executive Committee of the Memorial Fund and others.

Lord Shand (Chairman).
Sir Joseph Fayrer, Bart., K.C.S.I., F.R.S.
Sir Henry Thompson, Bart.
Sir Joseph Hooker, G.C.S.I., C.B., F.R.S.
Sir John Donnelly, K.C.B.
Sir Norman Lockyer, K.C.B., F.R.S.
Sir Michael Foster, K.C.B., M.P., F.R.S.
Sir Spencer Walpole, K.C.B.
Sir A. Geikie, F.R.S.
Mr. Briton Riviere, R.A.
Dr. P. L. Sclater, F.R.S.
Prof. G. B. Howes, F.R.S. (Hon. Secretary).
Mrs. Huxley and members of the Huxley family, to the number of thirty-two.
Sir E. Maunde Thompson and Officers of the British Museum, Bloomsbury.
Prof. E. Ray Lankester, the Director, and the Officers of the British Museum (Natural History).

Among other persons who were seated in the central enclosure were the following:—

Sir F. Abel, Bart., F.R.S.
Prof. T. Clifford Allbutt, M.D., F.R.S.
Sir L. Alma-Tadema, R.A.
Sir Edwin Arnold, K.C.I.E., C.S.I.
The Attorney-General.
Mr. Alfred Austin.
Sir Squire Bancroft.
Hon. Edmund Barton, Q.C.
Prof. Bastian, F.R.S.
Sir Lowthian Bell, Bart., F.R.S.
Mr. Horace Brown, F.R.S.
Sir T. Lauder Brunton, M.D., F.R.S.
Rt. Hon. L. Courtney, M.P.
Sir Wm. Crookes, K.C.B., F.R.S.
Mr. Francis Darwin, F.R.S.
The Earl of Ducie, F.R.S.
Sir W. Thiselton-Dyer, K.C.M.G., F.R.S.
Mr. R. Etheridge, F.R.S.
Prof. J. B. Farmer, M.A.
Lady Flower.
Prof. Le Neve Foster, F.R.S.
Dr. R. Garnett, C.B.
Dr. J. H. Gladstone, F.R.S.
Lieut.-Col. Godwin-Austen, F.R.S.
Dr. A. Günther, F.R.S.
Mr. G. Henschel.
Lord Hobhouse, K.C.S.I., C.I.E.
Prof. Victor Horsley, F.R.S.
Prof. J. W. Judd, C.B., F.R.S.
Right Hon. W. E. H. Lecky, M.P.
Sir Hugh Low, G.C.M.G.
Dr. P. Manson.
Dr. Ludwig Mond, F.R.S.
Prof. R. Meldola, F.R.S.
Sir Francis Mowatt, K.C.B.
Sir Andrew Noble, K.C.B., F.R.S.
Admiral Sir Erasmus Ommanney, Bart., C.B., F.R.S.
Prof. J. Perry, F.R.S.
Sir W. C. Roberts-Austen, K.C.B., F.R.S.
Sir Henry Roscoe, F.R.S.
Prof. A. W. Rücker, F.R.S.
Sir J. S. Burdon-Sanderson, Bart., F.R.S.
Dr. D. H. Scott, F.R.S.
Sir G. G. Stokes, Bart., F.R.S.
Prof. G. Johnstone Stoney, F.R.S.
Mr. J. J. H. Teall, F.R.S.
Prof. T. E. Thorpe, F.R.S.
Prof. W. A. Tilden, F.R.S.
Rev. Canon Tristram, F.R.S.
Sir William Turner, F.R.S.
Prof. W. F. R. Weldon, F.R.S.

Foreign nationalities were represented by:—

Dr. F. P. Moreno (of the Argentine Republic).
Major Dr. von Wissmann Germany).
Mons. L. Geoffray (France).
Mons. F. Fuchs (Congo Free State).
Prof. Batalha Reis (Portugal).
Prof. G. Paladino (of Naples).
Prof. G. Gilson (of Louvain).
Señor Don Pedro Jovar y Tovar (Spain).
Count Bottaro Costa (Italy).
Plenipotentiaries at the International Conference for the preservation of wild animals in Africa.

Punctually at the time appointed (1.15 p.m.), his Royal Highness took up a position to the spectators' left of the statue, supported by the Standing Committee of the Trustees of the Museum, with Sir Maunde Thompson and Prof. Ray Lankester; while Sir Joseph Hooker, similarly supported by the members of the Executive of the Memorial Committee, stood on the right; the sculptor, Mr. Onslow Ford, being in proximity to the statue.

The proceedings were opened by Prof. Ray Lankester, with the following introductory statement:—

YOUR ROYAL HIGHNESS, MY LORDS, LADIES AND GENTLEMEN,—The duty of briefly explaining the nature of the present proceedings has devolved upon me. I feel it to be a great privilege to discharge this duty on the occasion designed to do honour to my venerated master, Prof. Huxley. This celebration would have been no less dear to Huxley's fellow-worker and friend, the late director of this museum, Sir William Flower, who unhappily is no longer with us to witness the completion of the memorial statue which he, especially, desired to see placed in this hall.

A few months after Prof. Huxley's death in 1895, a committee was formed for the purpose of establishing a memorial of the great naturalist and teacher. At a meeting of that committee, held on November 27, 1895, at which 250 members were present, and at which his Grace the Duke of Devonshire presided, the following resolution was carried :—

> "That the memorial do take the form of a statue, to be placed in the Museum of Natural History, and a medal in connection with the Royal College of Science; and that the surplus be devoted to the furtherance of biological science in some manner to be hereafter determined by the committee, dependent upon the amount collected."

From all parts of the world, besides our own country, from every State of Europe, from India and the remotest Colonies, and from the United States of America, subscriptions have been received for the Huxley memorial, amounting in all to more than 3380*l*.

Three years ago the committee commissioned and obtained the execution of a medal bearing the portrait of Huxley, and has established its presentation as a distinguished reward in the Royal College of Science. The re-publication of the complete series of Huxley's scientific memoirs, which was proposed as one of the memorials to be carried out by the committee, has been undertaken by Messrs. Macmillan, without assistance from the committee. I am glad to be able to state that two large volumes of these richly illustrated contributions to science have been already published.

Whilst these other memorials were in progress under the auspices of the executive committee, they secured the services of Mr. Onslow Ford, R.A., to execute the statue which it had been decided by the general committee to regard as the chief object of the subscriptions entrusted to them. On the completion of the statue, the trustees of the British Museum agreed to receive it and to place it in the great hall where we are now assembled.

On behalf of the vast body of subscribers to the memorial, Sir Joseph Hooker, Huxley's oldest and closest friend, himself the survivor of that distinguished group of naturalists, including Charles Lyell, Richard Owen and Charles Darwin, who shed so much lustre on English science in the Victorian age, will hand over the statue of Huxley to the trustees of the British Museum. Your Royal Highness has been graciously pleased, as one of the trustees, to represent them on the present occasion, and to receive the statue on their behalf. The memorial statue of Huxley is the expression of the admiration, not only of the English people, but of the whole civilised world, for one who as discoverer, teacher, writer and man, must be reckoned among the greatest figures in the records of our age.

Sir Joseph Hooker then stepped forward from among the committee, and presented the statue in the following words :—

MAY IT PLEASE YOUR ROYAL HIGHNESS,—I have the honour of being deputed, by the subscribers to the statue of my friend the late Prof. Huxley, to offer it to your Royal Highness, on behalf of the trustees of the British Museum, with the intent that it should be retained in this noble hall as a companion to the statues of Prof. Huxley's distinguished predecessors, Sir Joseph Banks, Mr. Darwin and Sir Richard Owen. It would be a work of supererogation, even were I competent to do so, to dwell upon Prof. Huxley's claims to so great an honour, whether as a profound scientific investigator of the first rank, as a teacher, or as a public servant; but I may be allowed to indicate a parallelism between his career and those of two of the eminent naturalists to whom I have alluded, which appears to me to afford an additional argument in favour of retaining his statue in proximity to theirs. Sir Joseph Banks, Mr. Darwin and Prof. Huxley all entered upon their effective scientific careers by embarking on voyages of circumnavigation for the purpose of discovery and research under the flag of the Royal Navy. Sir Joseph Banks and Prof. Huxley were both Presidents of the Royal Society, were both trustees of the British Museum; and, what is more notable by far, so highly were their scientific services estimated by the Crown and their country, that they both attained to the rare honour of being called to seats in the Privy Councils of their respective Sovereigns.

With these few words I would ask your Royal Highness graciously to accede to the prayer of the subscribers to this statue, and receive it on behalf of the trustees of the British Museum.

He was followed by Sir Michael Foster, who pronounced the following *éloge* on Huxley's work and influence :—

MAY IT PLEASE YOUR ROYAL HIGHNESS,—Before you unveil this statue it is my duty and privilege to add a few words to those which have just been spoken by the beloved Nestor of biological science. Sir Joseph D. Hooker, born before Huxley was born, a sworn comrade of his in the battle of science, standing by him and helping him like a brother all through his strenuous life, may perhaps be allowed to shrink from saying what he thinks of the great work which Huxley did.

We of the younger generations, Huxley's children in science, who know full well that anything we may have been able to do springs from what he did for us, cannot on this great occasion be wholly silent.

Some of us have at times thought that Huxley gave up for mankind much which was meant for the narrower sphere of science; but if science may seem to have been thereby the loser, mankind was certainly the gainer; and indeed it was a gain to science itself to be taught that her interests were not hers alone, and that not by one tie or by two, but by many was her welfare bound up with the common good of all.

To many perhaps the great man whose memory we are here met to honour was known chiefly as the brilliant expositor of the far-reaching views of that other great man who through his statue is now looking down upon us. Your Royal Highness is doubtless at this moment thinking of that interesting occasion, fifteen years ago, when you unveiled that statue of Darwin, and you are calling to mind the weighty words then spoken by him whose own statue brings us here to-day.

Huxley it is true fought for Darwin, and indeed "he was ever a fighter." But he fought not that Darwin might prevail; he fought for this alone—that the views which Darwin had brought forward might be examined solely by the clear light of truth, untroubled by the passion of party or by the prejudice of preconceived opinion. As he never claimed for those views the infallibility of a new gospel, so he always demanded that they should not be peremptorily set aside as already proved to be wrong.

Huxley worked for his fellow men in many ways other than the way of quiet scientific research. Had we not known this we should have thought that his whole life had been given up to original scientific investigation, so much has the progress of biologic science, since he put his hand to it, been due to his labours. On the sands of many a track of biologic inquiry he has left his footprint, and his footprint has ever been to those coming after him a token to press on with courage and with hope. The truths with which he enriched science are made known in his written works; but that is a part only of what he did for science. No younger man, coming to him for help and guidance, ever went empty away; and we all—anatomists, zoologists, geologists, physiologists, botanists, and anthropologists—came to him. The biologists of to-day, all of us, not of this country alone, but of the whole world of science, forming, as it were, a scattered fleeting monument of this great man, are proud at the unveiling of this visible lasting statue here.

In conclusion, Sir M. Foster, facing the Prince, added the words :—May I crave your Royal Highness's permission to seize this opportunity to assure you incidentally, but none the less from the bottom of our hearts, on the part of men of science that we, in common with all Her Majesty's subjects, are rejoicing that you escaped the dreadful peril to which a few days back you were exposed, and to express to you our continued esteem and respect?

On Sir M. Foster's return to his seat among the committee, the Duke of Devonshire, speaking from in front of the veiled statue, said he had the honour nearly five years ago of presiding over the committee formed for the purpose of establishing a memorial to Prof. Huxley. He had now to report to his Royal Highness that the labours of that committee had terminated, and to say that the committee desired to present the statue to his Royal Highness on behalf of the trustees of the British Museum. They felt, however, that the real memorial to the deceased man of science was to be found in the writings which had already been referred to, and still more in the scientific work he accomplished or helped to promote, and in the influence he exercised and was still exercising upon the minds of younger men, many of whom they trusted might at some future time emulate his distinguished example. On behalf the committee he begged to tender his Royal Highness their thanks for having come to give a final sanction to their proceedings, and for having undertaken the duty of unveiling the statue that day.

