

and sometimes D, the first two being doubtless the earliest and the D the latest, as we find on Gaulish coins of a corresponding period. Addedomaros was probably a prince of the Iceni, as the coins bearing his name are generally found in Norfolk and near Cambridge.

The name of Addedomaros does not occur in history, but he may probably be a descendant of, and bearing the ancestral name of Ædd-mawr, or Ædd the Great, of the Welsh chroniclers. This is the more probable as, in a similar manner, we can trace the name of Dubnovellaunus to the Welsh Dyfnawal or Durwallo, and that of Caractacus to a similar source. Of Ædd-mawr nothing is stated by the chroniclers in question, except that he was one of the progenitors of a long line of ancient British kings, which might lead, as just suggested, to the supposition that the Addedomaros of the coins bore the ancestral name of the founder of his line.

With regard to the date of his coins, in so far as it may be approximately ascertained by means of the Greek termination in *os* of the name of Addedomaros, it should be stated that there is a strange confusion in the use of the Greek or Latin terminations on early British coins; both the *us* and *os* occurring occasionally, though very seldom on the same coin. It may, however, be accepted as a general rule, that the Celts first Grecianized and afterwards Latinized their names, and that the Latinized terminations generally occur after the invasion of Cæsar. In 60 B.C., for instance, the terminations of proper names were generally in *os*, while about 40 or 50 B.C., after the Roman invasion, *us* began to prevail universally.

In like manner, the *RIX* of the earlier period becomes generally *REX* at the last-named epoch; but the time of transition is not so distinctly marked, and there are some striking irregularities to be noticed hereafter.

H. NOEL HUMPHREYS.

THE GENESIS OF ORGANIC FORMS.

WHATEVER may be said as to the limits of man's power in intellectual observation, it is quite certain that it is not through lack of courage that he is not by this time master of every secret of the universe. "The Celestial Worlds Discovered, or Conjectures Concerning the Inhabitants of the Planets," by Christianus Huygens, may go with Lake's Moon Story, as exemplifying the desire of man to overleap eternal barriers, and in disappointment searching in his imagination for what he cannot find in Nature. The great problem which modern scientific inquiry has chosen for solution is as to the origin of life on the globe, whether it is the result of distinct creation, whether it created itself, whether it has existed from all eternity, whether it is inevitably allied to form, whether form

is only the visible expression of it, or whether it is a necessity of form, and, like gravitation or electricity, universally diffused throughout all material substances. It would be a pity not to have as many variations of this species of inquiry as possible, so we must allow license to those who question the fact of life altogether, and agree with them at least so far as to admit that, *perhaps*, like time and space, it is only an abstraction. The "rough-and-ready" method is to take things as they are, agree that life is a practical fact, even if we cannot define it, and that the forms in which life is manifested have an inevitable association with it, for the present at least, whatever may be said as to the past or the future. Quite a pretty library of books has sprung up as food for this in-

quiry, and not as food only, but as zests for appetite, and organs of digestion into the bargain, so that we may, if we choose, put out our thinking as we do our tailoring, and have any imaginable multiplicity of hypotheses served up to us in the style of compounded French dishes, and the less we inquire about the ingredients the better. In the style of the philosopher's conversation with the boatmen, we should say to the friend who has not read Darwin's "Origin of Species," "There's half your life gone." If he had not read "Vestiges of the Natural History of Creation," "There's another half your life gone." After that, of course we could not mention Gosse's "Omphalos," Dr. Dawson's "Archæia," Dr. Bree's "Species not Transmutable," Hugh Miller's "Testimony" and "Footprints," Mackie's "First Traces of Life," or any of the dilutions of Lamarck, travesties of Oken, or warped inferences from Owen, Lyall, and Murchison; for the simple reason that two halves make one whole. There is something of a charm, though, about this inquiry; it is a putting on trial of at least some of the elements of our faith; it is flattering to ourselves, and the mind always likes to have the Pegasus of imagination in the harness when it makes a bold drive along the dark ways of physical and metaphysical speculation. In plain truth, where we pretend to grope our way by the aid of pure reason alone, we are too often following the *ignis fatuus* of fancy, and ready to accept as the fruit of logic that which is the fruit of invention.

