and unique position of Mr. Darwin, the scientific historian of the future will recognize how much the development of the modern theory of evolution, from its first conception in the mind of Mr. Darwin, was facilitated by the interaction upon one another of the work and minds of Darwin, Hooker, and Lyell. It was due to the earnest efforts of his two friends that Mr. Darwin was induced to publish the first sketch of the origin of species at all. And no one, had he been alive, would have more cordially recognized than Mr. Darwin how vast an armoury of facts the wide botanical experience of Hooker constantly placed at his disposal in fortifying and supporting his main position.

Of the two Royal Medals, it is customary, though it is not an invariable rule, to award one for mathematics or physics, and the other for biological science.

The medal, which, in accordance with the usual rule, has been devoted to mathematics and physics, has this year been awarded to Colonel A. Clarke for his comparison of standards of length, and determination of the figure of the earth.

Colonel Clarke was for some twenty-five years the scientific and mathematical adviser for the Ordnance Survey, and whilst acting in that capacity he became known to the whole scientific world as possessing a unique knowledge and power in dealing with the complex questions which arise in the science of geodesy.

His laborious comparison of the standards of length, carried out under General Sir Henry James, R.E., are universally regarded as models of scientific precision.

His determination of the ellipticity and dimensions of the earth from the great arcs of meridian and longitude involved a very high mathematical ability and an enormous amount of labour. The conclusion at which he arrived removed an apparent discrepancy between the results of pendulum experiments and those derived from geodesy, and is generally accepted as the best approximation hitherto attained as to the figure of the earth.

The accounts of these investigations have been published in a number of memoirs, several of which have been communicated to the Royal Society.

In 1880 he published a book on geodesy, which, besides giving an accurate account of that science, embodies the main results of the work of his life.

In the biological division of the sciences the Royal Medal has this year been awarded to Prof. Henry N. Moseley for his numerous researches in animal morphology, and especially his investigations on Corals and on Peripatus.

The result of his elaborate investigations on Corals, an account of which has been published in the Philosophical Transactions, was to show that the Milleporidæ and the Stylasteridæ were not, as had been thought, Anthrozoan in nature, but were composite coral-forming hydroids. Many new genera and species were described by him in these memoirs, and in fact a new group of organisms, the Hydrocorallinæ, was not merely indicated, but the complete morphology and systematic subdivisions of that order were worked out.

Moseley's memoir on Peripatus is not less remarkable. He was the first to point out the true nature of this remarkable animal, and to demonstrate that it was in reality an archaic Arthropod. The subsequent investigations of Balfour and Sedgwick have further increased the importance of Moseley's discovery.

Moseley's memoir on the Land Planarians of Ceylon (Phil. Trans., 1872) is an important contribution to the anatomy of the Turbellaria. He was the first to apply the method of section-cutting to the Planarians, and his paper is full of new facts of great importance, which have stood the test of subsequent work over the same ground.

Besides these three great memoirs published in the Philosophical Transactions, Moseley has published numerous minor discoveries, and his spectroscopic observations on the colouring matters of marine organisms have proved the starting-point of valuable investigations.

Mention must not be omitted of Moseley's admirable book, "Notes of a Naturalist on the *Challenger*," which has been justly compared, for the varied ability, interest, and activity which it evinces on the part of the author, to Darwin's "Voyage of the *Beagle*."

Since the date of the works above referred to, Moseley has been chiefly active in the discharge of his duties as Linacre Professor, and the success with which he has directed the work of his pupils is evinced by the important memoirs on zoological subjects which several of them have produced whilst working under his direction. He has himself also published a remarkable discovery with regard to the Chitons. In the shells of many genera and species of these mollusks he has detected highly developed eyes, of which he has described the minute structure.

The Davy Medal for the year 1882 was awarded by the Council to Profs. Mendelejeff and Lothar Meyer conjointly, for their discovery of the periodic relations of the atomic weights. This relation, now known as "the Periodic Law," has attracted great attention on the part of chemists, and has even enabled Prof. Mendelejeff to predict the properties of elements at the time unknown, but since discovered, such as gallium for instance.

But while recognizing the merits of chemists of other nations, we are not to forget our own countrymen; and accordingly the Davy Medal for the present year has been awarded to Mr. John A. R. Newlands, for his discovery of the Periodic Law of the chemical elements. Though, in the somewhat less complete form in which the law was enunciated by him, it did not at the time attract the attention of chemists, still, in so far as the work of the foreign chemists above mentioned was anticipated, the priority belongs to Mr. Newlands.