The Prince of Wales then withdrew the covering from the statue, and brought the proceedings to a close with the following words:—

MY LORDS, LADIES AND GENTLEMEN,—I consider it a very high compliment to have been asked by the Huxley Memorial Committee to unveil and receive this statue, and to do so in the name of the trustees of the British Museum, of whom I have the honour to be one. I have not forgotten that fifteen years ago I performed a similar duty in connection with the fine statue of the celebrated Charles Darwin, which is at the top of the stairs, when it was similarly handed over to the British Museum. We have heard to-day most eloquent and interesting speeches with reference to that illustrious man of science and the great thinker, the late Prof. Huxley. It would, therefore, be both superfluous of me, I may even say unbecoming in me, to sound his praises here in the presence of so many men of science, who know more about all his work than I do. I can only, on my own behalf, endorse everything that has fallen from the lips of those gentlemen who have spoken, and I beg to repeat the expression of the great pleasure it has given me for the second time to have performed the interesting ceremony of taking over the statue of another great and illustrious man of science.

The statue is a colossal seated one of white marble, the figure being represented in a doctor's gown, with the right hand clasping one arm of the chair, and the left lying across the other with the fist clenched. The pedestal is of Verona marble on a black base, and bears upon its face the name and dates of birth and death in simple bronze letters.

The statue is a thoroughly successful work of art, and stands out in bold relief to the dim mystery of the recess in which it is placed. Though the expression of the face is perhaps a little severe, the features are true to nature; and when it is considered that the artist was never privileged with a sitting in life, and that the only material available to him were the death mask and an assemblage of none too favourable photographs, it must be admitted he has done well. Great praise must be given to the modelling of the hands, in which those who knew the great philosopher intimately will recognise a faithful portrayal of well-defined characteristics.

The first and main object of the Memorial has thus been successfully achieved. As for those which remain, the award at the Royal College of Science is to be known as the "Huxley Gold Medal," for the "promotion of science in the directions in which Huxley was distinguished," and especially for research to be carried on in the laboratory which bears his name. It has been further arranged that the use of the obverse die shall be granted to the Anthropological Institute (of which Huxley was practically the founder), in connection with the establishment by that body of a Huxley Lectureship, and a medal, for which they will furnish the reverse. Huxley's labours as an anthropologist are among the most important of his scientific career, and it may be questioned whether his "Man's Place in Nature," published against the advice of some of his friends, who feared his "ruin" did it appear, does not now rank among the best and most enduring of his works. His influence as an anthropologist was great, and devotees to that branch of science will hail with satisfaction this decision to perpetuate his memory.

PRELIMINARY NOTES ON THE RESULTS OF THE MOUNT KENYA EXPEDITION, 1899.

THE Mount Kenya Expedition left Nairobi, the then head of the Uganda Railway, on July 26, 1899, and returned to Naivasha, a station on the Uganda Road, on September 29. Considerable difficulties were experienced in the matter of commissariat, on account of the drought and famine prevalent throughout East Africa. For this reason a longer sojourn on the mountain would have been impracticable, even if other circumstances had permitted of it.

Previous accurate knowledge of Mount Kenya rested chiefly on the work of Captain G. E. Smith, R.E., who had fixed the position of the peak, by triangulation along the Uganda Road, and of Dr. J. W. Gregory, who, in 1893, ascended the south-western slope to a height which appears to have been nearly 16,000 feet. An account of the 1899 journey is given in the May number of the *Geographical Journal*.

Mount Kenya is a vast flattened dome, seered with radiating valleys. It rises from a plateau, the level of which is 5000 to 7000 feet above the sea. Upon the crown of the dome is a precipitous pyramid, the cleft peak of which has an altitude of 17,200 feet. The entire *massif* measures about fifty miles from east to west and forty miles from north to south. Its northern slopes are crossed by the equator.

We made a plane table survey of the central portion of the mountain, and connected it by route surveys with Nairobi and Naivasha. The altitude of the central peak was determined by boiling point and theodolite, combined in four different ways, with an average result practically the same as that obtained by Captain Smith at a distance of ninety miles.

The central pyramid is the core of the denuded and dissected volcano, a fact first suggested by the late Joseph Thomson, who saw the mountain from the Laikipian plateau. Although not yet examined in section, the holocrystalline rock on the summit may probably be identified with the nepheline syenite obtained by Gregory at a lower level. The core must, therefore, have risen considerably above the present peak, and if allowance be made for still loftier crater-walls, the original height of Kenya may have equalled that of the still complete Kibo summit of Kilimanjaro.

The most significant point in the structure of the mountain is the fact that, while the major axis of the peak strikes west-north-westward and throws the glaciers down northern and southern slopes, the chief water-parting runs in a direction at right angles to this, past the eastern foot of the central peak, with the effect that the valleys are thrown off eastward and westward, and that all the existing glaciers belong to the westward drainage. From a series of rock specimens obtained at widely separated spots on the summit of the craggy ridge constituting the divide, it appears that the lie of the water-parting has been determined by a system of great dykes, which must almost have split the mountain in two.

There are fifteen existing glaciers, of which two are a mile in length, and the remainder are small. Their lower ends descend to about 14,800 feet. Everywhere and at all hours at the time of our visit the surfaces were dry and crisp. Comparatively little water flowed from them, and the stream banks below gave small indication of floods. The ice was intensely hard, and fed by fine hail rather than snow. These facts may be explained by the meteorological conditions. Although the air-temperatures were not very low at night, there was then great radiation into the cloudless sky. In the afternoon, on the other hand, a cloud cap regularly warded off the sunshine. The air was usually dry, the relative humidity falling on more than one occasion to 54 per cent.

Evidence of past glaciation was frequent down to 12,000 feet both in the eastern and western valleys, and there were occasional traces down to about 9000 feet. The whole of the central part of the mountain, with the exception of the peak and the dividing ridge, must have been buried under a sheet of glacier, more than comparable to that of Kilimanjaro, at a time later than the erosion of the existing valleys.

Snow was absent from the summit, and several species of brilliantly coloured lichen were collected there. Everlasting flowers grew in the rock chinks up to 16,500 feet. In the upper Alpine zone were two distinct species of giant groundsel and two of giant lobelia, seeds of which have been brought home. The greater part of our dried plants was lost, but the mosses and lichens were saved. A series of photographs of the Alpine vegetation in various stages of growth was taken by my colleague, Mr. C. B. Hausburg.

Mr. Oldfield Thomas has described, before the Zoological Society, the skulls and skins of the mammals collected by us. The most interesting is a new species of Rock Dassy (*Procavia Mackinderi*), whose nearest relative has recently been sent home from the Eldoma Ravine by Mr. F. J. Jackson (*P. Jacksoni*). Apart from these two species, no Rock Dassies have been found in any part of East Africa, nor are they known further south. *P. Mackinderi* appears to be isolated above the forest-zone (7000–10,000 feet) on Mount Kenya. A new Forest Dassy was obtained from a lower level.

Kenya Peak, from the south-west.

The collection of birds has been described by Dr. Bowdler Sharpe. It includes a new eagle owl, as large as the European species, which feeds on the rats of the Alpine zone of Kenya, and there are three other new species. Generally the birds are similar to those of Mount Elgon, and in a lesser degree to those of Kilimanjaro. This is strikingly indicated by the fact that if Mr. Jackson had not explored Mount Elgon in 1890, nearly every bird we obtained would have been new.

The few human inhabitants of Kenya are Wandorobo, elephant hunters, who live in the forest up to its higher limit. On one occasion a party of them was seen at over 12,000 feet.

To west of Mount Kenya is the so-called Aberdare Range, traversed for the first time by the members of our expedition. It consists of two much denuded volcanic stumps, Nandarua and Sattima, rising to 12,900 and 13,200 feet respectively, and of a raised block, 9000 feet high, defined by parallel fault scarps, which strike in the same direction as the scarps of the Great Rift Valley. This mountain block and the Rift Valley may be the necessary complements of one another.

Only a small collection of insects was obtained, chiefly in Kikuyu, but Prof. Poulton informs me that it includes new species of Coleoptera, Forficulidæ and Hymenoptera.

H. J. MACKINDER.

THE DUKE OF ARGYLL.

AMONG the losses which science is from time to time called upon to deplore, not the least serious arise from the death of men of prominent public position who have taken an active personal interest in the advance of natural knowledge, and have done their best to promote it. The late Duke of Argyll was an eminent example of this type of man. Heir of a long line of illustrious ancestors, who for many generations have played a leading part in the stormy annals of their native country, called early in life to the legislature where he mingled conspicuously in the political conflicts of his time, full of wide and generous sympathies which prompted him to speak or to write on most of the great questions that agitated the public mind during his long and brilliant career, the Duke yet found time to read much and widely in science, and to keep himself acquainted with the progress of scientific discussion and achievement. He was happily gifted with a marvellous versatility, so that he could turn rapidly from one sphere of thought and activity to another far removed. Hence, amid the cares of State and of the administration of a great domain, as well as in the sorrow of domestic bereavement, he was often to be found immersed in the perusal of some recent treatise, or carrying on a research of his own in those parts of the scientific field which more specially interested him. Whether as an acute critic of the labours of others, or as an observer of nature himself, his devotion to these pursuits remained a characteristic feature of his life from the beginning to the end. It is difficult at present to define with precision the extent and value of the services of such a man in the progress of the science of his time. His own original contributions may be little in amount or importance, but his example and his enthusiasm, together with his political activity and his social rank, combine to make him a force in the land, which powerfully aids any good cause which he espouses. The death of the Duke of Argyll is thus an event which must be chronicled with sincere regret in the pages of a scientific journal.

It was through geology that the Duke first came practically in touch with science, and it was in geological pursuits and criticisms that he found the most congenial employment of his leisure moments. It is just half a century since, on a visit to his property in the Island of Mull, he found that one of his tenants had gathered a number of fossil leaves and plants from the rocks of the neighbourhood. At once appreciating the geological significance of these remains, he investigated their mode of occurrence, and recognised their association with sheets of lava and volcanic ashes. The plants were pronounced by Edward Forbes to be probably of Miocene age, and thus was securely laid the first stone of the edifice that has since been reared in illustration of the volcanic history of the Inner Hebrides. It is matter for regret that the Duke never followed up this important discovery.

Other geological fields attracted him, where he found ampler material for the exercise of that critical acuteness and the display of that forensic style of argument which made his writings so lively and so pungent. He had imbibed his earliest ideas of geological causation in the school of the cataclysmists, and to these ideas he adhered to the last. When the earlier views of Hutton and Playfair with regard to the denudation and sculpture of the land were revived and began to spread among the younger men, the Duke raised his protest against them, and poured on them the contempt and ridicule which they seemed to him to deserve. As they grew in acceptance, both in this and other countries, and as their advocates increased in number and in confidence, his vehemence of declamation seemed to augment in proportion.

Nor was this the only line along which the modern tendency in geological speculation seemed to the Duke to be running in an entirely wrong direction. When he began to interest himself in these questions, Agassiz' doctrine, that not only Britain but a large part of Europe was once buried under land-ice, had not been generally accepted. The geologists of this country preferred to account for the phenomena by supposing that the land had been submerged in a sea across which floating ice drifted. The Duke of Argyll was never able to accept the modern doctrine, except in a limited degree. He admitted the former existence of local valley-glaciers, but could not recognise the force of the evidence adduced to show that not only the valleys, but the surrounding hills had once been over-ridden by a vast sheet of ice.

The rise of the modern school of evolution afforded the Duke full scope for the exercise of his acute reasoning power and keen critical faculty. In article after article, address after address, and volume after volume, he subjected the doctrines of that school to the closest scrutiny. It may be freely admitted that he detected here and there a fallacy, and pointed out a conclusion different from, but not less probable than, that which his opponents had drawn. But perhaps his most valuable service lay in that border-land of philosophy and science in which he specially loved to exercise his thoughts and his pen. Even when men of science differed widely from his conclusions, they could not but admit that in his "Reign of Law" and his "Unity of Nature," he showed he wide range of his reading, the clearness and vigour of his reasoning powers, the force and eloquence of his style, the grasp he had of some of the more difficult scientific problems of his day, the strong bent of his nature towards metaphysics, and, above all, the lofty tone of his sentiments in regard to the moral nature and destiny of man.

