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A THEORY OF CREATION.

A

REVIEW

OF

"VESTIGES OF THE NATURAL HISTORY OF

CREATION."

FROM THE NORTH AMERICAN REVIEW FOR APRIL, 1845.

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A [Pg 1]

THEORY OF CREATION.

Vestiges of the Natural History of Creation. New York: Wiley & Putnam. 1845. 12mo. pp. 291.

This is one of the most striking and ingenious scientific romances that we have ever read. The writer of it is a bold man; he has undertaken to give a hypothetical history of creation, beginning, as the title-pages say, at the earliest period, and coming down to the present day. It is not quite so authentic as that of Moses, nor is it written with such an air of simplicity and confidence as the narrative of the Jewish historian; but it is much longer, and goes into a far greater variety of interesting particulars. It contradicts the Jewish cosmogony in a few

particulars, and is at variance with probability and the ordinary laws of human reasoning in many others. But the rather liberal rules of interpretation, which it is now the fashion to apply to the first chapter of Genesis, will relieve the reader from any scruples on the former account; and as to the latter, in these days of scientific quackery, it would be quite too harsh to make any great complaint about such peccadilloes. The writer has taken up almost every questionable fact and startling hypothesis, that have been promulgated by proficients or pretenders in science during the present century, except animal magnetism; and for this omission we have reason to be thankful. The nebular hypothesis, Laplace's or Compte's theory of planets *shelled off* from the sun, spontaneous generation,—some of these vagaries, we admit, are of much older date than the year 1800,—the Macleay system, dogs playing [Pg 2] dominoes, negroes born of white parents, materialism, phrenology,—he adopts them all, and makes them play an important part in his own magnificent theory, to the exclusion, in a great degree, of the well-accredited facts and established doctrines of science.

We speak lightly of the author's plan, as one can hardly fail to do of a scheme so magnificent, and going apparently so far beyond the ordinary sources of information and the range of the human intellect. But the execution of the work is of so high an order, as fairly to challenge attention and respect. The writer, who has not chosen to give his name to the world, is evidently a man of great ingenuity and correct taste, a master of style, a plausible, though not a profound, reasoner, and having quite a general, but superficial, acquaintance with the sciences. His materials are arranged with admirable method, the illustrations are copious and interesting, the transitions are skilfully managed, and the several portions of the theory are so well fitted to each other, and form such a round and perfect whole, that it seems a pity to subject it to severe analysis and searching criticism. It is a very pleasant hypothesis, set forth in a most agreeable manner; and though it contains many objectionable features, these are cautiously veiled and kept in the background, and the reader is seduced into accepting most of the conclusions, before he is aware of their true character and tendency.

Before a just opinion can be formed of the correctness of the writer's views, it is necessary to take to pieces this skilful fabric, and to bring the parts together in a different connection and with greater succinctness, following out each doctrine to its inevitable, but most remote, conclusions, so as to obtain a just idea of the position in which we should be placed by the acceptance of the theory as a whole. For obvious reasons, the author has not chosen to give a general summary of his views, or to mention explicitly all the inferences that may be drawn from them. He merely puts the reader upon the track, indicating its general direction, and leaving it for him to find out what objects will be encountered by the way, and where the journey will end. We propose to finish the work that is thus left incomplete, and to set forth the doctrine in its plainest terms. We would reduce the theory at once to its narrowest compass and simplest expression; but at the same time, would incorporate into it every doctrine which properly belongs to it, and follow out each hypothesis to its remote, though [Pg 3] necessary, inferences and conclusions. To this end, it is requisite to separate, as far as possible, the doctrines themselves from the evidence adduced in support of them; and to consider the former as a whole, before proceeding, to discuss the cogency of the latter. The following may be taken as the most concise abstract that we can form of the history of the creation, according to this author.

In the beginning—we use this word in a kind of preter-perfect sense—in the *very* beginning of things, immense portions of infinite space were filled with finely diffused nebulous matter, heated to an intensity that is altogether inconceivable. The particles of this "fire mist," as it is appropriately called, were the true *primordia rerum*,—the elements of the universe,—the principles of all the forms of inorganic matter and all organic things. At the outset, the Creator endowed these particles with certain qualities and capacities, and then stood aside from his work, as there was nothing farther for him to do. The subsequent progress of creation is only the successive *development*, upon mechanical and necessary