SCIENTIFIC SERIALS.

Rivista Scientifico-Industriale, October.—On the crepuscular phenomena of 1883–84, by Prof. Annibale Riccò. These remarks are made in connection with the author's comprehensive work, now nearly ready for the press, on the remarkable after-glows of the years 1883–84. One of the chief conclusions arrived at in this work, after a careful consideration of all the evidence, is that the volcanic theory, first advanced by Mr. Norman Lockyer, is the only one that can be now accepted. The light-effects appeared soon after the great eruption of Krakatão on August 27, 1883, were propagated from the neighbourhood of the volcano to the most distant parts, and then gradually died out, precisely in the same way that similar manifestations were made immediately after the eruption of the island of Ferdinandea (Julia) in 1831. It is further concluded that the after-glows were due, not to the ashes or scoriæ ejected by Krakatão, but to the condensation of the aqueous vapours caused by the volcano, which condensation increased the quantity of solar light reflected by the atmosphere.

Bulletin de l'Académie Royale de Belgique, October.—On the mass of the planet Saturn, by L. de Ball. By a comparative study of its satellites, made at the Observatory of Cointe during the winter of 1885–86, the author finds the mass of Saturn to be 1/3492·8 that of the sun, which is rather less than the values obtained by Meyer, Hall, and Struve, which are 1/3482·5, 1/3481·3 and 1/3490·8 respectively.—Experimental researches on the sense of vision in the Arthropods, by Felix Plateau. Of this elaborate memoir the first part only appears in this issue, dealing first with the work already accomplished down to the year 1887 on the structure and functions of simple eyes; secondly, with the eyes of Myriapods. The four remaining parts, to be published in subsequent numbers of the *Bulletin*, will treat of vision in the spiders, and in larvæ generally; of the part played by the frontal eyes in perfect insects; of compound eyes and the perception of movements; with an anatomico-physiological summary, and experiments with insects.—Remarks on the total solar eclipse of August 19, 1887, by L. Niesten. A comparative study of the photographs obtained by MM. Niesten and Karelin at the station of Jurjewetz, shows that with Van Monckhoven's sensitive plates an almost instantaneous image is obtained not only of the protuberances but also of the corona; and further that a pose of thirty seconds gives no more detailed images of the corona than those obtained at the end of eight seconds. Hence it would appear that photographs of the corona obtained after an exposure of over a minute should be attributed to physical phenomena due to the atmospheric conditions, or to light-effects produced in the photographic apparatus itself.

SOCIETIES AND ACADEMIES.

LONDON.

Linnean Society, November 3.—W. Carruthers, F.R.S., President, in the chair.—Mr. J. H. Hart, of Trinidad, was elected a Fellow of the Society.—The President called attention

to the death-roll since last June meeting, specially deploring the loss of Prof. Julius von Haast, N.Z., Dr. Spencer Baird, U.S., and Prof. Caspary, of Königsberg.—Mr. H. N. Ridley gave an account of his natural history collection in Fernando Noronha. The group of islands in question is in the South Atlantic, 194 miles east of Cape San Roque. The largest is about five miles long and two miles across at broadest part. Although chiefly basaltic, phonolite rocks crop up here and there. The indigenous fauna and flora seem to have been much modified, and in some cases extirpated, by human agency. Of mammals, the cat is reported to have become feral, and rats and mice swarm ; Cetacea occasionally frequent the coast. The land-birds comprise a dove, a tyrant, and a greenlet (*Virio*). Sea-birds are numerous, though apparently less so than in the time of the early voyagers. Among reptiles occurs an Amphisbæna, a Skink, and a Gecko ; turtles also haunt the bays. The absence of batrachians and fresh-water fish is noteworthy. A well-known Brazilian species of butterfly is plentiful. Though insects generally are abundant, there are, notwithstanding, but few species. Two shells (*Trochus*) show a southern distribution, though other marine forms indicate West Indian relationship. Several interesting plants were got, a *Solanum* with medicinal properties, a new *Erythrium*, and flower of the "Burra," a Euphorbiaceous tree. Of ferns, mosses and hepatics, lichens and fungi, several interesting sorts were collected.—Mr. Geo. Murray exhibited *Vallonia ovalis* from Bermuda and Grenada ; the former sort consisting of a balloon-shaped cell an inch long and two wide. He explained by diagrams the development of *V. utricularis*, incidentally comparing this with *Sciadium*.—Prof. Marshall Ward showed specimens and made remarks on the peculiar development of *Agaricus* (*Amillaria*) *mellens*.—Mr. E. A. Heath exhibited examples of fruits of two species of *Solanum* from Barbados.—A paper was read on the scars occurring on the stem of *Dammara robusta*, by Mr. S. G. Shattock. He says that the process of disarticulation of the branches is like that by which a leaf or other organ is shed. The parenchymatous cells across the whole zone of articulation multiply by transverse division, a layer of cork resulting from the formation of this secondary meristem, and through the distal limits of this, solution of continuity occurs. After this the slender connecting bond of wood is broken across by the weight of the branch or the first trivial violence ; this completion of the process being aided, perhaps, by the tension made upon the wood in consequence of the cell-division of the surrounding parenchyma which occurs across its axis. It thus happens that the whole of the parenchymatous system of the stem is closed by cork *before* the branch is actually shed.—A communication followed, by Messrs. J. G. Baker and C. B. Clarke, on the Ferns of Northern India ; it being a supplement to a memoir published in the Society's Transactions.