The Duke of Argyll was essentially a man of action, to whom the stir of conflict and the stimulus of controversy were not uncongenial. Even in his scientific discussions he could not always quite forego the style in which he vilipended the opposite party in the House of Lords or in the public prints. He seemed sometimes hardly to realise the full extent and meaning of the evidence which he was criticising. In conversation, indeed, he might appear for a time to be impressed by the force of this evidence, and be willing to admit that the truth might, perhaps, lie somewhere between his own views and those to which he was opposed. But the force of early conviction or prepossession would, in the end, be too strong for him, and possibly the next morning his opposition would be found to be as complete and confident as ever. Unflinching and resourceful as an antagonist, enforcing with almost passionate enthusiasm what he held to be the truth, independent and self-reliant alike in his opinions and his actions, dignified and courteous after the manner of an older time, he formed altogether a striking and picturesque personality.

But the energy of the doughty debater was combined with much personal kindliness even towards those from whom he most seriously differed. Above all the other features of his character there shone out an intense love of nature and an eager desire to know more of her processes and laws. Year after year the Duke would spend weeks at a time in his yacht among the Western Isles, which he loved with all the enthusiastic devotion of one who was born and spent his youth among them. He was familiar with that western coast from one end to the other, under every change of sunlight and shadow. He had skétched every peak and crag and island, and he delighted to recall from his sketch-books the charm with which these scenes had fascinated him. To all their obvious attractions for the ordinary visitor his geological knowledge enabled him to join the fresh interest which is given to them by an acquaintance with the history of their remote past. In this way he kept himself in touch with some of the aspects of nature that most vividly appealed to his imagination. His poetic temperament found refreshment in these frequently renewed sojourns amid the varied scenery of the West of Scotland. As shown by his published writings, his wide acquaintance with modern English poetry furnished him with many an apt quotation and allusion. Tennyson's poetry seemed to be particularly familiar to him, insomuch that a casual citation of a line or expression from that poet by one of the company would sometimes lead the Duke to quote from memory the whole passage.

As the head of a great historic clan, the Duke of Argyll was a true Scot, who had studied his country's history both geological and political, and had made himself personally acquainted with a large part of its surface. The geological problems that more particularly engaged his attention were largely those which his own Highland hills and glens had suggested to his mind. Now and then, in the midst of an eager conversation, a Scottish word or expression would come most readily to his lips as conveying the meaning he wished to express. Of his general services to the country at large this is not the place to speak. But we may confidently anticipate that when some future historian shall review the various forces which have furthered the advance of science in this country during the Victorian age, a well-marked place will be assigned to the services rendered by the Duke of Argyll.

A. G.

PROF. A. MILNE-EDWARDS.

IT is with sincere regret that we have to record the death, at the age of sixty-four, of Prof. Alphonse Milne-Edwards, the Director of the Paris Museum of Natural History, which took place at Paris on Saturday, April 21, after a brief illness. The late professor was of English descent, being the grandson of Mr. Bryan Edwards, M.P., a West Indian planter who settled at Bruges; and, with this ancestry, it is curious to note how extremely imperfect was his colloquial knowledge of the English language. His father, Prof. Henri Milne-Edwards, was the well-known eminent zoologist of Paris, who died in 1885; and father and son were for many years associated in zoological work.

Born in Paris in 1835, Alphonse Milne-Edwards took his medical degree in 1859, and was nominated Professor at the School of Pharmacy in 1865. In 1876 he acted as deputy for his father as Professor of Zoology at the Jardin des Plantes; in the following year he succeeded the late Prof. P. Gervais as a member of the Institute of the Paris Academy of Sciences; and in 1885 he entered the Academy of Medicine. In 1891, being already Professor of Zoology, he was appointed Director of the Paris Museum of Natural History and of the Menagerie in the Jardin des Plantes; his official title as regards the latter post being *Administrateur chargé de la Direction de la Ménagerie au Musée d'Histoire naturelle.*

Having published, in 1864, an important memoir on the anatomy and affinities of the Chevrotains, and a second, in 1866, on the osteology of the Dodo, in 1867 Milne-Edwards issued the first fasciculus of his magnificent work, entitled "Recherches Anatomiques et Paléontologiques pour servir à l'Histoire des Oiseaux Fossiles de la France," which was completed in four volumes (two of text and two of plates) in 1872. As mentioned by Prof. A. Newton, this monumental work marked an epoch in ornithology, for it showed the possibility of forming a classification of birds by means of their "long bones." Much interest was excited by the identification in this work of remains of peculiar existing African and Malagasy genera of birds in the French Tertiaries. While this work was in progress, Alphonse Milne-Edwards was associated with his father in bringing out the "Recherches pour servir à l'Histoire naturelle des Mammifères," which was commenced in 1868 and completed in 1874. A large proportion of the latter was devoted to the description of new types of mammals from Central Asia, among them being the many strange forms, like *Aeluropus*, then recently obtained by Père David in the Moupin district of Eastern Tibet. The period from 1866 to 1874 also saw the issue of "Recherches sur la Faune ornithologique éteinte des Îles Mascareignes et de Madagascar." And the late professor's interest in the Malagasy fauna was likewise shown in a paper on the embryology of the Lemurs, published in 1871, and in his contributions to Grandidier's "History of Madagascar," still in course of publication.

But it would be a mistake to suppose that the researches of Prof. Milne-Edwards were by any means restricted to mammals and birds. From an early period in his career his attention had been directed to the study of zoophytes and crustaceans; and later on he had attentively studied the animals adherent to submarine cables, which had been raised after a sojourn at the bottom of the sea. With this latter subject the study of the ocean floor was intimately connected. And in 1880 he brought before his Government the advisability of fitting out an expedition for submarine surveying, with the result that in the following year a party of savants, under his own direction, embarked on the *Travailleur* to survey the Gulf of Gascony. The results obtained were so important that the same vessel was again put at the disposal of the professor, who completed the survey of the Gulf of Gascony, and explored the sea-bottom of the Strait of Gibraltar and of a considerable portion of the Mediterranean. In 1882 the *Travailleur* undertook a surveying voyage of the Atlantic as far as the Canaries. The year following the *Talisman* took the place of the *Travailleur*, and carried Prof. Milne-Edwards and his associates to the coasts of Portugal, Morocco, and the Canary and Cape Verde Islands, and then on to the Sargasso Sea, whence it returned by way of the Azores. The results of these dredging expeditions were published under the title of "Expéditions scientifiques du *Travailleur* et du *Talisman* pendant les années 1881, 1882 et 1883."

For these deep-sea explorations, Milne-Edwards was awarded the gold medal of the Royal Geographical Society. In 1876 he was elected a Foreign Member of the Zoological Society of London, and in 1882 a Foreign Correspondent of the Geological Society. He paid several visits to England, the last on the occasion of the Zoological Congress at Cambridge in 1898. R. L.

NOTES.

THE funeral of the Duke of Argyll will take place at the family burial ground, Kilmun, on the Holy Loch, on Tuesday next, May 8.

THE annual conversazione of the Institution of Electrical Engineers will be held at the Natural History Museum, South Kensington, on Tuesday, June 26.

THE Duke of Cambridge, president of the Sanitary Institute, will occupy the chair at the Institute dinner on Friday, May 11.

THE University of Göttingen has awarded the Volbrecht prize for scientific research to Dr. Gegenbauer, professor of anatomy at Heidelberg. The prize is of the value of 12,000 marks (600*l.*)

To commemorate the foundation of the k. k. geologischen Reichsanstalt of Vienna, in 1849, a jubilee meeting will be held in the great hall of the Institute on June 9, and representatives of science or of scientific institutions are invited to be present.

THE *Botanical Gazette* records the death by drowning, in September last, of Prof. Kyokichi Yatabe, the founder of the Botanical Society of Japan.

THE annual meeting of the American Association for the Advancement of Science will be held at Columbia Universtity, New York, from June 25 to June 30.

WE learn, from the *American Naturalist*, that the herbarium and the principal part of the botanical library of Columbia University have been transferred to the New York Botanic Garden, and that, in future, the advanced work in botany of the University will be carried on in the laboratory of the Garden.

THE *British Medical Journal* states that the tenth award of the Riberi prize of 20,000 lire (800*l.*) will be made by the Royal Academy of Medicine of Turin on December 31, 1901, for the best printed or manuscript work, or the most important discovery, during the quinquennium 1897–1901, in the domain of experimental pathology, hygiene, or forensic medicine.

THE Franklin Institute has awarded John Scott medals and premiums to Mr. A. V. Groupe for his improved braiding machine, to Messrs. C. A. Bell and S. Tainter for their invention of the graphophone, and to Mr. A. M. Hopkins for his pneumatic system for preventing the bursting of water-pipes by freezing. Elliott Cresson medals have been awarded to Mr.

L. E. Levy for his acid-blast method of etching metal plates; and to Prof. W. O. Atwater and Mr. E. B. Rosa for their respiration calorimeter.

THE *Daily News* states that Lieut. R. E. Peary has forwarded some interesting relics to the Royal Naval College, Greenwich. These consist of the sextant left behind in Repulse Harbour by Lieut. Beaumont in 1876, and subsequently recovered by Lieut. Peary, and the original record deposited in a cache by Sir George Nares on Norman Lockyer's Island in 1875. The great meteorite which Lieut. Peary brought back from his last Arctic expedition still remains on the Cob Dock of the Brooklyn Navy Yard. The meteorite weighs 200,000 pounds, and Lieut. Peary wishes to obtain 15,000*l.* for it.

THE Trinity House steam vessel *Irene*, with the deputy master, Captain G. R. Vyvyan, on board, accompanied by a committee of the Elder Brethren and their scientific adviser, Lord Rayleigh, has proceeded to the Bristol and English Channels in order that special surveys in connection with new lighthouse works, and observations on both English and French lights from seaward, may be made.

THE death is announced of Mr. G. V. Ellis, who succeeded Prof. Quain as professor of anatomy in University College, London, in 1850, an appointment which he held for twenty-seven years, resigning in 1877, when he was appointed Emeritus Professor. Mr. Ellis was co-editor with the late Dr. William Sharpey of the sixth edition of "Quain's Elements of Anatomy," published in 1856, and the author of several works for students of anatomy.

AMONG the items included in the Prussian Budget is a sum of 7,300,000 marks, for the purchase of lands in Berlin, on which is to be erected a building for the Academy of Sciences and the Royal Library. The value of the land is estimated at more than 11,000,000 marks, but about 3,000,000 marks is obtained by the exchange of other property, and 1,000,000 marks is to be voted next year.

A SUMMER meeting of the Anatomical Society of Great Britain and Ireland will be held at the Owens College, Manchester, on Thursday and Friday, June 21 and 22. Opportunities will be afforded to members of seeing things of local interest during their visit to Manchester. An excursion to the Lake District will be arranged, and members who desire to join the party are requested to inform the local secretary, Dr. Peter Thompson, the Owens College, Manchester.

A COMMITTEE composed of many eminent men of science in France has been formed for the purpose of obtaining funds for the erection of a modest monument at Langres in honour of Auguste Laurent, the renowned chemist. Laurent was born at La Folie, near Langres, in 1808, and in 1831 became assistant to Dumas, under whom he acquired a special knowledge of organic chemistry, and carried on his original researches on naphthalene and carbolic acid, together with their derivatives. After filling various posts, the last of which was a chemical professorship at Bordeaux, Laurent became Warden of the Mint at Paris, where he remained in intimate connection with Gerhardt until his death in 1853. Subscriptions for the proposed monument should be sent to the treasurer of the Committee, M. Caublot, 45 rue de Belleville, Paris.