principles, and as fast as proper occasions were offered, of these qualities thus made inherent in the primitive constitution of matter. The atoms thus marvellously endowed have gone on, without any further aid from Almighty power, to form suns, and astral systems, and planets with their satellites, and worlds tenanted by successive generations and races of vegetable and animal things. And this work of creation, or rather of development, is still in progress all around us, and in all its various stages, though in the portion most directly exposed to the observation of man it is far advanced towards perfection. Upon this earth, the unaided action of these atoms is still evolving all the phenomena of generation, progress, and decay, of vegetable and animal life, of instinct and of mind. In the abyss of space, it is also forming new suns, and solar systems, and worlds that are to pass through the same stages and wonderful transformations to which our own planet has already been subjected. All that has occurred with respect to this earth, and the system of which it forms a part, is but a type of what is constantly going on in the countless other systems of stars that people the firmament.

The first stage in the history of these fiery particles is the formation among them, in some unaccountable way, of nuclei, or centres of aggregation, like the bright points that are now [Pg 4] visible in some of the nebulæ of the heavens. As soon as these centres are formed, gravity, one of the original principles of matter, begins to act, and the atoms in all the neighbouring parts of space are attracted towards the nucleus and heaped upon it. In this manner, a central sun of vast dimensions is formed, which soon assumes a motion of rotation upon its axis from the general law which gives a circular movement to all fluids that are drawn towards a common centre. The centrifugal force thus generated tends to throw off matter from the equatorial regions of the great orb, but is restrained by the attraction of gravitation, which would prevent any separation of the parts, if the sun itself did not now begin to cool down, and consequently to shrink in size. Under this cooling process, a crust is formed upon the surface, too rigid to yield to the force of gravity, and the parts within, continuing to shrink, separate from this envelope; so that there is now a central orb, revolving more rapidly from its greater density and smaller diameter, and surrounded by an exterior shell, or band, like Saturn's ring, rotating at its original speed. As we cannot suppose that the ring would usually be of uniform thickness and strength, it eventually breaks up into fragments, the larger of which attracts the smaller into itself, and the whole is formed by its revolving motion into an oblate spheroid circling round the contracted sun in the centre. In this manner, the planet Uranus was shelled off from our sun, which originally filled the whole of the vast sphere, of which the distance from Uranus to the centre of the present sun is but the radius. The planet itself, by the same process of cooling, shrinking, and thus forming exterior rings, threw off successively all its six satellites; and the sun, also, continuing to contract from the loss of heat, formed another ring, and thus constituted the planet Saturn. In this way were formed successively all the planets and satellites of the present solar system. The original diameter of our earth was equal, of course, to the present diameter of the moon's orbit. In the case of Saturn, the two rings formed around it happened to be of unusual homogeneity and equal thickness, so that they were not broken up, but have preserved their primitive shape. A ring was formed from the sun in the space between the present orbits of Mars and Jupiter; but when it was broken up, the fragments did not [Pg 5] congregate into one, but spherified separately, so as to form the four smaller planets which now revolve in that opening.

> "We have no means of judging of the seniority of systems; but it is reasonable to suppose, that, among the many, some are older than ours. There is, indeed, one piece of evidence for the probability of the comparative youth of our system, altogether apart from human traditions and the geognostic appearances of the surface of our planet. This consists in a thin nebulous matter, which is diffused around the sun to nearly the orbit of Mercury, of a very oblately spheroidal shape. This matter, which sometimes appears to our naked eyes, at sunset, in the form of a cone projecting upwards in the line of

> the sun's path, and which bears the name of Zodiacal Light, has been thought a residuum or last remnant of the concentrating matter of our system, and thus may be supposed to indicate the comparative recentness of the principal events of our cosmogony. Supposing the surmise and inference to be correct, and they may be held as so far supported by more familiar evidence, we might with the more confidence speak of our system as not amongst the elder born of Heaven, but one whose various phenomena, physical and moral, as yet lay undeveloped, while myriads of others were fully fashioned and in complete arrangement. Thus, in the sublime chronology to which we are directing our inquiries, we first find ourselves called upon to consider the globe which we inhabit as a child of the sun, elder than Venus and her younger brother Mercury, but posterior in date of birth to Mars, Jupiter, Saturn, and Uranus; next, to regard our whole system as probably of recent formation in comparison with many of the stars of our firmament. We must, however, be on our guard against supposing the earth as a recent globe in our ordinary conceptions of time. From evidence afterwards to be adduced, it will be seen that it cannot be presumed to be less than many hundreds of centuries old."—pp. 22, 23.