Physical Society, November 12.—Prof. W. E. Ayrton, F.R.S., Vice-President, in the chair.—Lieut. Bacon, R.N., was elected a member of the Society.—Owing to the illness of Dr. Shettle, the paper announced to be read by him was postponed. —The following communication was read :—On a geometrical method of determining the conditions of maximum efficiency in the transmission of power by alternating currents, by Mr. T. H. Blakesley. In this paper the author confines himself to the consideration of a simple circuit containing generating, conveying, and recipient parts, in which the E.M.F. follows the law of sines. The maximum E.M.F.'s of both machines are supposed known, together with the resistance and coefficient of self-induction of the complete circuit. The variable on which the efficiency of transmission depends is the difference of phase of generator and receiver. A geometrical construction is given by which the phase which gives maximum efficiency can be determined. Mr. Kapp thought the construction would not apply where the receiver does mechanical work, owing to the E.M.F. not being a true sine function of the time. He also mentioned an experiment performed on a motor driven successively by alternating and direct currents, in which the *apparent* power $\left(\sqrt{\bar{e}^2}\sqrt{\bar{c}^2}\right)$ supplied by alternating currents was about five times that required when direct currents were used, the motor giving out the same power in the two cases. From this he inferred that the ratio of power to weight is much greater for a direct than for an alternating current motor. This he considered a serious drawback to the use of alternate currents for transmitting power. After some remarks by Prof. Ayrton and Prof. S. P. Thompson, Mr. Blakesley said that by placing a condenser between the terminals of the recipient machine a greater current could be passed through the receiver than that in the generator and line.—Prof. A. W. Rücker exhibited and described a lecture experiment for determining the velocity of sound. The principle of the arrangement is that used by Fizeau in determining the velocity of light. A vibrating reed is used as the source of sound and a sensitive flame as receiver. A long U-shaped tube has its two ends placed near and parallel to the plane of a perforated disk, which is capable of rotating about an axis perpendicular to its own plane. The reed and sensitive flame occupy similar positions on the opposite side of the disk. On rotating the disk, the sensitive flame flares or is quiescent according as the time taken to travel the length of the tube is an even or an odd multiple of $\frac{T}{2n}$, where T is the time of one revolution and n the number of holes in the disk.—Mr. Bosanquet exhibited a form of polariscope he had made some time ago for researches on the polarization of the sky. Its chief feature is a compound prism of right- and left-handed quartz which shows coloured bands with polarized light, whatever be the direction of the plane of polarization. It also forms a very sensitive object for polarimeters.

