Intelligence is a conservative principle, and always will direct effort and use into lines which will be beneficial to its possessor. Thus we have the source of the fittest—*i.e.*, addition of parts by increase and location of growth force directed by the will—the will being under the influence of various kinds of compulsory choice in the lower, and intelligent option among higher animals. Thus intelligent choice may be regarded as the originator of the fittest, while natural selection is the tribunal to which all the results of accelerated growth are submitted. This preserves or destroys them, and determines the new points of departure on which accelerated growth shall build.

Acceleration under the influence of effort accounts for the existence of rudimental characters. Many other characters will follow at a distance, the modifications proceeding in accordance with the laws here proposed, and retardation is accounted for by complementary or absolute loss of growth force.

SOCIETIES AND ACADEMIES

LONDON

Royal Society, January 18.—"Investigations of the Currents in the Strait of Gibraltar, made in August 1871," by Captain G. S. Nares, R.N., of H.M.S. *Shearwater*, under instructions from Admiral Richards, F.R.S., Hydrographer of the Admiralty.

Geological Society, Jan. 10.—Mr. Joseph Prestwich, F.R.S., president, in the chair. "On Cyclostigma, Lepidodendron, and Knorria from Kiltorkan." By Prof. Oswald Heer. In this paper the author indicated the characters of certain fossils from the yellow sandstone of the South of Ireland, referred by him to the above genera, and mentioned in his paper "On the Carboniferous Flora of Bear Island," read before the Society on November 9, 1870 (see Q. J. G. S. vol. xxvii. p. 1). He distinguished as species *Cyclostigma kiltorkense*, Haught., *C. minutum* (Haught.), *Knorria acicularis*, Göpp. var. *Bailyana*, and *Lepidodendron Veltheimianum*, Sternb.—Mr. Carruthers was glad that he had made the observations which he did on Prof. Heer's former paper, as it had caused the Professor to give the reasons on which his opinions were based. He was doubtful whether the success which had attended Prof. Heer's determination of species from leaves justified the application of the same principles to mere stems. He could not accept the difference in size or distance of leaf-scars as a criterion of species, inasmuch as they were merely the result of the difference in the age and size of the parts of the plants on which they were observed. Even Prof. Heer himself had united together specimens presenting greater differences in this respect than those which he distinguished. He considered *Cyclostigma kiltorkense*, *C. minutum*, and *Lepidodendron Veltheimianum* to be founded on different parts of one species. In the Kiltorkan fossils the outer surface of the original stems was often broken up into small fragments, the phyllotaxy on which proved them to be portions of large stems, and not entire branches. As to *Knorria*, it was certainly the interior cast of the stem of *Lepidodendron*, with casts of the channels through which the vascular bundles passed with some cellular tissue to the leaves; and the specimen figured showed that it belonged to a branch similar to that represented as *C. minutum*. He considered that the four supposed species belonging to three genera were only different forms of the same plant.—"Notes on the Geology of the Plain of Marocco, and the Great Atlas." By Mr. George Maw. The author described first the characters presented by the coast of Marocco, and then the phenomena observed by him in his progress into the interior of the country and in the Atlas Chain. The oldest rocks observed were ranges of metamorphic rocks bounding the plain of Marocco, interbedded porphyrites and the porphyritic tuffs forming the backbone of the Atlas Chain, and the Mica-schists of Djeb Tezah in the Atlas. At many points in the lateral valleys of the Atlas almost vertical grey shales were crossed; the age of these was unknown. Above these comes a Red Sandstone and Limestone series, believed to be of Cretaceous age, and beds possibly of Miocene age, which occupied the valleys of the Atlas and covered the plain of Marocco, where vestiges of them remain in the form of tabular hills. The probable age of these beds was determined on the evidence of fossils. The author noticed the sequence of denuding and eruptive phenomena by which the arrangement and distribution