We are not about to lay down a doctrine, so let the reader take comfort, and with us ask the question—Whence came all the forms of life we see? In a certain place there is a distinct reply, but it is a condition of this inquiry that what Nature exhibits Nature must explain. Here, then, let us introduce our good friend, Mr. P. H. Gosse, who has done so much for sea anemones, for microscopic zoology, and, by his charming books

on Jamaica and Alabama, for Observation as an instrument in the gathering of knowledge. Either the organic forms we behold around us have existed from all eternity, or they have each had a beginning. So says Mr. Gosse,* and there is no gainsaying him. Mere observation teaches that existing plants and animals had no beginning, because it is a necessary condition of an organic form, living or dead, to bear about it evidences of past duration. One illustration will suffice here. I write with a quill pen. I observe the quill, the vane, and shaft; the epidermic cells; the feather is the result of growth and development. With Mr. Darwin's sanction I may literally, as well as metaphorically, trace its origin to my brother, who was plucked, perhaps against his will, for my benefit. The feather did not grow instantly, it had its season of nourishment from the goose and comfort to it. Nor did the goose come to a condition to produce feathers instantly; and before feathers sprouted from their capsules, the whole complexity of goose and feathers was inclosed in the shell of an egg. The egg was the product of a goose, which was the product of an egg, which was the product of, etc. etc., and so on for ever. We promised not to lay down a doctrine, and we do not here say that Nature had no beginning; but *that*, at all events, is the conclusion to be arrived at by logical sequence, if the data are derived from observation only of any one particular organism. Mr. Gosse would put the matter still more forcibly thus: Suppose you have the privilege of inspecting the very first example of any particular organism—say, if you please, man himself—one instant after creation. He would bear about him all the marks of pre-existence; you would pronounce him a product of time, thirty years perhaps of growth about him, his hair, nails, teeth, ay, even the blood in his arte-

* "Omphalos: An Attempt to Untie the Geological Knot." By Philip Henry Gosse, F.R.S. Van Voorst.

ries, all testifying to an existence in the past. Your reason would tell you that he owed his existence to parentage, and away you go again after eternal succession, though an instant before such a creature had no existence. But an eternity of organic forms is, after all, only an intellectual fiction, the rough-and-ready reasoner will have a beginning, and is quite content to accept it even if bearing upon it false evidences of a past. The author of the "Vestiges" professes to help us out of the difficulty. An infinite succession of finite things we reject, and so there is provided instead the interesting suggestion of spontaneous generation. The mystery is solved, organization willed itself into being, and the only wonder is, that the book which brought such light into the world did not write and print itself. Let us be fair. *Ex nihilo nihil fit*. If existence cannot come from non-existence; if life cannot call itself when there is none to call, and nothing to be called; if a unit cannot spring out of nought, then "Vestiges" was written in vain, and to those who accept its doctrine we must say, "Your faith is vain, ye are yet in your sins." It might be harsh to judge "Vestiges" by the electrical experiments of Mr. Crosse, which men of sober thought and scientific experience agree in considering child's play, but the question must be pressed whence came the primordial germ which served as the typical seed-plot of all successive generations. "Give me a fulcrum," said Archimedes; "Give me an organic nucleus, a living cell," says the author of "Vestiges," and, *presto*, you shall in the course of a few billion eons have more plants and animals than you can ever hope to catalogue, with man at the head, the last and best fruit of successive developments, acknowledging the primordial cell as his remote, but honoured ancestor. It is a downright pity that Mr. Crosse and Mr. Weekes should have been favoured with acari, or mites covered with bristles, instead of primordial cells, because,

instead of illustrating progressive development, the creation of life by electricity was rather a confirmation of Mr. Gosse's plan of prochronism—a bursting into the circle, or line, of the organic scheme, instead of a commencement at the very beginning. If these experiments were worth the paper on which they were solemnly recorded, the author would not have to repeat, in this new and beautifully illustrated edition,* that "we do not present the Crossian experiment, and other alleged cases of primitive generation, as undoubted facts, or as indispensable parts of the present hypothesis." We remember well reading the first edition of "Vestiges" on the very day it was first issued from the publisher. We have read it several times since, and there has always appeared to us an absolute necessity for spontaneous generation as a fact to give the Lamarckian hypothesis a fair claim to hearing. Given that, and transmutation may follow. If any philosopher can produce an acarus, or even an amoeba, or the most simple cryptogamic cell, let him come forward and put to flight the armies of the aliens. We will not stone him or cast him out; we shall be lost in awe at beholding the bristly mite emerge from its silicated bath, and shall thenceforth be prepared to believe that between the infinite and the finite there is no gulf fixed. That "the basis of all vegetable and animal substances consists of nucleated cells," is no key to the mystery of life at all, any more than the production of foliated crystals proves the conversion, by qualities inherent in matter, of inorganic into organic entities. A poplar-tree may be "the brush realized" to perfection in the *imagination of the author*, but a fancied resemblance is not creative power. Organic bodies contain inorganic elements, we are told, in the chapter on "Particular Considerations" (p. 111); and, willing to admit as much as we can, we admit *that*. But you