MR. JAMES MANSERGH has been elected president of the Institution of Civil Engineers, in succession to Sir Douglas Fox. Sir William White, K.C.B., F.R.S., Mr Charles Hawksley, Mr. J. C. Hawkshaw, and Mr. F. W. Webb have been elected vice-presidents. The following awards have been made for papers read and discussed before the Institution during the past session:—A George Stephenson medal and a Telford premium to Sir Lowthian Bell, Bart., F.R.S.; Telford medals and premiums to Messrs. H. H. Dalrymple-Hay, B. M. Jenkin, F. W. Bidder and F. D. Fox; a Watt medal and a Telford premium to Mr. J. Dewrance; a Crampton Prize to Sir Charles Hartley; and Telford premiums to Messrs. C. N. Russell and R. A. Tatton. The presentation of these awards, together with those for papers which have not been subject to discussion, and will be announced later, will take place at the inaugural meeting of next session.

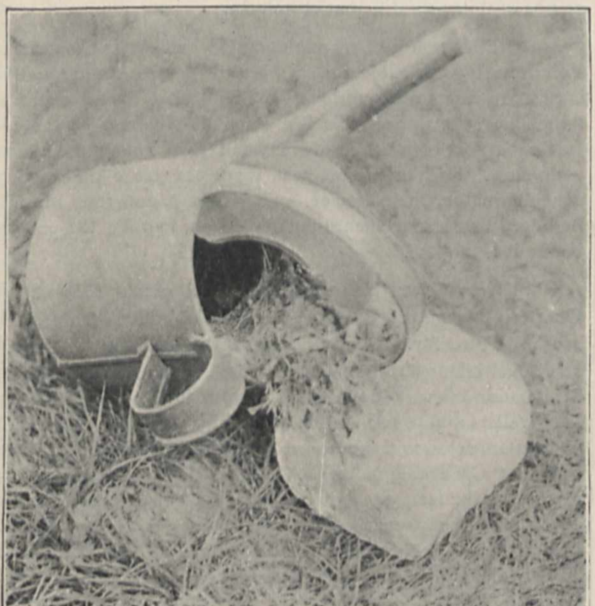
AMERICAN ethnology has been deprived of a prominent worker by the death of Mr. Frank H. Cushing. Mr. Cushing, says the *Scientific American*, was born in 1857, at Northeast, Pa., and when he was only eighteen years of age his work was brought to the attention of the late Mr. Spencer F. Baird, who was then Secretary of the Smithsonian Institution, and in 1875 he went to Washington as an assistant in that institution. He had charge of the ethnological exhibit at the Centennial Exposition of 1876, and in 1879 he accompanied an expedition from the Smithsonian Institution to investigate the Pueblos of New Mexico, and at his request was left at the Pueblo of Zuni, where he lived almost continuously for six years. He returned to Washington in 1884 and began to work up his voluminous notes. Two years later he was made Director of the Hemenway South-western Archæological Expedition. Extensive excavations were made in South Arizona and New Mexico, and the large collection of objects of prehistoric art which he gathered is in the Peabody Museum at Cambridge, Mass. This work took up two and one-half years of his time, and then Mr. Cushing returned to the United States Bureau of Ethnology to supervise a memoir on the Zuni myths printed by the Bureau. Three years later he became director of the expedition fitted out by Mrs. Phœbe A. Hearst and the late Dr. William Pepper, conducted under the auspices of the National Museum, the Bureau of Ethnology and the University of Pennsylvania.

THE motion for the second reading of the Sea Fisheries Bill in the House of Commons, on Monday, resulted in a lively discussion. The Bill prohibits the sale of flatfish below a specified size, and its rejection was moved on the grounds that it would not have the effect of preventing the destruction of immature fish, or of increasing the supply of fish. In the course of the discussion, an honourable member said that the whole of the trouble arose from the institution of a number of committees composed of farmers, lawyers, and captains of the horse, foot, and artillery, who knew little of fishing, and who ventilated strange theories and supported them with portentous and irrelevant statistics. This remark was used as an argument against the Bill, but it may also be taken to mean that if fishery matters were controlled by scientific men familiar with the natural history of the sea, and questions concerning fisheries were referred to marine biologists, recommendations would be made upon which reasonable regulations might be based. Board of Trade statistics prove that there is a large destruction of immature fish, and that the quantity of fish landed has decreased during recent years. The Government, wishing to preserve a great national industry, have put forward the present Bill, which is really the Undersized Fish Bill of last year, and has appeared under various other titles in previous years. The discussion upon the Bill was not completed when the House adjourned on Monday.

THE report presented at the anniversary meeting of the Zoological Society, held on Monday, stated that the number of Fellows of the Society at the end of last year was 3246. The total income of the Society during the past year was 28,880*l.* The average annual receipts of the Society for the previous ten years have been 26,370*l.*, so that the receipts for 1899 exceeded that average by 2509*l.* The number of visitors to the Society's

Gardens in 1899 was 696,707. The number of animals now living in the Gardens is 2753, of which 821 are mammals, 1471 birds, and 461 reptiles and batrachians. Amongst the additions made during the past year, thirteen were specially commented upon as being of remarkable interest, and in most cases new to the Society's collection. Of these, by far the most noticeable objects exhibited for the first time were the pair of Grévy's zebras placed under the care of the Society by Her Majesty the Queen. These animals, which had been presented to Her Majesty by the Emperor Menelik of Abyssinia, were brought down to Zeila, on the coast of Somaliland, under the care of Captain J. L. Harrington, the British Political Agent. At Zeila they were handed over to the Society's assistant superintendant, Mr. Arthur Thomson, who had been sent there by the Council at the request of the Foreign Office on purpose to receive them, and by him they were landed safely in London on August 14 last year. The Council also called special attention to the young male giraffe, acquired in April 1899, by purchase, for the sum of 800*l*. It is believed that this animal, together with the female purchased in 1895, form the only pair of young giraffes now to be found in any of the zoological gardens in Europe. The works in connection with the new bore at the well and the new machinery for pumping were completed last year. The new water supply has been further improved by the construction of a second and larger reservoir, so that an excellent supply of water will henceforth always be available in every part of the Gardens.

MR. F. W. HASELGROVE sends us a photograph of a robin's nest in a water-can, with the bird sitting upon its eggs, now to be seen at Finchley Cemetery. Robins are well known to build



their nests frequently in curious places, one of the most remarkable instances on record being that of a nest in a battered beer-can between the rails over which trucks were continually passing at Worthing railway station. Flower-pots and water-cans appear to be favourite nesting-places of the birds.

THERE are reasons for believing that the Scandinavians discovered America and settled in Massachusetts in pre-Columbian days. The evidence consists in the occurrence of certain ruins which correspond closely with ruins of the Saga-time in Iceland, but which differ from native dwellings and early European ruins on the coast; and also in the correspondence in the physical features of the Massachusetts coast with the description of the country called Vinland in Icelandic literature. This evidence has recently been brought together in an illustrated article by Miss Cornelia Horsford in *Appleton's Popular Science Monthly*.

THE recent Norwegian earthquakes are studied by Mr. J. Rekstad in a paper published in the *Bergens Museums Aarbog* (1899, No. iv.). During the four years 1895–1898, the number of recorded earthquakes is 77, the corresponding number for Great Britain being 24, and for Greece, 1652.

A SLIGHT earth-shake occurred near Manchester at about 1.17 a.m. on April 7. It was felt at Pendleton, Pendlebury, Seedley, Salford and other places in the immediate neighbourhood of the Irwell Valley fault. The small disturbed area and the rather marked intensity of the shock point to a local origin, probably connected either directly or indirectly with the extensive coal-workings of the district. On February 27, 1899, a similar earth-shake was felt at the same places (see NATURE, vol. lxi. p. 546).

WE have received a reprint of a paper, published in the *Bulletin* of the Geographical Society of Philadelphia, "On the Nicaragua Canal in its Geographical and Geological Relations," by Prof. Hugelo Heilprin. The paper, which is illustrated by maps and photographs, discusses (1) the volcanic phenomena of the region of the proposed canal; (2) an assumed inconstancy in the level of Lake Nicaragua; and (3) the deformation of the Nicaragua coast-line. After pointing out the marked deficiency of trustworthy information concerning the region, especially with regard to lake and river topography and hydrography and dynamical geology, the author concludes that "the facts that are known render doubtful, or at least open to question, the advisability of constructing, or even the practicability, of a canal such as is contemplated." . . . "It may, perhaps, be properly questioned whether, if the canal had been constructed a hundred years ago, along the site that is now being contemplated, it would be in existence to-day."

THE current number of *La Geographie* contains a suggestive paper on the variation of the limits of the Mediterranean region, by M. Gaston Bonnier. It is pointed out that attempts to define the boundary from geological considerations have proved unsatisfactory, and that the region is more clearly distinguished by its climate. This may be traced in the flora, the Mediterranean region being roughly taken in France as the region of the olive. M. Bonnier contends that it can be more closely followed, especially in certain regions, by reference to other plants, and discusses a number of interesting observations with regard to exposure and elevation.

AT the close of an address recently delivered as president of the Anthropological Society of Washington, Mr. W. J. McGee enunciated the cardinal principles of science as follows:—"The indestructibility of matter, the contribution chiefly of chemistry; the persistence of motion, the gift mainly of physics; the development of species, the offering of the biotic sciences; the uniformity of nature, the guerdon of geology and the older sciences; and the responsivity of mind, the joint gift of several sciences, though put in final form by anthropology." These principles are comprehensive enough, but they will not satisfy all students of epistemology, so much depends upon the point of view occupied.

THE manufacture of silk cord from spiders' web seems likely to attain commercial importance, for we learn through the *Board of Trade Journal* that one of the most novel exhibits in the Paris Exposition will be a complete set of bed-hangings manufactured in Madagascar from the silk obtained from the halabe, an enormous spider that is found in great numbers in certain districts of the island. The matter has been taken up by M. Nogue, the head of the Antananarivo Technical School. The results he has already achieved show that the production of spider silk should quickly become a highly important industry. Each spider yields from three to four hundred yards of silk. After the thread has been taken from the spiders they are set free, and ten days afterwards they are again ready to undergo the operation. The silk of these spiders, which is of the most extraordinary brilliant golden colour, is finer than that of the silkworm, but its tenacity is remarkable, and it can be woven without the least difficulty.

WE have received from the Agricultural Department of the Economical Society of Youriev (Dorpat) a report upon the results of rainfall and temperature observations made in the Baltic Provinces of Livonia and Esthonia during 1898. This is the thirteenth year of publication; the report contains a large amount of very useful statistics, including monthly and yearly means and the number of rainy days at no less than 203 stations. The same information is also shown very clearly in a graphical manner, together with a comparison of the year's results with a ten years' average. We note that the publication of the results for the year 1899 may be expected very shortly.

THE Weather Bureau of the United States has published a valuable discussion of the climate of San Francisco (*Bulletin* No. 28), by Messrs. A. G. McAdie and G. H. Willson. The work is based upon observations collected during the last thirty years, and the results are given in considerable detail on account of the important position of the town and the peculiarity of its climate. The authors state that if a native of San Francisco were asked which was the coldest month of the year, he might be unable to answer, and if asked which was the warmest, he might say November. This arises from the comparative small range of temperature; the mean annual temperature is about 56·2°. May and November have practically the same temperature; the warmest month is September, 60·9°, and the coldest January, 50·1°. The highest temperature recorded was 100°, in June, 1891, and the lowest 29°, in January, 1888. The mean of the three consecutive warmest days has never exceeded 76·3°, and the mean of the three coldest days was 40·7°. The annual rainfall is 23 inches. July and August are practically without rain, while December and January together have nearly 10 inches.

A SERIES of Lower Silurian fossils from Baffin Land, in the region between Hudson Bay and Davis Strait, has been described and figured by Mr. Charles Schuchert (*Proc.* U.S. Nat. Museum, vol. xxii. 1900). The fossils belong to the Trenton group, and the strata rest unconformably on old crystalline rocks. The author notes the early introduction in the Baffin fauna of Upper Silurian genera of corals, such as *Halysites*. He also remarks that the corals, brachiopods, gasteropods and trilobites have a wide distribution, and are less sensitive to differing habitats than the cephalopods or lamellibranchs.