of these rocks has been modified, and described the more recent changes resulting in the formation of enormous boulder-beds flanking the northern escarpment of the Atlas plateau, and of great moraines at the heads of the valleys of the Atlas, both of which he ascribed to glacial action. An elevation of the coast line of at least seventy feet was indicated by raised beaches of concrete sand at Mogador and elsewhere, and the author considered that a slight subsidence of the coast was now taking place. The surface of the plain of Marocco was described as covered with a tufaceous crust, probably due to the drawing up of water to the surface from the subjacent calcareous strata and the deposition from it of laminated carbonate of lime. Mr. Ball, as an Alpine traveller who had also visited the Atlas in company with Dr. Hooker and Mr. Maw, offered a few remarks. The plain of Marocco was not, in his opinion, a level, but an inclined plane, rising gradually in height up to the foot of the mountain, so that the base of the boulder ridges was at some height above the level of the plain near Marocco. He did not think that the boulder deposits could be safely attributed to glaciers, but thought rather that they had been carried into and deposited in a shallow sea. He thought also that Mr. Maw had somewhat over-estimated the thickness of some of the boulder deposits; and though there was one instance of an undoubted moraine in one of the higher valleys of the Atlas, yet he could not agree in the view that the glaciation of the Atlas was general. He could not accept such a great thickness of beds as that represented by the vertical shales in Mr. Maw's section. Prof. Ramsay was pleased that the author, though giving so many interesting details, had not assigned any definite age to many of the beds. He agreed with him as to the cause assigned for the great tufaceous coating of the country. He had already assigned the same cause for the existence of certain saline beds, and would attribute the existence of the great coating of gypsum at slight depth below the surface of the Sahara to the same cause. As to the existence of moraines, he was not surprised to find them in the Atlas, as they were already known in the mountains of Granada. As to the escarpments, it was now well known that, as a rule, they assumed a direction approximately at right angles to the dip of the strata; and he felt inclined to consider that the bulk of the mounds at the foot of the escarpment of the Atlas were rather the remains of a long series of landslips from the face of the cliffs than to an accumulation of moraine matter. Mr. D. Forbes commented on the similarity of the rocks to those of the Andes in South America. In the Andes the porphyritic tuffs appeared to belong to the Oolitic age; and the igneous rocks associated with them were of the same date. He thought that, so far as the author's observations had gone, the structure of the Atlas was much the same as that of the Andes. Mr. W. W. Smyth mentioned that in the district to the east of the Sierra Nevada, in the south part of Spain, where there was great summer heat, and also heavy occasional rainfall, the same tufaceous coating as that observed in Marocco was to be found. He had been led to much the same conclusion as to its origin as that arrived at by Mr. Maw. The upper part was frequently brecciated, and the fragments re-cemented by carbonate of lime. Mr. Seeley, though accepting Mr. Etheridge's determination as to the Cretaceous age of the fossils if found in England, could not accept it as conclusive in the case of fossils from Marocco. The genius *Exogyra*, for instance, which ranges through the Secondary to existing seas, might well belong to some other age; and even the fossils presumably Miocene might, after all, date from some other period. Mr. Maw, in reply, stated that he agreed with Mr. Ball as to the rise in the Marocco plain as it approached the Atlas, having taken it in one direction at 400 feet in 25 miles. He pointed out the resemblance between the moraines in the valley of the Rhone and those which he regarded as such on the flanks of the Atlas. As a proof of their consisting of transported blocks, he mentioned the fact that the Red Sandstone rock of which they were composed did not occur in the adjacent escarpments, but was not to be found within seven or eight miles. There was, moreover, a mixture of different materials in the mounds.