Zoological Society, November 15.—Prof. W. H. Flower, F.R.S., President, in the chair.—The Secretary read a report on the additions that had been made to the Society's Menagerie during the months of June, July, August, September, and October, 1887, and called attention to certain interesting accessions which had been received during that period.—A communication was read from Herr W. von Nathusius, of Königsborn, on *Symbiotes equi*, a parasite of the horse, causing what is called "greesy-foot," of which he sent specimens for exhibition.—The Secretary read a letter addressed to him by Dr. Emin Pacha, dated Wadelai, April 15, 1887, referring to some communications which he was proposing to offer to the Society. —A letter was read from Surgeon-General George Bidie, referring to a case of the breeding of the Elephant in captivity.—Prof. Bell made some observations on the "British Marine Area," as proposed to be defined by the Committee of the British Association. Prof. Bell opposed the idea of omitting the Channel Islands from the British area.—Prof. A. Newton, F.R.S., exhibited (on behalf of Mr. W. Eagle Clarke) a specimen of Bulwer's Petrel (*Bulweria columbina*), believed to have been picked up dead in Yorkshire.—Mr. H. E. Dresser exhibited (on behalf of Lord Lilford) specimens of a new species of Titmouse allied to the Marsh-Tit (*Parus ater*), obtained by Dr. Guillemard in Cyprus, which he proposed to designate *Parus cypriotes*.—Mr. Boulenger exhibited a living specimen of a rare African Batrachian (*Xenopus lævis*), which had been sent to him by Mr. Leslie, of Port Elizabeth.—Prof. Flower exhibited a photograph of a specimen of Rudolphi's Whale (*Balænoptra borealis*), taken in October last, in the Thames near Tilbury.—Mr. G. A. Boulenger, read on account of the Reptiles and Batrachians collected by Mr. H. H. Johnston on the Rio del Rey, West Africa. Amongst these were examples of two species of Batrachians new to science. —Mr. Edgar A. Smith read some notes on three species of shells obtained by Mr. H. H. Johnston at the Rio del Rey, Cameroons. —Mr. A. G. Butler read a paper containing an account of two small collections of African Lepidoptera obtained by Mr. H. H. Johnston at the Cameroons and the Rio del Rey.—A communication was read from Mr. G. E. Dobson, F.R.S., on the genus *Myosorex*. The paper contained the description of a new species from the Rio del Rey (Cameroons) district, which he proposed to call *Myosorex johnstoni*, after Mr. H. H. Johnston, who had sent home the specimens.—Mr. G. A. Boulenger gave the description of a new species of *Hyla* from Port Hamilton, Corea, living in the Society's Gardens, which he proposed to name *Hyla stepheni*, after its discoverer.

Institution of Civil Engineers, November 8.—Mr. G. B. Bruce, the new President, after presenting the medals and premiums announced at the annual meeting in May last, delivered his address on assuming the chair for the first time. Having entered upon his apprenticeship in the locomotive works of Robert Stephenson within a few months of the beginning of the present reign, the President chose the state of engineering then and in the Queen's Jubilee year as the subject of his remarks. Starting with the workshop, in 1837 machine-tools were practically unknown, reliance being placed upon the skill of the workmen, who could chip and file by hand almost as truly as the machine. It was scarcely credible, but it was a fact, that there

was not a single crane in Robert Stephenson's shops in 1837; and the only steam-engine, in that which was the most important locomotive shop in the world of that day, was a vibrating pillar-engine, with a single 16-inch cylinder and 3-feet stroke. About the only machine-tool, properly so called, in the works was a planing-machine, which probably weighed about 3 tons. At the present time there were lathes 75 feet long, weighing 100 tons, giving a yield of steel-turnings at the rate of 10 and 20 tons a day, and planing-machines weighing 90 tons and operating over surfaces of 20 feet by 15 feet. Having spoken of the changes in the position of the workmen, the President referred to the progress of railways, the development of the iron and steel industries, and sanitary engineering. Reference was made to the electric telegraph, which had developed from the 5-needle instrument of Cooke and Wheatstone, employing six wires and working at about the rate of four words a minute, to the system of multiplex and automatic telegraphy, by means of which six messages could be sent at once on one wire with a speed of, say, 600 words per minute. Touching successively on the telephone, electric light, and the application of electricity as a motive power, the President hazarded the opinion that when some way should have been discovered of storing up in a more efficient and financially successful manner the unemployed forces of Nature, such as the winds and tides, then would electricity become a factor in the world's life compared with which it was at present as nothing.

Anthropological Institute, November 22.—Prof. Flower, C.B., Vice-President, in the chair.—Canon Isaac Taylor read a paper on "The Primitive Seat of the Aryans," in which he urged the view that the Finns are the nearest representatives of the ancient Aryan stock, and that the race took its origin in North Germany.

EDINBURGH.

Royal Physical Society, November 16.—Prof. Duns delivered the introductory addressfor the session 1887–88. At the outset obituary notices of several deceased Fellows were given, notably of Mr. Robert Gray, the late Secretary of the Society. After some remarks upon the history and progress of the Society, he passed on to consider the claims of Scotland upon Government aid for scientific purposes, and advocated the union of the various scientific corporations of Edinburgh to form an Academy of Science for dealing with general questions of this nature.