* "Vestiges of the Natural History of Creation." Eleventh edition, illustrated. John Churchill.

see, if we resolve structures into their components, we must come to something more elementary than themselves, and the statement is on a par with one we venture to offer as a parallel, namely, that an arithmetical quantity consists of units; and the second statement is just as good as the first, for all that we gain of knowledge as to the origin of organization. Microscopists are not so puzzled about the origin of penicillium and its kindred as some people imagine, and they never give way even to a dream of spontaneous generation, even when a crop of infinitesimal fungi breaks out upon a clean glass slide.

It comes to this, we must give to the author of "Vestiges," and to Mr. Darwin also, a primordial germ. Give them an act of creation to start with, and they will build up the existing fabric without further help; they will show that man is but a monkey modified, the monkey but a transformed oyster, the oyster but an expanded rhizopod, and the rhizopod a grandchild of the created nucleus. Nay, there is the "secure future of equally inappreciable length," the certainty of further improvement, and the possible budding of angelic wings, and development of angelic attributes. The hypotheses of these two authors do not greatly differ. The "Vestiges" proceeds on the supposition that the primordial cell was gifted with an innate power of expansion. That the expansion, growth, development, call it what you will, is of a character which tends towards improvement or ascent in the scale of organization. To be just to the hypothesis, we must add that it is not necessary that any low form of life, which may be the presumed causal antecedent of more complicated forms, is in itself imperfect; it is simply contended that life is in its essence a transforming power, in virtue of which A changes by the operation of law into B, and B into C. Or, to adopt an illustrative example, when organization has, by successive developments, produced a monkey from some primal germ, the monkey, with a

laudable desire for improvement, compels his tail to shrink up into an *os coccygis*, his thumbs to become opposable, his countenance to lose the grin of the satyr, and acquire divine complacency, while his brain expands into human completeness by the mere exercise of his thoughts on the glorious change which the future has in store for him. The author puts the case differently, we admit, and with elaborate discussion on cumulative evidence; but it comes to this. "Life," he says, "pressed in as soon as there were suitable conditions" (p. 104), and those suitable conditions were presented in succession, and all the wondrous plan of adaptiveness in vegetable and animal existence was the result of "law," not of design; the fruit of a "tendency," not the response to the exercise of divine will. And here we are provided with a smooth and slippery path over all the obstacles that reason and experience might suggest in the supposed key to the process of development furnished by the history of embryos. "All organisms, vegetable as well as animal, commence with a simple cell, of which it is impossible to tell in any case to what form it is destined to advance. A series of changes takes place. First, of an animal embryo, we can distinguish whether it is destined for the radiate, molluscous, articulate, or vertebrate sub-kingdom. Take an embryo of the vertebrate sub-kingdom, we next trace in it the change which will determine whether it is to belong to the fish, reptile, bird, or mammal class. Take an embryo of the mammal class, the characters of the particular order are next determined. Afterwards those of family, genus, species, sex, and individual are evolved in succession." (P. 130.) If every germ has locked up within it the elements of the human form—a necessary postulate—then how is it that when organization has attained to the human standard, any lower forms remain? They are arrested, says the author, at some one stage in the embryonic process, so that a fish is a

mammal with a swim-bladder, and a mammal a fish with lungs; a monkey is a man with a tail, and a man is a monkey with an opposable thumb, a habit of wearing spectacles, and not a word about the intermaxillary bone. So, from a nucleated cell which springs into being by a fortuitous concourse of atoms, the whole organic fabric is constructed on the principle of development from little to much.

Mr. Darwin's hypothesis is very nearly the same.* The breath of life was first breathed into a primordial form. There was expansion, of a typical kind at least, and the primordial germ, like Topsy, "grewed." The only essential difference between the two authors is as to method and terms. Mr. Darwin is rather synthetical. He perceives among animated forms deviations from their types. He describes these deviations, multiplies instances, and works among his facts like a great naturalist, as he is. Variation, he concludes, is in accordance with law—the "Law of Variation." Every organic form has to "struggle for existence" against adverse circumstances, and in this struggle the strongest, the best fitted to contend against destructive influences, the most perfectly developed, survive by a process of "natural selection," and by this process of natural selection "all the organic beings which have ever lived on this earth have descended from some one primordial form, into which life was breathed by the Creator" (p. 484).