IN an article on the Dwyka Coal-measures (*Trans.* S. African Phil. Soc. vol. xi.), Mr. E. J. Dunn points out that the Dwyka conglomerate, which occurs at the base of the coal-bearing series, is a most valuable horizon, and that its length of outcrop exceeds 2000 miles. This is shown on an accompanying map. Within this outcrop coal *may be present* at varying depths over an immense area, extending from the southern part of the Transvaal to Kimberley and near East London. Borings alone can decide if profitable seams occur, and if so, at what depths.

IT is well known that the blood of animals that have been poisoned with carbonic oxide loses its power of absorbing oxygen. Dr. Adolfo Moutuori, writing in the *Rendiconto* of the Naples Academy, describes experiments tending to explain the fact that dogs are capable of surviving the injection into their veins of a quantity of carbonic oxide far greater than would poison them if inhaled. It is found that the poisoned blood reacquires its power of absorbing oxygen when it is brought into contact with the pulmonary tissues, but not otherwise.

THE statics and dynamics of pseudospherical space in three dimensions form the subject of a memoir by Prof. D. de Francesco in the *Rendiconto* of the Naples Academy. Defining the co-ordinates of a point as the hyperbolic sines of the perpendiculars on three principal orthogonal planes of reference, the author introduces the conception of the moment of a force with regard to a point, analogous to the moment in ordinary statics, and, in addition, the new notion of the co-moment, of which an analytic expression is given. By representing forces by the hyperbolic sines of segments measured on their lines of action the equation of virtual work is established, and by applying this equation to a rigid system the author determines the six characteristics, the central axis, and the invariants. Starting from the conception of the co-moment, the problem of dynamics is treated by the method of Poinsot. Two invariants are found, and the conditions for their vanishing lead to remarkable geometrical properties, which do not exist in ordinary mechanics. The same author discusses in the *Atti dei Lincei* the kindred problem of integration of the differential equations of free motion of a rigid body in space of constant curvature.

MR. J. E. GRIFFITH, of Bangor, author of the "Flora of Carnarvonshire and Anglesey," proposes to publish a series of photographic reproductions of the cromlechs of these two counties of Wales. The series will contain forty-three photographs of thirty-six different cromlechs.

A RUMOURED project of reclaiming Wicken Fen in Cambridgeshire, forming the subject of a recent leader in the *Standard*, once more raises the question as to the desirability of acquiring by public subscription this last remaining habitat of the old fauna and flora of the Fen district, and thus saving them from extinction. Such a project was suggested some time ago by Mr. Carrington, the editor of *Science Gossip*, and it is much to be hoped that a movement may be set on foot for the purpose before it is too late.

WE have received No. 3 (vol. i.), for April, of *Climate*, "a Quarterly Journal of Health and Travel," edited by Dr. C. F. Harford-Battersby. The periodical is the organ of the Travellers' Health Bureau, the object of which is to supply to inquirers information of every kind connected with the health and comfort of travellers and of residents in unhealthy climates. Among the original articles in the number before us is a very interesting one on "Gardening in West Africa," by Miss Kingsley, and a *résumé* of the facts at present ascertained connecting malarial fever with the pa asite of the mosquito. A short paper on "European Children in Tropical Climates," by Dr. G. D. McReddie, will be read with interest by many.

A "FLORA OF BOURNEMOUTH" is announced for early publication by the Rev. E. F. Linton, of Bournemouth (subscription price, 7*s.* 6*d.*). The area taken is a radius of twelve miles, and includes portions of the counties of Hants and Dorset, with the Isle of Wight. The total number of flowering plants and Pteridophytes is stated as 1137.

IN the *Naturwissenschaftliche Wochenschrift* for April 15, Prof. M. Möbius gives an interesting account of pigments in the vegetable kingdom. Commencing with the colouring matters of fungi and lichens, he proceeds to those in the various groups of Algæ, and then to the pigments of Muscineæ, Pteridophytes, and Phanerogams, contained in the stem, root, leaves, flowers, and fruits. He regards chlorophyll and hæmoglobin as antagonistic substances, the one characteristic of the vegetable, the other of the animal kingdom.

To the *Sitzungsberichte* of the Berlin Academy for March 15, Dr. K. von Möbius, the director of the Zoological Museum, communicates a suggestive paper on our perception of the æsthetic proportions of various mammals.

THE April number of the *Journal of Anatomy and Physiology* contains the full text of the paper read by Dr. Albert Gray at the last meeting of the British Association on Helmholtz's theory of hearing. The author proposes a modification of the theory of the German investigator, according to which a remarkable analogy between the senses of hearing and touch is shown to exist.

IN the last issue of the *Transactions* of the South African Philosophical Society, Dr. R. Marloth gives the results of his investigations as to the mode of growth of the barnacle infesting the Southern Bight Whale. Were it not for some special provision, the growth of the epidermis beneath, coupled with the wearing away of the outer layer, would soon cause the parasite to be shed, and, as a matter of fact, this actually takes place with the dead shells. The living barnacle cannot, however, be discarded in this manner, since it dissolves the part of the epidermis with which its skin is in contact at the same rate at which fresh epidermal tissue is formed below. Consequently the layer of epidermis between the barnacle and the true skin never varies in thickness, and the parasite accordingly retains its position, the shell disintegrating at the apex at the rate at which it grows at the base.

MM. GAUTHIER-VILLARS, Paris, have published the third revised edition of the "Traité élémentaire d'Electricité avec les principales Applications," by M. R. Colson.

MR. FELIX L. DAMES, Berlin, has issued a catalogue of books and papers on astronomy, geodesy, meteorology and related sciences, which he has acquired from the library of the late Dr. H. Romberg, and offers for sale.

THE seventh edition of the late Prof. Milnes Marshall's well-known and practical manual on "The Frog: an Introduction to Anatomy, Histology, and Embryology," edited by Dr. G. Herbert Fowler, has been published by Mr. David Nutt. The chief addition consists of a new series of woodcuts in illustration of the development and metamorphosis of the frog.

THE "Handbook of Jamaica," compiled by Mr. T. L. Roxburgh and Mr. J. C. Ford, and published by Mr. Edward Stanford, is filled with historical, statistical and general information concerning the island. We notice that the magnetic declination, which was 6° 30′ E. at the end of last century, and has been steadily decreasing since then, is now only 1° 24′ E., and in 1910 its value will be zero.

IN the course of a few weeks, Mr. Gustav Fischer, Jena, will commence the publication of "Aus den Tiefen des Weltmeeres," an elaborate work in which Prof. Carl Chun will describe and illustrate the German deep-sea expedition to Antarctic waters. The work will be published in twelve parts, the first of which will appear during this month and the last in November.

A SIXTH edition, revised and enlarged, of "A Text-book of Assaying," by C. and J. J. Beringer, has just been published by Messrs. Charles Griffin and Co. Mr. J. J. Beringer is responsible for the revision of this handy book for assayers; and he remarks in the preface: "The principal changes in this edition are additions to the articles on gold, cyanides and nickel, and a much enlarged index. The additional matter covers more than forty pages."

SCIENTIFIC students and investigators in Melbourne should be grateful to Mr. T. S. Hall for the "Catalogue of the Scientific and Technical Periodical Literature in the Libraries in Melbourne," which he has prepared. Besides periodicals, the list includes reports of scientific societies, as well as Government reports and Parliamentary papers of scientific import. The catalogue will be a very useful guide to scientific literature accessible in Melbourne and its suburbs.

THE sixteenth part of Mr. Oswin A. J. Lee's fine work, "Among British Birds in their Nesting Haunts, illustrated by the Camera," has just been published by Mr. David Douglas, Edinburgh. The birds illustrated and described are the blackcap, bullfinch, short-eared owl, yellow wagtail, stock dove, pintail, wryneck, and lesser whitethroat. The present part completes the fourth volume, and it is hoped that the whole work will be finished in the course of a few months.

AT the meeting of the Chemical Society on June 1, 1899, Prof. Sydney Young, F.R.S., described a series of tests made by him to determine the relative efficiency of various forms of still-heads for fractional distillation. The design of several new still-heads, superior in many respects to those in common use, was an outcome of the investigation; and chemists will be glad to know that Messrs. J. J. Griffin and Sons have now placed these improved forms upon the market.

THE additions to the Zoological Society's Gardens during the past week include a Mozambique Monkey (*Cercopithecus pygerythrus*, ♀) from Uganda, presented by Lady Ashburnham; two Leopards (*Felis pardus*, ♂ ♀) from India, presented by Mrs. C. Simpson; a Tawny Owl (*Syrnium aluco*) from Scotland, presented by Mrs. C. M. Blackwood; six Common Vipers (*Vipera berus*) from Dorsetshire, presented by Mr. A. Old; nine Natterjack Toads (*Bufo calamita*) from Norfolk, presented by Mr. J. B. Thornhill; a Sykes's Monkey (*Cercopithecus albigularis*, ♀), a Flap-necked Chameleon (*Chamaeleon dilepis*) from East Africa, a Cactus Conure (*Conurus cactorum*) from Bahia, deposited; two Gold Pheasants (*Thaumalea picta*, 2 ♀), two Silver Pheasants (*Euplocamus nycthemerus*, 2 ♀), two Cabot's Horned Tragopans (*Ceriornis caboti*, ♂ ♀) from China, two Germain's Peacock Pheasants (*Polyplectron germaini*, ♂ ♀) from Cochin China, two Japanese Pheasants (*Phasianus versicolor*, ♂ ♀), two Sœmmerring's Pheasants (*Phasianus soemmerringi*, ♂ ♀) from Japan, three White-backed Trumpeters (*Psophia leucoptera*) from the Upper Amazons, four Wonga-Wonga Pigeons (*Leucosarcia picata*) from New South Wales, a Musky Lorikeet (*Glossopsittacus concinnus*) from Australia, three Blue-crowned Hanging Parrakeets (*Loriculus galgulus*) from Malacca, an Ural Owl (*Syrnium uralense*), North-east European; a Great Wallaroo (*Macropus robustus*, ♂) from South Australia, a Barbary Wild Sheep (*Ovis tragelaphus*, ♂) from North Africa, purchased; a Yak (*Poephagus grunniens*, ♂), born in the Gardens.

OUR ASTRONOMICAL COLUMN.

NEW VARIABLE IN TAURUS.—In the *Astronomische Nachrichten* (Bd. 152, No. 3635) M. W. Ceraski, of Moscow, announces the discovery of another new variable by Madame Ceraski during her examination of the plates taken by M. S. Blajko. The star's position is:—

R.A. h. m. s.		Decl. ° ′ ″	
5 33 17·33	...	+26 18 58·3	(1900)
5 30 29·56	...	+26 17 7·9	(1855)

The star is not found in the B.D. At its maximum it is of 9·0–9·5 mag.; at minimum, about 12 mag. or less. On 1900 March 29, it was at the limit of visibility in a telescope of 4·5 inches aperture.

SEARCH EPHEMERIS FOR EROS.—In view of preparing for observations of this minor planet during the coming opposition, the following ephemeris has been prepared by J. B. Westhaver from the elements computed by H. N. Russell (*Astronomical Journal*, No. 479, vol. xx. p. 185).

Ephemeris for 12h. Greenwich Mean Time.