Linnean Society, January 18.—Mr. Bentham, president, in the chair. "On the Anatomy of *Limulus polyphemus*," by Prof. Owen (continued). The author resumed and concluded the reading of this memoir. The nervous system of *Limulus* appeared to have occupied most attention, and was described in detail. From the fore part of the œsophageal ring, answering to the brain, were sent off the "ocellar," "ocular," "antennular," and "antennal" nerves; the latter supplying the second pair of articulate limbs—the homologues of the "external antennæ" of higher *Crustacea*. From the post- or sub-œsophageal part of the ring, proceeded large nerves to the four succeeding pairs of limbs; and also smaller nerves, having distinct origins,

to the chilaria and to the opercular plate-limbs. The neural axis then continues, as a pair of coalesced chords, to the middle of the thoracetron, developing five ganglions supplying the five gill-limbs. Beyond the fifth ganglion the chords separate; each forms a loop resembling a ganglion, beyond which each chord penetrates the base of the "pleon." To this it supplies five dorsal and five ventral nerves before being continued and resolved into a plexus toward the end of the tail and spine. The author remarked that, as the nervous system preceded the tegumentary in the order of development, it might thus manifest evidences of the more generalised segmental type of the pleon, more plainly than had been noticed in the formation of the chitinous walls of that division of the body, in the embryo, in which it first budded forth as a ninth segment of the thoracetron. Details of the organs of the senses, of the digestive, circulatory, respiratory, and generative systems were then given, and illustrated, like the nervous system, by minutely-finished drawings. The heart was elongate, vasiform, included in a pericardial-like sinus: besides an anterior and posterior aortic trunk, there were seven pairs of lateral primary branches. The arteries soon lose their tubular form, and, as they expand, lose likewise much of their fibrous walls, and seem reduced to delicate membranous sinuses which follow the shapes of the parts or interstices along which the blood meanders as it returns by the venous sinuses to the general pericardial one. The most remarkable of the arterial prolongations are those which the author had previously described in his "Lectures on Invertebrata" (8vo ed., 1855, p. 310) as expanding upon, and seeming to form the neurilemma of, the central axis and branches of the nervous system; so that injection of the anterior aorta coats the neurine and demonstrates a great part of the nervous system by its colour. (A drawing showing this effect of fine red injection was exhibited.) Finally the author cited the chief results of the observations of Lockyer, Packard, and Dohrn on the development of the king-crab. There was neither a nauplius stage nor a trilobite stage. A superficial resemblance to trilobites is shown by the absence of the pleon in the embryo king-crab; but the very fact of the late appearance of this terminal division was decisive against any real representative resemblance of the embryo *Limulus* to the trilobites; on the acceptance, at least, of Barrande's observations of the successive and later appearance of the segments of the "thoracetron" in the space between the head ("cephaletron") and "pygidium" (pleon and tail-spine) of the embryos of *Sao*, *Agnostus*, and *Trinucleus*. The author here recalled attention to Newport's observations of the like development of successive segments, anterior to the caudal one, in Iulidæ, and remarked that with other facts noted in the anatomical sections, especially the fusion of the pair of cephalic ganglia, and the short and thick crura connecting these with the subœsophageal mass, giving the condition of that part of the nervous system in *Scorpio* and *Iulus*, *Limulus* manifested in an instructive and interesting way the more "generalised type" of articulate structure, in which arachnidan and myriapodal characters were associated with crustaceous ones. But, in the development of *Limulus*, the pleon, pygidium, or tail-spine