PARIS.

Academy of Sciences, November 21.—M. Janssen in the chair.—On the nervous system of the Gasteropods (Aplysia type, *A. depilans* and *A. fasciata*), by M. H. de Lacaze-Duthiers. The Aplysia, a large mollusk, abounding especially in the Mediterranean seaports, is here studied for the purpose of determining the type of its nervous system in order to compare it with those of Gadinia, Testacella, and other Gasteropods already described by the author.—Remarks in connection with M. Colladon's recent note on waterspouts and tornadoes, by M. H. Faye. It is again shown that M. Colladon's illustration, as published in the *Comptes rendus*, has only a very remote connection with true waterspouts and whirlwinds. Reference is also made to the statement, in W. Ferrel's new work on meteorology, that much sea-water is carried up by the ascending current of waterspouts, the fish and other animals in small ponds being even in this way borne aloft and wafted to great distances. On the contrary, M. Faye insists with Lieutenant Finley, of the United States Signal Service, that no appreciable quantity of water is pumped up in this way, although much is driven horizontally to the right and left by the gyratory velocity of the air, which has always a descending, and never an ascending motion.—On the crystalline form of cinchonamine, by M. C. Friedel. Some crystals of the alkaloid discovered by Arnaud in certain varieties of quinquinas are described as hexagonal prisms terminating in a rhombohedron and of the true orthorhombic type.—On a meteorite which fell on August 18/30, 1887, at Taborg, in the Government of Perm, Russia, by M. Daubrée. This meteorite, which has but slight cohesion, with density 3·620, appears to closely resemble those which fell on April 1, 1857, at Heredia (Costa Rica); on May 14, 1861, at Canellas, Province of Barcelona (Spain); on January 19, 1867, at Khethree, Rajputana (India); and on August 17, 1875, at Feid Shair (Algeria).—On a simple relation between the wave-lengths of spectra, by M. A. E. Nordenskjöld. The researches here described tend to confirm the author's previous view that, at least in the spectra of certain simple bodies, the differences between the logarithms of the wave-lengths of each element are simple multiples of the same number. The universality of this law, as applicable to the spectra of all bodies, is still far from being established. But further investigation will probably show, either that the spectra of all simple bodies conform absolutely to this law, or else that they are disposed in more or less independent groups, to which the law may still be applicable.—On the volcanoes of Hawaii, by Mr. James Dana. Reserving for the *American Journal of Science* a detailed account of a recent visit to these volcanoes, the author here remarks chiefly on the remarkable fluidity of the lavas, and on the fact that the eruptions show no sign of being in any way associated with the surrounding marine waters. The salts deposited in the hottest recesses, and those of solfataras, do not appear to have hitherto yielded any chloride, while the sulphate of soda is very common.—Researches on meteorites: general conclusions, by Mr. J. Norman Lockyer.—Observations of Olbers' comet (1815 I.), at its return in 1887, made with the 0.38 m. equatorial of the Bordeaux Observatory, by MM. G. Rayet and F. Courty. The observations cover the period from September 8 to September 25.—On sidereal evolution, by M. Stanislas Meunier.

BOOKS, PAMPHLETS, and SERIALS RECEIVED.

Die Welt in Ihren Spiegelungen unter dem Wandel des Völkergedankens. Prolegomena zu Einer Gedankenstatistik; Ethnologisches Bilderbuch mit Erklärendem Text: A. Bastian (Mittler, Berlin).—Sound, Light, and Heat: M. R. Wright (Longmans).—A Primary Geometry: S. E. Warren (Trübner).—Quantitative Chemical Analysis: Classen and Herrick (Trübner).—Myth, Ritual, and Religion: A. Lang (Longmans).—Translations of Foreign Biological Memoirs, I. Memoirs on the Physiology of Nerve, of Muscle, and of the Electrical Organ, edited by J. Burdon-Sanderson (Clarendon Press).—Earth Knowledge: Harrison and Wakefield (Blackie).—Colour: Prof. A. H. Church (Cassell).—Elementary Microscopical Manipulation: T. C. White (Roper and Drowley).—Quarterly Journal of Microscopical Science, November (Churchill).—Annales de la Faculté des Sciences de Toulouse, tome i., 1887, 4 parts (Gauthier-Villars, Paris).

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