1900.	R.A. h.	m.	s.	Decl. °	′	″	Mag.
May 3	23	2	0·1	−4	0	25	13·4
5		5	46·7	3	28	2	
7		9	32·3	2	55	29	13·3
9		13	16·9	2	22	45	
11		17	0·5	1	49	52	13·3
13		20	43·1	1	16	48	
15		24	24·9	0	43	35	13·2
17		28	5·8	−0	10	11	
19		31	45·8	+0	23	22	13·2
21		35	25·0	0	57	4	
23		39	3·3	1	30	55	13·1
25		42	40·8	2	4	55	
27		46	17·5	2	39	4	13·1
29		49	53·3	3	13	22	
31	23	53	28·4	+3	47	48	13·0

RELATION BETWEEN SOLAR ACTIVITY AND EARTH'S MOTION.—In the *Astronomische Nachrichten* (Bd. 152, No. 3635), Mr. W. G. Thackeray criticises the recent paper by Dr. J. Halm (*Astr. Nach.* Bd. 151, No. 3619, NATURE, March 8, p. 445), deducing certain relations between the sun-spot cycle, the changes in the obliquity of the ecliptic and the variations of the terrestrial latitude. Mr. Thackeray states first, that continuous observations of sun spots have only been made since 1825, so that the sixty years period lacks sufficient evidence; secondly, that Dr. Halm has ignored some of the systematic errors of observation, particularly those depending on the corrections for temperature in the transit circle reductions, although in some cases their amount affects the value of the obliquity by as great a quantity as the whole amplitude of Chandler's long period inequality of latitude variation. The paper includes a table showing the annual corrections to Leverrier's obliquity from 1836–1896, with corresponding yearly means of Wolf's spot numbers. These differ from the values adopted by Dr. Halm, and the resulting plotted curves show little or no resemblance.

DETERMINATION OF SOLAR PARALLAX FROM OPPOSITION OF EROS.—In the *Astronomical Journal* (No. 480, vol. xx. pp. 189–191), Prof. S. Newcomb directs attention to the favourable opportunity for determining the Solar Parallax which will be afforded by the coming opposition of the minor planet Eros, in December 1900, the conditions being conducive to more accurate direct measurements than have ever before been presented. As another such favourable opportunity will not occur for more than thirty years, several suggestions are made for determining the best combination of observations.

The period during which determinations may be made is remarkably long, as during the five months from 1900 October 15 to 1901 March 15, the distance of the planet will be less than 0·50 astronomical unit.

The high degree of precision attainable in late years by photography indicates this as the best method, an additional point in favour of this plan being that photographic telescopes are already in use at various stations, and need only devoting to this work. In arranging the programme of observations three objects should be kept in view:—

First, the station and hours of exposure should be so chosen as to secure the maximum of parallactic angles.

Secondly, endeavour should be made to secure simultaneous exposures at different stations, in order to lessen the uncertainties arising from differences of scale, changes in relative position of planet among stars, and in the reduction of the position of the planet from hour to hour. Series of independent determinations should also be made, each within an interval of twenty-four hours.

Thirdly, the relative displacement should, as nearly as possible, be in a direction at right angles to the motion of the planet among the stars.

Prof. Newcomb then describes four charts included in the paper, showing projections of the earth as seen from Eros at the Epochs (1) middle of October to end of November; (2) about December 16; (3) about January 10; (4) about February 1. On these are marked the sunset and sunrise lines, and parallels of latitude corresponding to the principal observatories: Helsingfors, Pulkowa, 60° lat.; Greenwich, Paris, Potsdam, &c., 50° lat.; Jamaica, Madras, 15° lat.; Arequipa, −15° lat.; Cape of Good Hope, −35° lat. On these projections the direction of the planet's motion for different dates is indicated, so that observers may find by inspection the relative importance of observations at various stations and at various times of night.

Respecting the degree of precision it may be possible to attain in the final result, it is noticeable that the course of the planet throughout the entire period will lie along the borders of the Milky Way, ensuring more and nearer comparison-stars than would otherwise be available. An element of uncertainty is the probable error of measurement from the plates. From a consideration of Kapteyn's investigation of the Helsingfors parallax plates, and those at Potsdam, it is likely that the probable error of the solar parallax from a pair of simultaneous plates at Arequipa and Helsingfors would be ±0″·02, and even this might be reduced were it not for the uncertainty arising from the motion of the planet.

WORKING SILICA IN THE OXY-GAS BLOWPIPE FLAME.

THE plastic state of silica, and the elasticity of fine threads of vitreous silica, were first observed by M. Gaudin (*Comptes rendus*, viii. 678, 711) in 1839; but his observations seem to have attracted but little attention, and the valuable qualities of "quartz threads" remained unutilised till they were independently rediscovered and applied by Prof. C. V. Boys in 1887.

Similarly, M. A. Gautier succeeded, in 1869, in making very narrow tubes of silica, and showed such tubes in Paris in the year 1878, but he failed to make further progress, even with the aid of M. Moissan's electric furnace (*Comptes rendus*, cxxx. 816, March 26), and his early work was so completely forgotten, both in France and England, that the latest French worker on the subject, M. A. Dufour, was evidently unaware of its existence a few weeks ago (*Comptes rendus*, cxxx. 775, March 19).

But though it thus appears that Prof. Boys was not, as has been supposed, actually the first physicist to draw silica into threads, or work it into fine tubes, there can be no doubt but that his observations, methods of working and experiments have formed the basis of all that has been done since the publication of his first paper in 1887.

In June 1899, one of the authors of this article exhibited (in conjunction with W. T. Evans), at the Royal Society's soirée, a tube of vitreous silica, about 12 cm. in length and 1 cm. in diameter, and at the same time showed the process by which it had been made. Since that date we, the present writers, have made a good deal of further progress. We have succeeded in making longer tubes of various thicknesses, and in joining such tubes both end to end and at right angles. On February 22, we filled and sealed an ungraduated mercury thermometer made entirely of vitreous silica [1]; and what is equally important, we have entirely overcome the difficulty caused by the great tendency of quartz to splinter when suddenly thrust into the oxy-gas flame. We therefore now publish a short account of our methods in the hope that they may enable others to take advantage of the new material without undertaking a tedious preliminary investigation into its properties and the methods of working it. We may perhaps be permitted to add that we have already commenced experiments intended to test the suitability of silica for use in mercury and air thermometers, especially in regard to the fixity, or otherwise of their zero points, that M. A. Dufour is engaged on similar work, especially in relation to high temperature thermometers, and that we are also studying the fitness of silica apparatus for researches on the properties of pure gases.[2]

To prepare Non-splintering Silica.—The best form of silica for use before the blowpipe is rock crystal. This may be obtained in the form of chippings, or in masses which have proved unsuitable for optical work. We have experimented with the lighter particles of Kieselguhr, after well washing them with strong hydrochloric acid, and also with well-washed precipitated silica; but, though these can be worked before the blowpipe without much difficulty, they have not proved satisfactory in our hands, as they yield an opaque product which is only suitable for a few purposes.

1 NATURE, April 5, p. 540.
2 This will obviously involve a careful investigation into its power of condensing gases and vapours.

In order to prepare non-splintering silica from native masses of rock crystal, the latter must be heated in a Bunsen flame, unless they are already perfectly clean, until the outer impure layers can be removed easily by a blow from an iron pestle or hammer. The clean masses of silica must then be heated in a vessel containing boiling water for some time, and dropped whilst hot into clean cold water. This treatment will cause the masses to crack to such an extent that they may easily be broken into fragments of convenient dimensions by sharp blows from a clean hammer. When the material has thus been broken up, the fragments must be examined one by one, and all those which contain foreign matter must be rejected. Finally, the selected fragments must be heated to a yellow-red heat in a platinum dish, and then quickly thrown into deep cylinders containing cold distilled water. After the quartz has been treated in this manner twice, it will be found to be semi-opaque and very much like a white enamel in appearance. It may now be brought safely into the oxy-gas flame, or be pressed suddenly against masses of white-hot plastic silica without any preliminary heating, such as is necessary in the case of the natural quartz. These processes do not occupy much time, and the use of the prepared material saves a great deal of time and trouble at the subsequent stages. We have tried unprepared opal and natural cloudy quartz, but both these splinter badly.

The Blowpipe.—We have worked silica both in the flame of an ordinary "blow through" jet, and in the flame of a good "mixed gas" burner. We find the latter gives by far the more satisfactory results. The large "blow through" burners, such as may be used for welding and melting iron, or for melting platinum, do not give satisfactory results, from an economical point of view, with silica.

Some necessary precautions.—In working silica it is necessary to use very dark glasses to protect the eyes. The darkest glasses usually supplied by spectacle makers are not, in our experience, satisfactory. We use spectacles made specially from glass so strongly darkened, that it is difficult at first to work with them at all. We lay some stress on this matter, as we are satisfied that want of care in selecting the spectacles would be likely to result in injury to the sight of any one who should work silica before the blowpipe frequently, and for long spells.

Relative difficulty of working Glass and Silica.—The fashioning of apparatus from silica before the blowpipe is expensive, for the consumption of oxygen is large, and it demands some patience to build up large pieces of apparatus from shapeless masses of quartz. But owing to the remarkable fact that properly prepared silica, and also silica rendered vitreous by fusion, may be plunged directly into the hottest part of the oxy-gas flame, and afterwards be suddenly cooled, and reheated and recooled, apparently as frequently as one pleases, without any risk of its cracking, it is really very much easier to manipulate silica than any variety of glass. The most careless and most inexperienced worker runs no risk of breaking his apparatus through want of skill in managing the flame, or through the exigencies of his affairs compelling him to put aside half-finished work. It is important, however, to apply the flame to the opaque prepared silica, in the first instance, in such a way as to avoid the forming of air bubbles. Our practice is to heat first the lowest surface of each fresh mass of silica, and to take care that fusion proceeds regularly from below upwards. If this be done, a perfectly clear glass-like product is obtained.

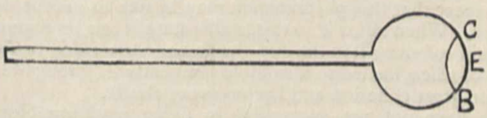
Silica is very liable to exhibit a phenomenon resembling devitrification, especially at the earlier stages before the traces of sodium and lithium, which seem to be present in most quartz, have been expelled. In order to avoid permanent injury to the finished work from this cause, care must be taken to employ a quiet flame. If this be done, any devitrification that may appear will be removed easily by reheating the disfigured surfaces.

To make Silica Tubes.—Before one commences to construct apparatus of silica it is well to prepare a stock of the vitreous material in the form of rods about 1 mm. in diameter. These are made by holding a small lump of non-splintering silica in the flame, by means of forceps with platinum tips, so as to melt one corner of the mass, pressing a second fragment of the material against the heated spot till the two adhere, heating the second portion from below upwards until it assumes a clear vitreous appearance, then adding a third fragment of silica to the second, a fourth to the third, and so on, until an irregular rod has been formed. Finally, this irregular rod must be reheated in small sections at a time, and drawn out to the desired extent. These rods are easily made by any one; a capable laboratory boy will produce about a score of rods 20 cm. long in an hour, after a few days' practice at the work; but his consumption of oxygen must be watched closely. The platinum tongs do not suffer much if one works in the manner described, for after the first start off they are only used to press *cold* fragments of silica against the fused ends of the growing rods. Our forceps have been used by four beginners, and are quite unharmed after several years.

When a supply of the rods of vitreous silica has been prepared, bind a few of them, at their ends, with fine platinum wire round a rod of platinum 1 to 1·5 mm. in diameter; heat the silica cautiously till the rods adhere to one another, and then withdraw the platinum core. If the tube is not perfect, add bits of silica at the defective places and reheat them. Close one end of the rough tube thus produced and blow a small bulb upon the closed end, proceeding in the manner employed for producing glass bulbs. Heat the bottom of the bulb, attach a rod of silica to it, reheat the whole bulb and then draw it out into a tube. Blow a fresh bulb at one end of the fine tube thus made, and draw this out in its turn until the tube is six or seven cm. in length. By the time this is accomplished the worker will have discovered that the hottest spot in his oxy-gas flame is just inside the tip of the inner cone, but not too near the orifice of the jet; and after this, if he can perform the simpler operations of glass working, he will, with a few weeks' practice, find it easy to make larger apparatus by following the simple instructions given below.

The chief difficulty met with when one wishes to make large bulbs, tubes, &c., is due to the fact that the only thoroughly satisfactory burners give comparatively small flames, and that it is only the hottest parts of these flames that give the desired results. There is no doubt, however, that suitable combinations of small burners could be contrived if they should be demanded, for the production of apparatus of really considerable dimensions.