was the last to appear, and, at its first budding, looked like a ninth segment of the thoracetron. Packard speaks of indications, transitory indeed, of segmentation of the crust; and such indications, as the author had shown in the anatomy of *Limulus*, were more strongly and lastingly given by the nervous system. The tail-spine belongs to the series of body-segments, and is no mere appendage to the dorsal arc of such. After formifaction and the attractive and repellent forces have produced in the germ-masses the phenomena of segmentation and vegetative repetition, as manifested in the similar and parallel heaps of granules, like bricks for the building, the inherited influences overrule the polaric ones, and operate in differentiating and adaptive lines, speedily showing the embryo *Limulus*, which, like that of *Astacus fluviatilis*, *Palæmon adspersus*, *Crangon maculosus*, *Eriphia spinifrons*, and one may add, all Cephalopods, takes its own course to the full manifestation of its specific characters, agreeably with the nature originally impressed on the germ. There was no divergence to a larval form with a term of active life as such; there was no metamorphosis, either "nauplial" or "trilobitic." Some objected to the king-crabs being called Crustacea; there was more ground, the author thought, for objecting to call them Arachnida or Myriapoda. Characters common to *Limulus* with their allied extinct gill-bearing, well limbed Articulata, have not a class-value. The author could not, at least, raise the Merostomes to an equivalency with, and run them parallel to and alongside of, the rest of the branchiate Condylopods. A class, after all, was an artificial group, a help to the classifier. One may call *Limulus* a Crustacean and yet discern in its anatomy the evidence of its more "generalised structure" than in Malacostraca; its type preceded that of either macrourous or brachyurous Crustacea, and indicates characters subsequently appropriated by and intensified in the air-breathing members of the Apterous Insecta of Linnæus. As compared with its longer-bodied and many-jointed predecessors, *Limulus* itself shows a concentrative specialisation; but vegetative repetition still reigns in the limb-series. "Inner antennules," "outer antennæ," "mandibles," "maxillæ," "maxillipeds," "legs," all work together by their basal joints in subserviency to mastication, and all end in pincers. As compared with modern crabs no structure was more striking and significant than the resistance, so to speak, of the heart in *Limulus* to the concentrative tendencies; it is still the "dorsal vessel," though the body-part containing it has the breadth and shortness of the crab's carapace, in which the heart is shaped to match. In both the neural axis supplying the cephaletral limbs is annular, but in modern crabs the subœsophageal part is defined by distance and concomitantly long and slender from the super-œsophageal or cerebral part. This differentiation had not taken place in *Bellimurus*, *Neolimulus Prestwichia*, and other palæozoic predecessors of *Brachyura*, whose organisation we have to thank their long-lived, lingering representative genus for enabling us to peer into. That such glimpses, with concomitant tracing of the development of the individual *Limulus*, afford us some ground, and that the like work, with persevering quest of its palæozoic fossil allies, may afford more, for guessing at the ways in which a pre-ordained plan of derivation by congenital departures from parental form has operated, in originating the various deviations from a common primitive articulate type, is an encouraging faith. That the old ocean should have given the chance conditions of origin of crustaceous sub-classes, orders, genera, species, by natural selection, was not conceivable by the author, who, nevertheless, held the conviction that all forms and grades of Articulata were due to "secondary cause or law," as strongly as when he expressed the same conclusion in regard to the Vertebrata, and termed it "the deep and pregnant principle" evolved in the researches on the general homologies and archetype of their skeletons.