Vast as are the fields of inquiry over which we are invited to range by these remarkable works; delightful as it is to be led, even towards a mere hypothesis, through the domain of natural phenomena, strewn everywhere with wonders; lively as is the interest awakened by the analysis of analogies and resemblances, and, above all, by the conformity to types, of the great divisions of Nature, and of the

agreement of types with types, and the possible relation of all types to one type; yet, when we come to results, the whole question is one of the permanency of species. If species are permanent, if they are as distinct entities, as oxygen and hydrogen, as the angles of a cube and the relations of a circumference to its diameter, then Lamarck and the "Vestiges" are only examples of scientific toying, and Darwin must be respected for his facts, and smiled at for his fancies.

Species have been variously defined. They are a sort of right lines in organic geometry. Cuvier says, "Species are the collection of all beings descended the one from the other, or from common parents." De Candolle includes as one species all the individuals which bear to each other so close a resemblance as to allow of our supposing that they have proceeded originally from a single pair. This last may suffice us here, with this proviso, that we do not care whether they have descended from a single pair or not; it is sufficient that the resemblances are such as to allow of our supposing that they have. The individuals of the same species must have certain uniform and permanent characters. However nearly species approach each other, there must be a visible line of demarcation—a possibility of determining, by physical tests, that this belongs to species A, and that to species B. The uniform characteristics must be transmitted to their offspring, so that by these we can trace them back to parentage, and predicate the nature of their progeny. The variations to which each species is liable must be included within the limits of its uniform characteristics, no matter by what means these varieties are developed.

On the hypothesis of the "Vestiges," species are transmuted by an initial force; on the Darwinian hypothesis we are referred to outward modifying circumstances, and have the key to the whole problem of organic form in a mule-canary, or a barn-door fowl, feathered to the toes. Variation takes place;

* "The Origin of Species by Natural Selection; or, The Preservation of Favoured Races in the Struggle for Life." By Charles Darwin, M.A. Fifth Thousand. John Murray.

the variation is perpetuated; other variations are added, and, in process of time, these have accumulated so as to give the subject of them all the characters of a species, so that species are not typical entities, but mere transitional states of life in process of improvement. Mr. Darwin writes delightfully about dogs, and pigeons, and horses, and humblebees; but he fails to adduce any one example of the transmutation of species. We have records of the pigeon as a domesticated bird extending over 4000 years. We have pouters, fantails, runts, and other varieties, all pretty permanent in the hands of skilful breeders, but all given to one practice, for which Mr. Darwin ought to reprove them, that of running out if left to themselves, of reverting back to a certain specific type, as if the variations had been brought about by man's interference with the conditions necessary to the preservation of the species in its typical form, and as if those variations were limited in extent and number. But the tendency to vary is evidently a matter quite distinct from the presumed tendency of species to change through variation; because, in this particular instance, the subjects of discussion are still pigeons. Then, as to dogs, we know that wonderful changes have been wrought in them, as to external appearance; but *Canis* is *Canis* still—he shows no disposition or tendency to become *Vulpus* or *Lupus*. If we were to ignore anatomy we should have a good test of species in all varieties of dog in the shape of the pupil of the eye, which, in the fox, contracts to an oval, in the dog it is round. The dog has been more subjected to modifying influences, and has undergone more variation, than any other animal that has had the attention of man, and is one of the most ancient of domesticated animals; and mark this, it is dog still; and if we had a scientific description of it as a species 4000 years old, it would agree with a description drawn up to-day, nothing more, nothing less. In pointing to the distinctions