Having thus explained the *genesis* of the solar system, we come down to the history of our own earth, since it shelled off the ring which formed our moon. Continuing to cool down and shrink, a thin but rigid crust of primary rocks, still bearing marks of the intense heat to which they have been subjected, was formed upon its surface; and then the vapors, with which the atmosphere had been charged, were condensed, and formed seas, which covered the whole, or the greater part, of the earth's rind. The continual agitation of these waters, and [Pg 6] their high temperature, as they were still nearly at the boiling point, disintegrated and wore down many of these rocks, and, in the lapse of ages, deposited their remains, in thick layers of sand and mud, at the bottom of the seas. Baked by the heat from beneath, and pressed by the weight of superincumbent waters, these layers slowly hardened into stratified rocks. Forms of vegetable and animal life, though only of the lowest type, the origin of which is to be explained hereafter, now began to appear. Some sea-plants, zoöphytes, infusory animalcules, and a few of the molluscous tribe, all low down in the order of being, but important from their immense numbers and joint action, commenced their work of absorbing the carbonic acid with which the air was overcharged, and building up vast piers and mounds of stone from their own remains. Meanwhile, the internal fires of the earth occasionally broke through the rocky crust that imprisoned them, threw up liquid primitive rock through the rents, and distorted and tilted up the strata that had been formed above.

We may remark, in passing, that the chronology of the events of which we now speak is not very accurately determined; the only thing certain about it is, that a series of ages, so protracted that the imagination cannot conceive their number, elapsed between the successive epochs in the history of the earth's crust. Some of the convulsions caused by the fiery mass within threw up rock above the surface of the waters, and thus the dry land began to appear. Islands were formed, and immediately land-plants made their appearance, of excessive luxuriance, under the tropical temperature that still prevailed all over the globe, and began their office of absorbing carbon, and storing it up for future use. Land-animals as yet were not, for the excess of carbonic acid in the atmosphere rendered it incapable of supporting animal life. But the richness of this island vegetation gradually purified the air; while the decaying plants themselves, being accumulated into vast beds and strata, and subjected, through the changes of the earth's surface, to the pressure of mighty waters, gradually formed immense deposits of coal, for the subsequent service of man. Animals of a higher grade were now formed; fishes became abundant, and amphibious monsters, huge [Pg 7] lizards and other reptiles, with an imperfect apparatus of respiration, began to breathe an atmosphere not yet fitted for birds and mammifers.

It is not necessary to trace out the comparatively well known facts and theories of geological science, that are incorporated into this history. It is enough, for the present purpose, to point out a few of the general conclusions of the geologist respecting the several great changes that the earth's crust has undergone, and the distinct races of vegetables and animals which have successively tenanted the earth's surface. These changes and these races have borne a constant relation to each other; as the scenes shifted, the inhabitants also changed, the latter being always adapted to the circumstances in which they were placed. There has been a constant progress, the soil and the atmosphere becoming more and more fitted for the support of the higher forms of life; and when all things were thus made ready for them, these higher forms have appeared, and the lower orders of being, which formerly occupied the scene, have entirely died out, so that their remains, entombed in the solid rock, are now the only indications of their past existence. In the era of the primary rocks, as we have seen, there was no organization or life, as there was nothing to support it. In the succeeding period, zoöphytes and mollusca appeared; these were followed by fishes, and then land rose above the surface of the waters. Land-plants and animals came next, though of a low type; continually advancing orders of beings, reptiles, birds, and mammifers, suited to the improved condition of things, successively appeared, until, at the latest epoch, man entered upon the scene, the head of animated nature as at present constituted, with powers and capacities well adapted for the full enjoyment of the augmented riches of the earth. And the end is not yet. "The present race, rude and impulsive as it is, is perhaps the best adapted to the present state of things in the world; but the external world goes through slow and gradual changes, which may leave it in time a much serener field of existence. There may then be occasion for a nobler type of humanity, which shall complete the zoölogical circle on this planet, and realize some of the dreams of the purest spirits of the present race."