Mathematical Society, January 11.—Mr. W. Spottiswoode, F.R.S., president, and subsequently Prof. Cayley, V.P., in the chair. Major E Close, R.A., was admitted into the society. Prof. Cayley gave an account of his paper "On the Surfaces the loci of the Vertices of Cones which satisfy six conditions."—Mr. J. W. L. Glaisher stated and illustrated the principal points in his communication "On the Constants which occur in certain summations by Bernouilli's Series.—Mr. W. B. Davis read a paper describing the methods he had used in the construction of tables of divisors, and exhibited tables of factors of numbers consisting of nine and twelve figures. A brief discussion ensued on the subject of this communication.—Mr. Roberts explained some of the results which he submitted to the society in his paper "On the parallel surface of Conicoids and Conics," and illustrated the same by means of a model and drawings of sections of one of the surfaces.

Zoological Society, January 16.—Prof. Newton, F.R.S., vice-president, in the chair.—The Secretary read a report on the additions that had been made to the Society's collection during the month of December, 1871, amongst which was particularly mentioned a young Prince Alfred's Deer (*Cervus alfredi*), born in the Gardens.—A letter was read from Prof. Owen, F.R.S., communicating some particulars received from Dr. Julius Haast, of Christchurch, New Zealand, respecting the finding of the remains of *Aptornis* in the Glenmark Swamp, New Zealand.—Mr. H. E. Dresser exhibited and made remarks on specimens of the eggs of *Reguloides superciliosus* and *Reguloides occipitatis*, collected by Mr. W. E. Brooks in Cashmere.—A communication was read from Dr. G. Hartlaub and Dr. O. Finsch, giving an account of a collection of birds from the Pelew and Mackenzie Islands in the Pacific, to which was added a complete synopsis of the ornithology of this portion of the Caroline group.—A communication was received from Mr. A. Sanders, containing a complete description of the Myology of *Liolepis belli*.—Mr. A. G. Butler communicated a synomic list of the species formerly included in the genus *Pieris*, with references to all others described since the subdivisions of that genus by recent authors.—A communication was read from Mr. John Brazier, of Sydney, N.S.W., giving a list of the *Cypræa* met with on the coast of New

South Wales.—A paper by Mr. A. Anderson was read containing the second portion of his notes on the Raptorial Birds of India.

Chemical Society, January 18.—Dr. Frankland, F.R.S., president, in the chair.—At this meeting Dr. Odling exhibited some very fine specimens of rare metals and their compounds, which had been lent to him by Dr. Richter and Dr. Theodor Schuchardt. Among these was a bar, weighing about seven ounces, of metallic indium; an element discovered a few years ago by Richter, in conjunction with Reich; also some metallic rubidium.—Dr. David Howard then read an interesting paper "On quinicine and cinchonicine and their salts." These alkaloids are prepared artificially, from quinine and cinchonine respectively, by the action of heat on their salts, and are isomeric with them. Quinicine occurs along with the two last-mentioned alkaloids in cinchona bark, being apparently the one which is first formed during the growth of the cinchona plant.

PARIS

Academy of Sciences, January 15.—A note by M. M. Levy on a property of the focals of surfaces, was presented by M. Bertrand, in which the author puts forward the proposition that any surface and its focal intersect each other at right angles.—A note from M. Catalan, on General Didion's communication concerning the relation of the circumference to the diameter, was read, in which the authorship of similar formulæ is ascribed to Euler.—M. H. Resal communicated a memoir containing equations of the vibratory movement of a circular plate, and M. Serret a note by M. E. Ciotti on the employment of vibrating elastic plates for the realisation of a propeller, in connection with a recent communication from M. de Tastes.—A memoir on the measurement of very high temperatures, and on the temperature of the sun, by M. H. Sainte-Claire Deville, was read. The author maintained that the temperatures which may be produced and measured in the laboratory are not greatly exceeded in nature, and that the temperature of the sun is not far from 2,500—2,800° C. (= 4,532—5,072° F).—M. Delaunay read a note on the secular variations of the mean movements of the perigee and node of the moon.—M. Faye presented a note upon the investigations of Dr. Heis on meteors, which are confirmatory of M. Faye's previous communication as to the different centres of radiation observed in November last.—A letter was read from M. Janssen on the principal consequences which may be drawn at present from his observations of the eclipse of December last. (A translation of this letter will be found in another column.)—M. P. Guyot forwarded a note on a meteor observed at Nancy on the 20th of December last at 10h. 28m. A.M. This meteor passed from Cassiopeia through Perseus towards the Pleiades, near which it exploded, with a bright green light.—M. E. Becquerel presented a report on various memoirs by M. W. de Fonvielle regarding observations to be effected during balloon ascents. M. E. Becquerel also presented a note by M. T. Sidot on the electrisation by friction of metals in sulphide of carbon, and on the decomposition of that body by light. The author finds that certain metals, especially silver, aluminium, and iron, become electrised, and produce sparks when strongly agitated with pure sulphide of carbon, and that the latter, when exposed to the light of the sun, is decomposed, producing a gas and a solid flocculent matter. The same gentleman also communicated a joint note by MM. F. Lucas and A. Cazin containing an account of some experimental researches upon the duration of the electric spark.—Notes by M. Lion and M. Diamilla Müller on the action of ecliptical conjunctions upon the elements of terrestrial magnetism were read. According to the former considerable perturbations were observed at Alençon during the eclipse of the 11th December last.—M. Tarry presented a further note on the movement of recoil of cyclones in equatorial regions.—In a paper on the combustion of carbon by oxygen, M. Dumas showed, in opposition to M. Dubrunfaut, that carbon is combustible in perfectly dry oxygen.—M. Chevreul made some remarks on this paper.—A note by MM. L. Dusart and C. Bardy on the transformation of phenole into alkaloids was presented by M. Cahours. The authors have obtained phenylamine, chloride of phenyle, and diphenylamine by the action of hydrochlorate of ammonia and fuming hydrochloric acid upon phenole.—M. P. Barbier announced his having produced cymene by treating hydrate of essence of turpentine with bromine.—A letter was read from M. V. Meyers on the reaction between sulphur and aqueous vapour in the synthesis of sulphuric acid, and on the preparation of pure zinc by electrolysis.—An important discussion on the vexed question of spontaneous generation was raised by the reading of some reflections concerning heterogenesis by M. A. Trécul. In the discussion MM. Balard, Fremy, and Blanchard took part.—A somewhat cognate matter was also treated by M. A. Béchamp in his paper on the cause of alcoholic fermentation by beer-yeast, and on the formation of leucine and tyrosine in this fermentation.—M. C. Robin presented a note by M. S. Chantran on the fecundation of the crayfish, in which the author describes the impregnation of the ova as taking place after their expulsion from the oviducts.—A note by MM. E. Mathieu and V. Urbain on the gases of the blood, was presented by M. Cahours.