between varieties and species, Professor Owen says of the dog: "Under the extremest mark of variety so superinduced, the naturalist detects in the dental formula, and in the construction of the cranium, the unmistakable generic and specific characters of the *Canis familiaris*. Note, also, how unerringly and plainly the extremest varieties of the dogkind recognize their own specific relationship. How differently does the giant Newfoundland behave to the dwarf pug, on a casual rencontre, from the way in which either of them would treat a jackall, a wolf, or a fox. The dumb animal might teach the philosopher that unity of kind or of species is discoverable under the strongest mark of variation." Mr. Darwin may cite instances of variation till doomsday, but the philosopher will all the while repeat the request for at least one actual instance of transmutation. And can he furnish it? No! He believes, with Dr. Horner, that man has existed on the earth 13,000 to 14,000 years. Without raising the question of the antiquity of man, let us grant even this extravagant article of his belief, and what then? Suppose man has existed a billion, or a billion billion of years, what then? We really want to be carried back to the date when he came forth, in his complete humanity from the womb of an ape or chimpanzee. We want a record or evidence of the transmutation, or rather we don't want anything of the kind; for it might induce us to worship our thumbs and great toes, pull out our teeth, measure our fore-arms, and look wistfully behind us in fear that a certain benefit of variation might undergo reversion and betray us. The variation hypothesis comes to nothing without at least some one authentic case of A becoming a veritable B. Of the many pens that have been exercised in the analysis of Mr. Darwin's law of variation, none have so completely crushed it in the grasp of precise reasoning on sound data as that of Dr. Bree, who, to the qualifications of a thorough naturalist, a master of classifi-

cation, and a careful observer, adds that of clear perception both in "rough-and-ready" methods and the more precise methods of the schools. In this work* the *rationale* of the Darwinian philosophy is thus tersely stated: "Go where we will, we find life, but always adapted to a special end, and formed for a wise purpose. All this we combine into a great scheme of creation, ordained and perfected by Infinite Wisdom. Adopt Mr. Darwin's theory, and what do we see? Through the gloom of myriads of ages we behold an 'unknown element of special creation,' uniting in itself the male and female structure. This primordial form has, by its liability to vary in its progeny, become the parent of every plant and animal in the world. We are now to see how long it remained sole tenant of the mighty world—how long the air and the deep waited for their creatures. We are led to suppose that, some time after it was called into existence, some one of its descendants exhibited, by mere chance, not by natural law, for a natural law cannot be partial in its operation—some slight variation. This alteration was transmitted to its offspring, and again it varied. As it can be pretty clearly proved that man has not varied towards a different form, at least during the historic period, it is clear these variations, slight as they were, must each have taken thousands, or even millions, of years to form. Never mind. Land, air, and water are patient; they still wait for their living tenants. At length our organism arrives at a point in which a 'struggle for existence' takes place. One class of descendants shows a decided tendency to 'vary' into plants, another has an animal tendency. The animal, being the strongest, wins the day, and henceforth takes the lead, and we have perfected the first animal form! Happy in its defeat, the unconscious plant takes root in the earth, and we

have the first vegetable structure. Of course these forms must be hermaphrodite. For countless ages they each go on increasing. Natural law plays her part well at first, and predominates. At length each form varies. The variation becomes permanent, and is transmitted from race to race. Gradually, one variation takes one form, another assumes a different one. The 'struggle for existence' in a world designed to be peopled goes on; myriads of ages pass; continents are destroyed and buried beneath the deep, carrying with them every transitional form by which posterity could recognize the power of 'natural selection.' The dawn of that geologic epoch, which we now call the first that came into existence, is attained. But all that has been arrived at by the 'laws of variation' are structures similar to those of reef-coral or sea-weed, oyster, nautilus, or woodlouse (tribolite). These, then, must have been the progenitors of the present race of man, and every animal on the face of the earth." And we will accept the conclusion when the right sort of evidence is placed before us, and *not till then*.

That species vary is an ancient fact, and it is also an ancient fact, admitted by Mr. Darwin, that "like produces like." Shall we escape from the difficulty of the boundary-lines, apparently drawn by Nature about all species, by taking refuge in hybridization? An unscientific observer at a cattle-show, or the fortunate possessor of a herd of pigmy Bretonne sheep or cows, might expect to see such a hypothesis as that of transmutation triumphantly established by the experiences of the cross-breeder. To model farm-cattle to an arbitrary standard is one thing, to get a race intermediate between any two species is another. The cattle-breeder works with varieties. His short-horns, long-horns, Devons, and Scots are all veritable oxen, and Bovis shows no sign of changing into Cerris; and if a hybrid be obtained between them, we have gone just far enough to learn the

* "Species Not Transmutable, nor the Result of Secondary Causes." By C. R. Bree, Esq., M.D., F.L.S. Groombridge and Sons.

extreme limits of species, and, by the extent of those limits, learn their definability—"Thus far, and no farther." To keep up the supply of mules for mountain roads, the same method is followed now as when man first discovered that he could modify organic forms. The sterility of hybrids is a patent fact, and we have the records of thousands of years to show that, even in this direction, the fixity of species is established. The source of error arises from forgetting that a species is a distinct idea in Nature; that all its variations are subservient to it; and that there is a constant tendency to revert to type, and to keep type true to its original character for ever.