In order to convert a small bulb of silica into a large tube, proceed as follows:—Heat one end of a fine rod of vitreous silica, and when it is in the plastic state apply it to the bulb at the point C. Then soften the adjacent parts of the rod and allow them to fall upon the bulb so as to form a ring C B, attached to the bulb. Heat the end of the bulb and C B till the silica softens, then blow out the end in the usual manner. If this process



is repeated the bulb will first become ovate and then form a short tube which can be lengthened, practically speaking, indefinitely. Tubes of 1·5 cm. diameter and of considerable length are easily made in this way by a patient person. It does not answer to add lumps of silica at E and then to blow them out; we had no success in working silica till we abandoned that method. The sides of a tube formed in that way are too thin, and blow-holes constantly form in them. The tubes are easily thickened, when necessary, by adding rings of silica, reheating these, and blowing them to spread the material as one would do when working glass. It is best to blow through a chamber containing potash. If this is connected to the end of the silica tube by india-rubber "valve" tube, one is able to move the silica tube with sufficient freedom. If a large tube is being made, it is best to blow out the softened material whilst it is still in the hottest part of the flame, but smaller objects may be transferred to the less hot parts of the flame with advantage at the moment of blowing. When a comparatively large object must be uniformly heated, it is convenient to place a sheet of silica in front of the flame a little beyond the object to be heated, in order that it may throw back the flames upon those parts of the material which are turned away from the chief source of heat. A suitable plate of silica is easily made by sticking together small, rounded masses of vitrified quartz.

We find that it is not difficult to produce tubes of various thicknesses and various internal diameters by heating and collapsing thin tubes made as described above, and that fine capillaries, "thick millimetre tubes," and tubes of two or three millimetres bore, of moderate thickness, can be produced in this way. Thermometer stems are best made by adding rings of silica to small bulbs, thickening them in the flame till their cavities are very small, and then quickly drawing them out whilst soft. Finally, we may add that tubes of silica can as readily be sealed to one another as tubes of glass, and that T-pieces and side tubes generally may be formed by fixing rings of silica in the positions to be occupied by the side tubes and extending them by blowing as already described, or by attaching tubes of suitable dimensions, previously prepared, to short side tubes blown as just described. It is therefore possible to construct such apparatus as Geissler tubes, small distilling tubes, and thermometers with stems of the German type, &c. We feel sure that small flasks could easily be made also by means of suitable combinations of several oxy-gas burners, though doubtless they would be rather expensive.

Finally, solid rods of silica five or six millimetres in diameter can be made by putting together small masses of prepared silica, or better by pressing together in the flame the softened ends of the fine rods already described.

Notes on some Properties of Vitreous Silica.[1]—A good many of the properties of silica have already been described by Prof. Boys, but a knowledge of the following, some of which are, we think, now described for the first time, will be found useful :—

(1) Vitreous silica is a very poor conductor of heat ; hence it is possible to hold a thick rod of silica very close to a strongly ignited zone.

(2) Our colleague, the Rev. H. Pentecost, finds that vitreous silica is less hard than chalcedony, but harder than felspar. Its surface appears to be about equally hard after it has been heated as strongly as possible and cooled suddenly, and after it has been heated and cooled in the air. Tubes of silica may be readily cut by means of a cutting diamond, and also with a good file of hardened steel.

(3) It has already been stated that cold vitreous silica can be plunged safely into the hottest part of an oxy-gas flame, and that the heating and cooling process can be repeated with impunity. Hot vitreous silica bears sudden cooling equally well. We have repeatedly plunged thick rods and large tubes of silica, heated till plastic, into cold water and even into fusible metal below 100°, without any injury to the material, for when afterwards cut with a diamond it did not fly.[2]

On the other hand, threads of silica become rotten when heated to the highest temperature of an ordinary blowpipe.[3] Large objects seem to be affected to a much less degree ; and we suspect that this phenomenon may be due to surface devitrification. When silica is in this friable state it can be re-annealed by again softening it in the oxy-gas flame. According to Gaudin, wires of silica heated to a suitable temperature (" rouge-blanc ") acquire great cohesion and become very elastic.

We have not yet succeeded in fixing platinum electrodes securely into silica tubes. But we have reason to hope that this may be found to be practicable by the use of kaolin, or some other natural silicate. Meanwhile, it seems possible that they might be soldered into the silica if necessary (see " Laboratory Arts," by R. Threlfall).

We may add that, according to M. Gaudin, emerald gives threads which are even more tenacious than those of silica.

W. A. SHENSTONE.
Clifton College. H. G. LACELL.

[1] See also Gaudin, *loc. cit.*

[2] Gaudin obtained similar results with drops of *liquid* silica.

[3] Gaudin observed a similar phenomenon in the case of fine threads, and so also, we believe, did Boys.

UNIVERSITY AND EDUCATIONAL INTELLIGENCE.

CAMBRIDGE.—The following is the Speech delivered, on April 26, by the Public Orator (Dr. Sandys) in presenting Mr. CHARLES HOSE for the degree of Doctor in Science, *honoris causa*.

Insulam Borneonem orbis terrarum inter insulas omnes prope maximam esse constat. Insulae autem illius insulis nostris fere duplo maioris in parte septentrionali patet regio quae unum e Britannis regem suum esse gloriatur. In eadem vero regione provincia quaedam, fluviorum ingentium infra confluentes, abhinc annos decem alumno nostro tradita est, qui barbarorum animos bellicosos pacis ad foedera vocavit, et armorum certamina saeva certaminis nautici in ludum mutavit. Idem non modo in foedere inter barbaros sanciendo victimarum caesarum haruspex sollertissimus, sed etiam avium in silvis volantium augur et auspex admirabilis exstitit. Ergo alumni nostri auspiciis et Helvetiae et Bataviae et Germaniae et Galliae et Britanniae musea avium et animalium exemplis eximiis aucta et suppleta sunt, et insulae ipsius zoologia, anthropologia, geographia, novo lumine illustratae. Talia propter merita alumnus noster non modo inter nosmet ipsos a regia geographiae societate praemio singulari donatus est, sed etiam inter Europae gentes tum aliis honoribus ornatus est, tum praesertim inter Germanos falconis albi eques iure optimo nominatus est. Nostra denique zoologiae, anatomiae, archaeologiae musea iam plus quam decimum per annum alumni nostri liberalitatem loquuntur. Ergo nos quoque insulae tantae non modo avium et animalium venatorem assiduum, sed etiam montium et fluminum exploratorem intrepidum, ob scientiarum fines etiam imperii Britannici prope terminos feliciter propagatos, laurea nostra hodie libenter coronamus.

Duco ad vos museorum nostrorum patronum liberalissimum, exploratorum nostrorum hospitem benignissimum, CAROLUM HOSE.

The General Board propose the establishment of a lectureship in ethnology, to which Dr. Haddon may be appointed ; and a lectureship in bacteriology and preventive medicine for Dr. Nuttall. Both have unofficially given valuable instruction in their respective subjects, and the recognition now suggested will probably be readily accorded by the University. New lectureships in experimental physics and in agricultural chemistry are also proposed.

The Board of Agricultural Studies, at the close of their first financial year, make a highly satisfactory report. Their income is sufficient for the provision of a complete course of instruction, which has now been organised under the direction of Prof. Somerville. They now ask the University to establish a special examination in agricultural science (botany, chemistry, physics and geology) for the ordinary B.A. degree.

THE history of the University of London, from the time of Sir Thomas Gresham's bequest, in 1575, of his house and garden in Bishopsgate, for the purposes of education, down to the completion of the work of the commissioners appointed under the University of London Act, 1898, is traced in an interesting article in the current number of the *Quarterly Review*. The large part the University has taken in the renascence of natural science, which will hereafter be regarded as the main characteristic of intellectual progress in the nineteenth century, is pointed out, as well as the fact that London degrees in science were the first conferred by British universities.

WE learn from *Science* that the University of Chicago has secured the 2,000,000 dollars needed to meet the requirements of Mr. Rockefeller's gift of an equal amount. At the recent convocation of the University, President Harper gave some details in regard to the gifts received since January 1st. They have come from more than 200 different persons, and 90 per cent. of them were unsolicited. The largest items appear to be the Gurley palæontological collection, 30,000 dollars from Mrs. Delia Gallup, and, given anonymously, 60,000 dollars for a commons, 50,000 dollars and 25,000 dollars for a students' club-house, 20,000 dollars towards a women's hall, and 30,000 dollars with specific use to be designated later. President Harper stated that the total assets of the University are now not far from 11,000,000 dollars.

THE Technical Education Board of the London County Council will proceed shortly to award five senior county scholarships, each of the value of 60*l*. a year for three years, with free tuition fees up to 30*l*. a year. These scholarships are intended to assist young men and women to pursue a course at some University or at a technical college of University rank. Some of the scholars who have been elected in previous years are holding their scholarships at Oxford and Cambridge, others are studying at technical colleges in different parts of England, while others are pursuing courses of study on the Continent. The scholarships are open only to candidates who are under twenty-two years of age, and whose parents are in receipt of not more than 400*l*. a year. In addition to the senior scholarships, the board has in past years made a certain number of grants of smaller value to assist students in pursuing advanced education, and the board has at its disposal a certain number of free places at University College, London, King's College, London, and Bedford College, London. The scholarships and grants are awarded, not on the result of a set examination, but on the consideration of the past achievements and promise of the candidates. Application forms may be obtained from the secretary of the Technical Education Board, 116, St. Martin's Place, W.C., to whom they should be returned not later than May 14. The board is also offering scholarships for the encouragement of horticulture and gardening. Two of these, tenable at the Swanley Horticultural College, Kent, give free board and tuition for two years, and may be reckoned as of the value of 60*l.* a year. They are open to candidates between the ages of sixteen and twenty, and one will be awarded to a young man and the other to a young woman as the result of a competitive examination. No candidate is eligible whose parents are in receipt of more than 400*l.* a year.

SOCIETIES AND ACADEMIES.

London.

Physical Society.—Ordinary meeting held by the invitation of Sir Norman Lockyer, F.R.S., in the Solar Physics Observatory, South Kensington, on April 27.—Mr. T. H. Blakesley, Vice-President, in the chair.—Sir Norman Lockyer gave a short account of the physical problems now being investigated at the Solar Physics Observatory, and their astronomical applications. The chief work carried on at the observatory is the comparison of stellar spectra with spectra obtained from lights emitted by laboratory sources. The light from a star (or the sun) and from an arc (or a spark) are focussed alternately upon the slit of a spectroscope, and the two spectra are photographed side by side upon the same plate. The number of lines in the arc spectrum depends upon which part of the arc is focussed on the slit. The image of the centre is rich in lines, the image of the edge gives a few single lines. Changes in spectra are also dealt with. The thickening and thinning of lines depends upon several things. In the first place, it depends upon the density of the substance, and thus the hydrogen lines in the spectrum of Sirius are much broader than those in α Cygni, the hydrogen being denser in the former star. Changes may also be produced by variations in quantity. A reduction in the quantity of a substance generally simplifies its spectrum, the longest line disappearing last. The motion of a luminous body to or from the spectroscope alters the wave-length of the light emitted and produces a shift in the lines of the spectrum. The amount of deviation is a measure of the velocity in the line of sight. In the case of Nova Aurigæ, we have dark and bright lines of the same substance side by side. This shows that there are two bodies involved, moving with different velocities, the one giving a radiation and the other an absorption spectrum. Another change in the lines depends upon temperature. In general an increase in temperature produces a greater number of lines, a notable exception being sodium, which gives its full number of lines at the temperature of an ordinary Bunsen flame. The spectra of metals obtained from the arc, and by sparking, are often quite different. Those lines which make their appearance, or are intensified in passing from the arc to the higher temperature of the spark, are known as enhanced lines. The comparison of stellar spectra with laboratory spectra is often easy. For instance, the presence of iron in the sun and hydrogen in Sirius is easily seen. Several lines in the spectrum of Bellatrix have been shown to be due to helium, the position of the lines being exactly the same as those due to the gases from clevite. In many cases it is possible to build up the spectrum of a star from the spectra of its constituents taken at the proper temperatures. For instance, the spectrum of γ Orionis can be closely imitated by means of oxygen, nitrogen, and carbon together with the well-marked lines of hydrogen and helium. We can roughly estimate by the character of the spectra of stars, the temperatures of those stars, and thus arrive at a stellar thermometry. Starting with a hot star like Bellatrix, and passing through β Persei, γ Lyræ, Sirius, Castor, Procyon to Arcturus, a cold star, we have a gradual change in the character of the lines which appear in the spectrum of any constituent. The widening of the lines in the case of spectra of sun spots enables us to trace changes in temperature of the sun, and we can compare these temperature changes with a variety of terrestrial phenomena, such as variation in latitude. The extraordinary number of lines exhibited by many metals suggests that what we are accustomed to call chemical elements are really complex bodies which are made up of simpler ones. Attempts have been made to build up the spectra of metals by superimposing simple sets of lines upon one another. In many cases a great number of series would be required to represent things completely. In the case of hydrogen it would be necessary to have at least twenty-seven series to give the structure spectrum only. Taking the atomic weight of hydrogen as unity, the atomic weight of the little masses which might give rise to any one of these series would be about ·0019. This is of the order of magnitude of the small bodies, of which the existence has been suggested by Prof. J. J. Thomson from his work on ions.