DIARY

THURSDAY, JANUARY 25.

ROYAL SOCIETY, at 8.30.—On the Absolute Direction and Intensity of the Earth's Magnetic Force at Bombay: C. Chambers, F.R.S.—On the Elimination of Alcohol: Dr. Dupré.—On the Action of Low Temperatures on Supersaturated Solutions of Glauber's Salt: C. Tomlinson, F.R.S.

SOCIETY OF ANTIQUARIES, at 8.30.—Miscellaneous Communications on Objects of Mediæval Antiquity.

FRIDAY, JANUARY 26.

ROYAL INSTITUTION at 9.—On the Demon of Socrates: Archbishop of Westminster.

QUEKETT MICROSCOPICAL CLUB, at 8.

SATURDAY, JANUARY 27.

ROYAL INSTITUTION, at 3.—On the Theatre in Shakespeare's Time: Wm. B. Donne.

SUNDAY, JANUARY 28.

SUNDAY LECTURE SOCIETY, at 4.—On Ice, as a Geological Agent: A. H. Green.

MONDAY, JANUARY 29.

LONDON INSTITUTION, at 4.—Elementary Chemistry: Prof. Odling, F.R.S.

ROYAL UNITED SERVICE INSTITUTION, at 8.30.—On Modern Ships of War, as illustrated by the Models in the Institution: Nathaniel Barnaby.

TUESDAY, JANUARY 30.

ROYAL INSTITUTION, at 3.—On the Circulatory and Nervous Systems: Dr. W. Rutherford, F.R.S.E.

WEDNESDAY, JANUARY 31.

SOCIETY OF ARTS, at 8.—On Individual Providence for Old Age as a National Question: G. C. T. Bartley.

THURSDAY, FEBRUARY 1.

ROYAL INSTITUTION, at 3.—On the Chemistry of Alkalies and Alkali Manufacture; Prof. Odling, F.R.S.

ROYAL SOCIETY, at 8.30.

SOCIETY OF ANTIQUARIES, 8.30.

LINNEAN SOCIETY, at 8.—On the Classification and Geographical Distributions of Compositæ: The President.

CHEMICAL SOCIETY, at 8.

CONTENTS

NOTICE

We beg leave to state that we decline to return rejected communications, and to this rule we can make no exception. Communications respecting Subscriptions or Advertisements must be addressed to the Publishers, NOT *to the Editor.*