The question now occurs, How are we to account for the origin of *life*, both in the vegetable and animal kingdoms? The answer can readily be given, if we follow out resolutely to their remotest consequences the principles that have already been established. The evolution of natural laws, the necessary action of the qualities with which atoms were at first endowed, has sufficed to produce this complex system of mutually dependent worlds, and all the successive transformations of the earth's rind, which have fitted it for the support of successive races of organic beings. May not the same causes have produced the beings themselves? The one process would seem to be not much more elaborate and intricate than the other. If the inherent qualities of matter have built up a solar system, they may have created, also, the first animalcule, the first fish, the first quadruped, and the first man. There has been a marked progress, in either case, from the chaotic, the rude, the imperfectly developed, up to the orderly, the complex, the matured forms. The first essays, the rude efforts, of nature have gradually been perfected. The chaotic world that was first shelled off from the sun differed not less widely from the admirably furnished planet we now inhabit, than does the zoöphyte, whose remains are not split out of the rock, from man, the present head of the animal tribe. At any rate, geology informs us, that the causes, whatever they may be, which produce life, have been long and frequently in operation. They were not exhausted in the first effort; they are probably still at work throughout the universe. Not merely successive generations, but successive races, both of plants and animals, widely distinguished from each other, have, at different periods, tenanted the earth's surface. Those of which we possess the fossil remains belong, almost without exception, to extinct species. They were crowded out of existence, as it were, by the new forms, more perfectly organized, which came to take their places in the improving condition of things. This continuous agency of the life-producing causes, effecting still higher results by each successive effort, seems to point directly to the gradual expansion and development of the qualities with which matter was first endowed. [Pg 8]

We actually see natural agents now at work around us, producing results which counterfeit life, if they do not constitute it. Many substances crystallize into shapes bearing a strong resemblance to vegetable forms, as in the well known chemical experiment producing the [Pg 9]

arbor Dianæ. The passage of the electric fluid leaves marks that are like the branches and foliage of a tree, and the same fluid exerts a direct influence on the germination of plants. Some of the proximate principles of vegetable and animal bodies, such as urea and alantoin, are said to have been produced artificially by the chemist; and in the combination of the simple elements, such as carbon and oxygen, into these proximate principles, it is now acknowledged that there is no violation of the ordinary laws of chemical affinity. The origin of all vegetable and animal life, so far as it can be traced, is in germinal vesicles, or little cells containing granules. Such are the ova of all animals; and both vegetable and animal tissues are entirely formed from them. When the parent cells come to maturity, they burst and liberate the granules, which immediately develope themselves into new cells, thus repeating the life of their original. Now, it has been asserted, that globules can be produced in albumen by electricity; and *if these globules are true germinal vesicles*, the difficult problem of producing life by artificial means is entirely solved.

But the burden of this part of the theory rests on the evidence that has been produced of late years to favor the doctrine of equivocal generation, or the production of living beings without the agency, either direct or indirect, of parents of the same species. Can such beings, *orphans* in the strictest sense, now be produced or discovered? We have not space to repeat our author's argument on this difficult mooted question in science, nor is it necessary; he sums up the evidence on his own side, and of course finds it satisfactory, though the weight of authority is against him. He adduces the experiments of Mr. Crosse, repeated by Mr. Weekes, who claim to have produced animalcules in considerable numbers, of a species before unknown, by passing a voltaic current through silicate of potash, and through nitrate of copper. The existence of *entozoa*, or parasitic animals, found in the interior of the bodies of other animals, and found nowhere else, is thought to support the same doctrine. The question is, How came they there? Being too large, either in their perfect form, or in the egg, to have passed through the capillary blood-vessels, how came they within the body of another animal,—itself but a few weeks or a few days old, or even in the embryo stage,— [Pg 10] unless they were created there without parentage of their own species?

These facts and reasonings, it is true, only go to prove, that animalcules, or beings of very small size, and low in the scale of animated existence, can be produced in this way by the inherent qualities of matter. No one will pretend, that a dog, a horse, or a man can thus be created. How can we account for the existence of these larger animals of a higher type, admitted to have been denizens of the earth only since the latest geological epochs, and therefore of comparatively recent origin? Here we come to another point in our author's theory,—the transmutation of species, or the successive *development* of higher and higher orders of being out of the species immediately below them, through the accidental or natural fulfilment of certain conditions, in the course of a long period of years.

Natural history teaches us, that there is quite a regular gradation among the several tribes of vegetables and animals; though we may not be able to range all the species, as constantly advancing in a single line, there is certainly the general appearance of a scale, beginning with the most simple, and going on to the most complex forms. While the external characteristics are very different, all are but variations of a single plan, which exists as the basis of all, and is varied in each individual only so as to accommodate it to the conditions under which the individual is to live. The germ of a higher animal—a mammifer, for instance—is the representative of a lower animal full-grown, like the *volvox globator*; the latter remaining in this initial stage, as an animalcule, through its whole existence; while the former is developed out of it, by successive stages, into a quadruped, or even into a man. Similar functions are performed in different animals by very different organs, the gills of fishes performing the same office as the lungs of the mammalia; and these different organs sometimes exist, at different periods, according to the degree of development, in the same animal. Thus, the tadpole, so long as it continues to be a fish, breathes by gills, which disappear and give place to lungs when it becomes a frog. Similar transformations of the

insect tribe are familiar to all. Imperfect or rudimentary organs are found in certain animals, as the mammæ of a man; a particular organ being here developed to a certain extent, though it is not needed; but being developed a little further, it becomes useful in the next set of animals in the scale. The same peculiarity is found among plants; the skilful gardener being able actually to develope these rudimentary organs by supplying the requisite conditions, and thus, as it were, to raise the plant one step in the scale. [Pg 11]