We shall be referred to the geological record, and asked if we do not read therein a lesson of organic progression. The author of the "Vestiges" relies upon the stone-book just as Mr. Darwin relies on the "principle of selection." It is true that as eras succeed each other in the chronology of the rocks, we meet with distinct classes of organic remains. There was an age of trilobites, an age of conifers and palms, an age of reptiles, an age of huge mammalia, and the last of the series is man. But it is one thing to find that organic forms have succeeded each other, and another to prove that the last are the lineal descendants of the first; that not only species but orders have arisen by a process of development from the forms which preceded them; and this must be shown to render any hypothesis of organic progression tenable. The Phoenix is an emblem of Nature only in the poetic sense. There is an incessant soaring of life from the tomb, but it is for sole to present us with a bird born of ashes; science knows the bird only as the product of the egg, the egg being a product of a bird, and so on for ever, as in the case of our quondam relative the goose. The earliest known fossils are soon described, and their places are easily assigned them in zoological classification. But it was a real

service to this sort of inquiry when Mr. Mackie sent forth his attractive little book on those first traces of life.* We know this much, that the creatures that dwelt on the face of the earth when the Longmynd was in process of deposition, were subjected to precisely the same influences as the creatures that now haunt the meadows or sport upon the pools. In the day of the silurian, air, earth, and heaven, had much the same aspects as far as the requisites of animal life were concerned; so if there was a "struggle for existence" then, it was of a kind such as we can reason upon from present experiences, without fear of going wrong. If these were the first forms of life on the globe, then we find nothing to support the hypothesis of improvement by variation, or development by initial impulse, for they are all of them far advanced beyond the imaginary nucleus, and are creatures of a higher organization than the hypothesis requires, so high, at all events, as to be fatal to it at its starting-point. Worm-tracks and worm-burrows are records of annelids; the trilobites are far removed from any primordial cell; the palæochorda and chondrites are forms of algae that carry us back as far as we choose to go by the law of like produces like; sertularia do not grow out of sea-froth by any aggregation of self-vitalized atoms. But grant that the ages precedent to the Cambrian and Silurian have left us no reliable records, yet here are representatives of "four out of five of the great divisions of the animal kingdom," and there are at least materials enough to start with for any number of transformations. According to Mr. Mackie's calculation of the rate of deposit of sediment, it is 3,200,000,000 of years since the silurian fauna flourished, so there is time enough, we suppose, for the changes as well. If there is not time enough, we can only say it is all you can have, for all

* "First Traces of Life on the Earth; or, The Fossils of the Bottom Rocks." By S. J. Mackie, F.G.S., F.S.A., etc. Groombridge and Sons.

other fossils are less ancient than they. If the hypothesis be good, there will from this point be an unbroken series of developments, each succeeding one higher than the last in the scale of organization, so as to form an inclined plane, or an inverted pyramid. This is inevitably necessary. In the coal-beds, where we find remains of the most ancient terrestrial flora, conifers abound, and palms were not uncommon. According to the transmutation hypothesis, we could scarcely have expected to find anything higher than ferns there. In the secondary, from the triassic to the Purbeck gymnosperms predominate, but with these are associated some monocotyledons of species inferior to no phænogamous (flowering) plants in the complexity of their organs. From the chalk to the uppermost tertiary all the principal classes of living plants occur. During this vast lapse of time four or five complete changes of species took place, yet no step whatever was made in advance by the addition of more highly organized plants. The lower silurian contains examples of radiata, articulata, and mollusca, with indications of fish; the upper silurian contains cestraciont sharks, "than which no ichthyic type is more elevated." In the Permian there are saurians of as high a grade as any now existing. A land-shell has been found by Sir Charles Lyall and Dr. Dawson in the coal measures of Nova Scotia. The fish and reptiles of the secondary rocks are as fully developed in their organization as those now living. We have yet to learn whether, in the secondary periods, there was a scarcity of mammalia. The lower, middle, and upper eocene, the miocene, and the pliocene present species of mammalia as highly organized as any now living, so that during five or more changes in this the highest class of vertebrates, not a single step was made in advance. Geological proofs that the human species was created after the zoological changes above enumerated, are very strong. It even appears that man came later on the earth than the larger