Paris.

Academy of Sciences.—M. Maurice Lévy in the chair.—The President announced to the Academy the death of M. Alphonse Milne-Edwards, and gave an account of his work.—On linear partial differential equations of the second order, and on the generalisation of the problem of Dirichlet, by M. Émile Picard.—On the heats of combustion and formation of some iodine compounds, by M. Berthelot. A redetermination of the heats of combustion of fourteen typical iodine derivatives. In spite of preconceived notions to the contrary derived from the incomplete combustion of such compounds as iodoform in air, no difficulty was experienced in completely burning any of the substances in the calorimetric bomb.—On rifling in cannon, by M. Vallier. A discussion on the best form of curve for the rifling of cannon, and an extension of the work of M. Zaboudski upon the same subject.—On the upright trunks, stems and roots of Sigillaria, by M. Grand'Eury. A study of the Sigillaria existing in a quarry in the neighbourhood of St. Étienne. From the fact that the stems (*Syringodendron*) found in a vertical position are not distributed at random, but are usually found in groups near each other forming well marked colonies, and from other characters of their growth, the author concludes that the hypothesis of R. P. Schmitt that they have been transported by water and deposited in the position found, is untenable. The view of Dawson that they have grown upon unsubmerged soil is also held to be untenable, all the facts noted by the author pointing to the Sigillaria have grown in the place in which they are found in marshy soil; under water varying from 1 metre to 7 or 8 metres in exceptional cases.—Reply to a reclamation of priority of M. Curie, by M. Gustave le Bon.—Reply by M. Th. Tommasina to a reclamation of priority, by MM. Ducretet and Popof.—Note by M. L. M. Bullier replying to M. Geelmuyden on a question of priority.—On the complementary terms in the criterium of Tisserand, by M. Gruey.—On differential equations of any order whatever with fixed critical points, by M. Paul Painlevé.—On the generalisation of analytical prolongation, by M. Émile Borel.—The theoretical cycle of gas engines, by M. A. Witz. A discussion of the remarks and criticism of M. Marchis.—On the dielectric constant and the dispersion of ice for electromagnetic radiations, by M. C. Gutton. The value of the refractive index for electromagnetic waves was found to vary with the wave-length from 1·76 for a wave-length of 14 cm. to 1·50 for 2088 cm., ice thus presenting normal dispersion for electromagnetic waves.—Two applications of Govi's camera lucida, by M. A. Lafay.—On the maximum sensitiveness practically employed in coherers for wireless telegraphy, by MM. A. Blondel and G. Dobkévitch. The increase of sensibility observed by M. Tissot to occur when the coherer is placed in a magnetic field, is ascribed by the authors to purely mechanical causes, the increase of contact between the powder and the electrodes produced by their mutual attraction.—On the radiations of radium, by M. E. Dorn. The author draws attention to the fact that he published a note on the deviation of the rays emitted by radio-active barium bromide in an electric field on March 11, independently of M. Becquerel.—On a new thermo-calorimeter, by M. G. Massol. Two improvements on Regnault's thermo-calorimeter are suggested, the replacement of alcohol by sulphuric acid, giving a large increase in the range of the instrument, and the use of a reservoir at the upper end of the instrument as in Walferdin's maximum thermometer by which the sensitiveness of the thermo-calorimeter is increased without undue lengthening of the stem. The instrument thus modified has been of especial service in the study of superfused liquids.—A new indicator in acidimetry, and its application to the estimation of boric acid, by M. Jules Wolff. The indicator proposed is a solution of ferric salicylate in sodium salicylate, which passes from violet to orange when the solutions become alkaline. Data are given showing the results obtainable with borates.—On the selenides and chloroselenides of lead, by M. Fonzes-Diacon.—Crystallised lead selenide, PbSe, is obtained by reduction of a selenate by hydrogen or by carbon, by the action of hydrogen selenide upon the vapours of lead chloride, and by the direct fusion in the electric furnace of precipitated lead selenide.—On the alkaline selenio-antimonites, by M. Pouget. Selenio-antimonites can be obtained of analogous composition to the sulpho-antimonites already known; mixed sulphur and selenium compounds, thioantimonites in which the sulphur is only partially replaced by selenium have also been prepared.—Micro-chemical researches on yttrium, erbium and didymium, by MM. M. E. Pozzi-Escot and H. C. Couquet.—Mechanism of the senility and death of nerve cells, by M. G. Marinesco. As the result of a study of nerve cells from the brain and spinal column of individuals of ages ranging from 60 to 110, it was found that the modifications constituting the old age of the nerve cell do not only consist of the diminution, more or less marked, of this body, but include other more interesting changes, some of which, tangible to the microscope, are described.—Heteroplastism, by M. Nicolas-Alberto Barbieri.—A determination of the conditions under which tissue from one mammal can be grafted on to another, to replace similar tissue. The results of experiments are given on the grafting of muscular, vascular, and nervous tissue.

DIARY OF SOCIETIES.

THURSDAY, MAY 3.

ROYAL INSTITUTION, at 3.—A Century of Chemistry in the Royal Institution: Prof. J. Dewar, F.R.S.

LINNEAN SOCIETY, at 8.—Note on the Movements in Fishes: Prof. R. J. Anderson.—On New Species of *Halimeda*, from Funafuti: Miss E. S. Barton.—On West Indian Fungi: Miss A. L. Smith.

CHEMICAL SOCIETY, at 8.—Brazilin, Part IV.: A. W. Gilbody, W. H. Perkin, jun., and J. Yates.—Hæmatoxylin, Part V.: W. H. Perkin, jun., and J. Yates.—The Substituted Nitrogen Chlorides and Bromides derived from *o*- and *p*-acet-toluide and their Relation to the Substitution of Halogens in Toluides and Toluidines: F. D. Chattaway and K. R. P. Orton.

RÖNTGEN SOCIETY, at 8.—Demonstration and Exhibition of New Methods and Results.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—If the discussion on Prof. Forbes's Paper, read on April 26, is concluded, the following Paper will be read:—The Calculations of Distributing Systems of Electric Traction under British Conditions: H. M. Sayers.

FRIDAY, MAY 4.

ROYAL INSTITUTION, at 9.—Pottery and Plumbism: Prof. T. E. Thorpe, F.R.S.

GEOLOGISTS' ASSOCIATION, at 8.—Some Features of the Recent Geology of Western Norway: Horace W. Monckton.

COLD STORAGE AND ICE ASSOCIATION (Examination Hall, Victoria Embankment), at 11.30.—Recent Researches in Refrigeration: G. Halliday.—Insulation and Insulators: W. D. A. Bost.——At 3.—Electric Lighting of Cold Stores: W. B. Esson.—The Design and Construction of Buildings for Ice Factories and Cold Storage: P. Gaskell.

SATURDAY, MAY 5.

ROYAL INSTITUTION, at 3.—Egypt in the Middle Ages: Prof. Stanley Lane-Poole.

MONDAY, MAY 7.

SOCIETY OF ARTS, at 8.—The Incandescent Gas Mantle and its Use: Prof. Vivian B. Lewes.

SOCIETY OF CHEMICAL INDUSTRY, at 8.—The Production of Nitrate of Soda in Chili: Dr. W. Newton.

TUESDAY, MAY 8.

ROYAL INSTITUTION, at 3.—A Corner of Sussex: Dr. H. R. Mill.

SOCIETY OF ARTS, at 8.—Art Metal Work: Nelson Dawson.

ZOOLOGICAL SOCIETY, at 8.30.—A List of the Batrachians and Reptiles of the Gaboon (French Congo), with Descriptions of New Genera and Species: G. A. Boulenger, F.R.S.—On the Birds of Hainan: W. R. Ogilvie Grant.—On the Rhopalocera collected by the late Mr. John Whitehead in the Interior of the Island of Hainan: Philip Crowley.

ROYAL PHOTOGRAPHIC SOCIETY, at 8.—The Effect of Colour on Gradation: Chapman Jones.

WEDNESDAY, MAY 9.

SOCIETY OF ARTS, at 8.—Improvement of our Roads: A. Moresby White.

GEOLOGICAL SOCIETY, at 8.—The Pliocene Deposits of the East of England. Part II. The Crag of Essex (Waltonian) and its Relation to that of Norfolk and Suffolk: F. W. Harmer. With a Report on the Inorganic Constituents of the Crag by Joseph Lomas.—The Salt Lake of Larnaca (Cyprus): C. V. Bellamy.

IRON AND STEEL INSTITUTE, at 10.30.—General Meeting.—On Blowing-Engines driven by Crude Blast-Furnace Gas: Adolphe Greiner.—The Solution Theory of Iron: Baron H. von Jüptner.—The Use of Fluid Metal in the Open-Hearth Furnace: James Riley.—Iron and Phosphorus: J. E. Stead.—The Continuous Working of the Open-Hearth Furnace: Benjamin Talbot.

THURSDAY, MAY 10.

ROYAL SOCIETY, at 4.30.—*Probable Papers*: On the Diffusion of Gold in Solid Lead at the Ordinary Temperature: Sir W. Roberts-Austen, F.R.S.—On Certain Properties of the Alloys of the Copper-Gold Series: Sir W. Roberts-Austen, F.R.S., and Dr. T. K. Rose.—Experiments on Supposed Vascular and Visceral Factors in the Genesis of Emotion: Prof. Sherrington, F.R.S.—On the Brightness of the Corona of April 16, 1893. Preliminary Note: Prof. H. H. Turner, F.R.S.

ROYAL INSTITUTION, at 3.—A Century of Chemistry in the Royal Institution: Prof. J. Dewar, F.R.S.

MATHEMATICAL SOCIETY, at 5.30.—Special Meeting.—The Differential Equation whose solution is the Ratio of Two Solutions of a Linear Differential Equation: M. W. J. Fry.—A Congruence Theorem relating to Eulerian Numbers and other Coefficients: Dr. Glaisher, F.R.S.

INSTITUTION OF ELECTRICAL ENGINEERS, at 8.—A Frictionless Motor Meter: S. Evershed.

IRON AND STEEL INSTITUTE, at 10.30.—Ingots for Gun Tubes and Propeller Shafts: F. J. R. Carrulla.—The Manufacture and Application of Water-Gas: Carl Dellwik.—The Equalisation of the Temperature of Hot Blast: Lawrence Gjers and Joseph H. Harrison.—The Manganese Ores of Brazil: H. Kilburn Scott.—The Utilisation of Blast-furnace Slag: Ritter Cecil von Schwarz (Liége).

FRIDAY, MAY 11.

ROYAL INSTITUTION, at 9.—Shakespeare and True Patriotism: Sidney Lee.

ROYAL ASTRONOMICAL SOCIETY, at 8.

SATURDAY, MAY 12.

ROYAL INSTITUTION, at 3.—South Africa; Past and Future: Dr. Alfred P. Hillier.

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