> "We have yet to advert to the most interesting class of facts connected with the laws of organic development. It is only in recent times that physiologists have observed that each animal passes, in the course of its germinal history, through a series of changes resembling the *permanent forms* of the various orders of animals inferior to it in the scale. Thus, for instance, an insect, standing at the head of the articulated animals, is, in the larva state, a true annelid, or worm, the annelida being the lowest in the same class. The embryo of a crab resembles the perfect animal of the inferior order myriapoda, and passes through all the forms of transition which characterize the intermediate tribes of crustacea. The frog, for some time after its birth, is a fish with external gills and other organs, fitting it for an aquatic life, all of which are changed as it advances to maturity, and becomes a land animal. The mammifer only passes through still more stages, according to its higher place in the scale. Nor is man himself exempt from this law. His first form is that which is permanent in the animalcule. His organization gradually passes through conditions generally resembling a fish, a reptile, a bird, and the lower mammalia, before it attains its specific maturity. At one of the last stages of his fœtal career, he exhibits an intermaxillary bone, which is characteristic of the perfect ape; this is suppressed, and he may then be said to take leave of the simial type, and become a true human creature. Even, as we shall see, the varieties of his race are represented in the progressive development of an individual of the highest, before we see the adult Caucasian, the highest point yet attained in the animal scale.
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> "To come to particular points of the organization. The brain of man, which exceeds that of all other animals in complexity of organization and fulness of development, is, at one early period, only 'a simple fold of nervous matter, with difficulty distinguishable into three parts, while a little tail-like prolongation towards the hinder parts, and which had been the first to appear, is the only representation of a spinal marrow. Now, in this state, it perfectly resembles the brain of an adult fish, thus assuming *in transitu* the form that in the fish is permanent. In a short time, however, the structure is become more complex, the parts more distinct, the spinal marrow better marked; it is now the brain of a reptile. The change continues; by a singular motion, certain parts (*corpora quadragemina*), which had hitherto appeared on the upper surface, now pass towards the lower; the former is their permanent situation in fishes and reptiles, the latter in birds and mammalia. This is another advance in the scale, but more remains yet to be done. The complication of the organ increases; cavities, termed *ventricles*, are formed, which do not exist in fishes, reptiles, or birds; curiously organized parts, such as the corpora striata, are added; it is now the brain of the mammalia. Its last and final change alone seems wanting,—that which shall render it the brain of man.'"—pp. 150–152. [Pg 12]

Usually, it is true, each species produces only its like,—"every creeping thing and beast of the earth" bringing forth young "*after his kind*." But the development of a single animal, under the ordinary law, takes place in a few weeks or days; while the development of distinct races and species is the work of a whole creation, and is spread over countless ages. It is reasonable to suppose, that the latter is effected by means of a higher law, manifesting

itself only at long intervals. Its infrequent manifestation is no argument against the regularity and necessity of its occurrence,—against its being a law at all. The comet that visits our system only once in five hundred years is controlled by the same inflexible principle which causes the return of another comet once in five years. The conditions requisite for a development more perfect than usual,—that is, for the production of a new species,—instead of a new individual of the same species, may be fulfilled only at long intervals; but when they are fulfilled, the result—the more perfect development—takes place as necessarily, as much by the virtue of law, as the more ordinary phenomenon of the propagation of one race. These conditions may be answered in the successive stages of improvement, through which the earth and its atmosphere pass, during the vast periods of time contemplated in geology. In the era of the old red sand-stone, for instance, there were no higher animals than fishes, because the atmosphere was highly charged with carbonic acid, and could not support respiration by lungs. When the air became purer, the gills were changed into the imperfect lungs of the amphibious tribes, such as the huge saurians and the frogs. Deprive these latter animals, in their lower stage, of all access to the light, and they [Pg 13] will not advance to their higher stage. Put a tadpole into a perforated box, and sink it to the bottom of a river, and the animal will never be perfected into a frog; he will grow to an enormous size, but he will continue a tadpole.