proportion of animals and plants which are now his contemporaries.*

Dr. Dawson has an able summary of the order of organic forms in the concluding section of his masterly work on the Biblical Cosmogony,† in which he insists on the advanced character of the lacertian reptiles of the mesozoic period—the megalosaurus, iguanodon, pterodactyle, cetiosaurus, ichthyosaurus, etc.: "These creatures actually filled the offices now occupied by the mammals, and though lacertian in their affinities, they must have had circulatory, respiratory, and nervous systems far in advance of any modern reptiles, even of the order of loricates. A dinosaurian, walking the earth with elephantine tread, or a pterodactyle, cleaving the air with rapid wings, must necessarily have enjoyed a far more perfect circulation and respiration than the highest living reptiles." (P. 329.)

Granted, because demonstrated, there has been a succession of organic forms, and that those existing are but a portion of the scheme embraced by the whole of geologic time, yet there has not been anything like a regular advance from the humblest forms to the most complex. When the fishes come in at the close of the silurian, it is not by any gentle transition from some pre-existing form, but they were in their highest development at once. The arachnides of the carboniferous series are not partially but wholly developed as such; they come in *propria persona*, not first a shadow, then a half-developed approach to the type, and then the type in full completeness.

Of reptiles and birds it may be said that instead of coming by degrees and improving with time, they may rather be considered to have degenerated since the eras in which

* Sir Charles Lyall's Anniversary Address to the Geological Society, 1831.

† "Archæologia; or, Studies of the Cosmogony and Natural History of the Hebrew Scriptures." By J. W. Dawson, LL.D., F.G.S. Sampson Low and Co.

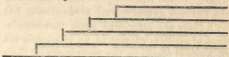
they were respectively ushered in. The author of the "Vestiges" makes the best of it, and is not too careful to indicate the weak points of the argument derived from geological succession. Mr. Darwin faces the fact more boldly, and complains of the "imperfection of the geological record." Doubtless there is much to be learnt, but we must infer the unknown from the known, and the known proclaims to all who love logic and hate sophistry that species are not transmuted one into the other.

But there is even yet another way out of the difficulty, and that is in suggesting what *might be*. Where links are wanting, Mr. Darwin "sees no difficulty in supposing that such links formerly existed." When we talk of this and that being "not improbable," of a supposed condition of things as one that "may be," and the facility of "conceiving" facts which Nature does not supply, we give reins to license, and, taking advantage of that license, we here solemnly record our opinion that we know not what might happen and what might exist if only the conditions of new existences were brought about. A dog may have shaggy hair, but his blood corpuscles will be of the same character as one petted because of his silken coat. A serpent may have the rudiments of limbs, but we shall not mistake them for a quadruped in embryo so long as we can remember what are the characteristics of serpent vertebræ. Food, climate, interbreeding may change the external aspects of animals, but the tests of species will be found in their osteological structure, in the arrangement of the teeth, and in other marks that never change and

cannot be obliterated. The progress of organization in time has not been by an inclined plane as here represented, but at each



ascent in the scale the forms ushered in have had their fullest and highest development at once, and the order must be represented by a series of steps.



We shall rejoice still in the accumulation of knowledge, and may gain many hints of analogy and relationship of types from these attempts to assign to Nature a power which lies above and beyond. When Mr. Gosse has laboured by prochronic tests to show that we cannot certainly say that fossil forms have ever lived at all, he admits that the study of geology, as a science, is in no way interfered with. We who believe that the sedimentary strata are the graveyards of the past, and that every scrap of fossil was once the depository of life, have no occasion to pause in our inquiries because of visionary schemes intended to unsettle the very foundations of experiment and inquiry. For the present we must evidently be content with the old lesson, taught alike by science and revelation, that organic forms were created "after their kind," or, as Dr. Dawson reads it, "species by species." SHIRLEY HIBBERD.

EXTERNAL CHARACTERISTICS OF THE DESMIDIACEÆ.



From Ralfs's admirable monograph we learn the best method of obtaining many species of *Staurastrum*, *Pediastrum*, and others, which usually form a greenish or dirty cloud

upon the stems and the leaves of thread-shaped or tape-shaped aquatic plants, and which require more care in their collection than was necessary for the specimens mentioned in

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