We see, then, the process of an "organic creation by law," or by virtue of the inherent qualities of inorganic matter. The ordinary chemical affinities of different substances may draw them together into such compounds as albumen and fibrin, which are the proximate principles of organic tissues. The action of electricity, heat, light, or some other mysterious imponderable agent, on these proximate principles, may produce globules, or germinal vesicles. These germs, multiplying themselves by fissiparous generation, will constitute a stock of animals of a low type, such as a tribe of infusory animalcules. Then "this simplest and most primitive type, under a law to which that of like production is subordinate, gives birth to the type next above it, this again produces the next higher, and so on to the very highest, the stages of advance being in all cases very small,—namely, from one species only to another; so that the phenomenon has always been of a simple and modest character." Thus, the first reptile was born from a fish, the first bird was generated by a reptile, and the first mammifer had birds for its parents. The transformations appear rather astounding, as we pass from one class to another; but the difference between the species, even, is often so great, that the transition appears hardly less difficult. In what quadruped, for instance, do we find the first ancestor of the huge and sagacious elephant? What humble lizard gave birth to those monsters of the fossil world, the plesiosaurus and megalosaurus, thirty or forty feet in length? Man, of course, upon this theory, is only a more perfectly developed monkey, or chimpanzee. With a nod of approbation to Lord Monboddo's theory, our author observes, that man has even the rudiments of "a caudal extremity" in the *os coccygis*.

That the instinct of animals and the mind of man are the results of nothing but material organization is an obvious corollary from this doctrine. "The difference," says this writer, "between mind in the lower animals and in man is a difference in degree only; it is not a specific difference." Mental phenomena, apparently so various and unstable in the [Pg 14] individual, are reduced at once to regularity, and become subject to calculation, if considered in the mass. This shows, that, like the phenomena of the weather, they are under the presidency of natural laws. The phrenologists are the only persons who have followed the order of nature in the study of mind; they have even determined the functions of the different parts of the brain. An experiment is mentioned with a newly killed animal, whose brain was taken out and its place filled with substances producing electric action, when the process of digestion, that had been interrupted, was instantly resumed, thus "showing the absolute identity of the brain with a galvanic battery." The experiment of inducing muscular action in a corpse, by applying galvanism, is sufficiently well known. To borrow an illustration from Sidney Smith, it would seem, that, if we only knew to what organs of the

brain to direct an electric current, an automaton, or a dead man, might be made to hold an argument, "at least as well as most country parsons."

A person who should hear for the first time this naked exposition of the writer's theory would be tempted at once to reject the whole, as too extravagant and absurd to deserve further notice. But he would be much mistaken in this conclusion. The theory is a very plausible one; it is one of the best cosmogonies that the wit of man has ever framed. It is a revival of the old atheistic hypothesis,—the Epicurean doctrine of the formation of the universe by a fortuitous concourse of atoms,—with all the modifications and improvements that were rendered necessary by the discoveries of modern science. We call it an atheistic theory, because, though the writer supposes that primitive matter was first endowed *by divine power* with its mysterious qualities and capacities, this supposition is gratuitous and arbitrary, and only mars the simplicity of the scheme, and injures the consistency and coherence of the parts with each other. We can more easily believe that these qualities are necessarily inherent in the constitution of matter, forming a part of its very essence, just like the properties of impenetrability and extension, than that they subsequently developed themselves by forming myriads of intricate organizations, without further aid from the divine architect. If we can credit the hypothesis, that bricks and mortar came together of their own accord, and arranged themselves into the first house meet for the habitation of man, we can very readily admit, also, that the bricks first assumed the proper shape, and mortar the proper tenacity and hardness, without the intervention of human labor and skill. If there is no need of a bricklayer, we may discard also the brick-maker. [Pg 15]

Putting aside, therefore, this gratuitous addition to the theory, we come to examine the plausibility of the doctrine which assumes, that material atoms, constituted as they now are, are capable, without oversight or direction, of forming a universe like our own, and producing all the animated tribes which tenant it. In all the atheistic reasoning upon this subject, and especially in the work now before us, there is a constant confusion between *what may be*, for aught we know to the contrary, and *what is*, so far as we are able positively to determine it from our present means of observation and experiment; between the *possibility* that is measured only by human ignorance, and the *probability* that is fairly inferred by the legitimate exercise of the understanding. Effects have unquestionably been produced, such as the formation of a solar system, and the production of new and perfectly distinct orders of being, which we are wholly unable to account for by the *present and ordinary* operation of what are called secondary causes. If a theorist chooses to assume, that these secondary causes, under certain conditions, which we never have seen, and never can see, realized, might produce very extraordinary results, might even fully account for the wonderful effects in question, we have a right to say, in reply, that he is dealing in pure speculation and hypothesis; that, having had no experience under the conditions or postulates of his theory, he is necessarily *speaking from* ignorance and *appealing* to ignorance; that, even if we could not point out a single difficulty, a single false assumption, in his whole scheme and argument, it would still remain a mere hypothesis, alike incapable of proof or disproof; and that, at the best, the arguments brought against it must be of nearly the same wiredrawn, speculative, and far-fetched character with those adduced in its support. On a mere sandbank, unsupplied either with arms or tools, the only edifice that can be built is one of sand, and sand affords the only means for its destruction. The fallacy to which such speculatists constantly have resort is, that the weakness or the entire absence of all considerations against their theory constitutes a positive argument in its support. No such thing; it affords only a fair presumption of the baseless character of the whole fabric. [Pg 16]

This may be made more clear by examples. If a child, who has had little experience of the laws of nature, and has learned nothing from books, is gravely assured by his instructor, that in a distant region of the ocean there is an island where stones fly upward instead of downward, and men walk on their heads instead of their feet, the young philosopher, however acute and ingenious we may suppose him to be, certainly could not offer one valid

argument against the alleged fact. He could only stare, and wonder, and say that it might be so *for all that he knew to the contrary*. Just so, when the atheist tells us, that far off in infinite space is a region, of which we can see nothing, even with our best telescopes, except a faint glimmer of light, floating like a cloudlet in the heavens, where the primitive atoms of matter, directed by gravity alone, are slowly congregating together, and forming suns, and planets, and secondary satellites, and giving birth to such intricate harmonies of mutually dependent and revolving worlds as those which have prevailed for ages in our own system; or that, thousands of years ago, the same unassisted laws of matter, which we now see producing only such comparatively meagre and insufficient results, actually caused animalcules to be produced from pure sand, and fishes to be created out of oysters, and birds to be generated by slimy and grovelling reptiles, and men to be born from monkeys;—if he should tell us all this, certainly we could offer no direct confutation of the wonderful tale. In regard to alleged facts of this character, the wisest of men are, and always must be, mere children. But it would be monstrous to say, that this wild assertion derived any support from their admitted bewilderment and incapacity. This would be to attempt to found knowledge upon ignorance. The dim analogies resting on questionable facts, the bold assumptions and slippery arguments on which such daring hypotheses must be based, can be refuted, for the most part, only by reasoning in kind,—by arguments nearly as uncertain, it may be, as those which they are brought to answer. We cannot *prove* a negative; we can only show the insufficiency of the ground on which the opposite assumption is made to rest; [Pg 17] and enough is done for this end, when it is made to appear, that the whole scheme is a *mere* hypothesis.

We make these general remarks only to relieve some readers of this volume from the doubt and perplexity which its perusal may have caused, solely because they were unable to detect any one glaring fallacy or inconsistency in the writer's theory. It appears plausible enough; for, though there is very little in its favor, it seems at first sight as if there was little or nothing to say against it. On closer scrutiny, it will be found, perhaps, that it is disproved by a multitude of considerations, any one of which would be fatal to it; as the hypothesis is of such a character, that, when a single breach is made in it, the whole edifice must tumble. If the intervention of an extraneous cause be absolutely necessary at any one stage or process in the creation, it may as well be admitted in all; the principle must be given up, and the whole purpose of the theist is answered. We shall endeavour to show that this hypothetical history of creation is not only faulty in every point, when viewed from the author's own ground, but, when examined in the proper direction, is absolutely unintelligible, or is in fact no history at all.

Let us look first at the nebular hypothesis. Certain spots and tracts in the heavens, of a whitish color, appearing to the naked eye to be nebulæ, on being examined through a telescope, instantly resolve themselves into a multitude of distinct and perfectly formed stars. Such is the greatest nebula of all,—the galaxy, or milky way. Other spots of a like character, if viewed through glasses of moderate power, still appear as nebulæ; but when seen through more perfect instruments, they immediately seem, like the others, to be a mere crowd of stars. Others, again, are not separated or resolved by the best telescopes; but what is the natural inference from this fact? Surely, we infer that they are merely crowded collections of stars, just like the others, except that they are too distant or too small to be seen as distinct bodies, even with the most powerful instruments that we possess. If telescopes of a greater range should hereafter be constructed, there is every reason to believe that these also will be resolved to the eye into their component parts as stars; and in fact, if newspaper accounts may be credited, when Lord Rosse's new and magnificent telescope was first turned towards some of these spots, which had always preserved their [Pg 18] nebulous appearance when examined by inferior instruments, it was immediately apparent, that they were composed of distinct stars. Yet the hypothesis we are now considering assumes, that these remote and faintly seen nebulæ are not crowds of stars, but primitive luminous matter, the particles of which are slowly congregating together, and forming one

new star, or several. Certainly, never was a bold theory built upon a narrower basis. It is due, however, to the two Herschels, the chief supporters of this theory, to say, that they have always spoken of it only as a hypothesis, and by no means as an established fact in astronomical science. And, as a hypothesis, it labors under this peculiar difficulty, that it evidently never can be verified. It must ever remain a *mere* guess, directly opposed by an obvious induction from those nebulæ which are resolvable into perfect stars.

The fact, that one or two bright points, assumed to be centres of aggregation, are seen in some of these nebulæ, is of no importance. If a bright star be seen from this earth in the same line of vision with the nebula, it will be projected on the ground of that nebula, and will appear as a part of it, though it may be many millions of miles on this side, and have no more connection with it than the planet Jupiter would have, if it should happen to be in conjunction with the nebula, and thus appear for a short time to be projected upon its disc.

There is one consideration of some weight, though we have never seen it adverted to, which tends directly to confute the nebular hypothesis. That faint radiance called the zodiacal light, which is seen to stream up in the form of a cone from our sun, is assumed by our author to be a residuum of the nebulous matter belonging to our system, which has not yet been drawn into the sun, though it is on its way thither. Others have supposed, with far more probability, that it is the sun's atmosphere, and therefore its present shape and size will never change,—as they never have changed, during the period in which they have been observed by man. But no matter; we are now reasoning upon our author's hypothesis. If the zodiacal light be composed of primitive nebulous matter, it must now be comparatively thick and dense, since the process of aggregation has been going on for countless ages, and, in our system, is considered as nearly completed; just as when a sediment is forming in a [Pg 19] tumbler full of turbid water, after the upper portion of the fluid has become entirely clear, there will be a stratum of water next to the sediment more turbid than the whole was before the deposition began. Yet this light is very faint, when seen only from the distance of our earth; and at the boundaries of our system, from the orbit of Uranus, for instance, we cannot believe that it is visible at all. Is it likely, then, that a portion of this nebulous matter, in which the process of deposition has hardly begun, and which is seen from a distance so vast, that in comparison with it the whole diameter of our solar system is but a point, would be visible from this earth? In the case of the other nebulæ, a multitude of perfectly formed suns, uniting their respective beams, are seen only as a faint, whitish speck on the blue arch. And yet we are required to believe, that the luminous matter which will ultimately form but one sun, or perhaps two, while still thinly diffused over an immense tract of space, the process of aggregation having hardly commenced, is yet visible to our eyes at this vast distance.

"Credat Judæus Apella;
Non ego."

We pass to the next chapter in the history, which professes to explain the gradual formation of a solar system by a process of cooling and shrinking, to which the central orb is exposed. And here we are met by a difficulty at the outset; for the existence of comets with their very eccentric orbits is wholly irreconcilable with the theory. At their perihelion, many of these bodies pass within the orbit of Mercury, while the aphelion of some lies without the path of Uranus. Where were they, when the body of the sun filled up the whole of the vast sphere circumscribed by the orbit of the remotest planet? If we suppose that they are late comers, after the rest of our system was perfected,—that they were generated by themselves in distant regions of space, and, having strayed about, orphan-like, for a while, they accidentally crossed our track, and were taken as adopted children into our family, another question remains to be answered. Why did they not remain in their first position, absorb their full share of nebulous matter, beget a respectable family of planets, and take rank as

chiefs of their own clan? These comparatively anomalous bodies are great stumbling-blocks for the *soi-disant* historians of creation.

Again, if an immense orb be formed, the parts of which cohere strongly enough for the whole to turn upon its axis as one body, the process of cooling can go on only from the surface. A crust may finally be formed there; but we see not how the refrigeration and shrinking of the interior parts can then go on separately, until the mass in the centre finally becomes detached from its envelope, like a shrivelled nut from its shell. Our earth is cooling down at this moment, unless the warmth which it receives from the sun exactly counterbalances the loss by radiation of internal heat. But the exterior and interior do not cool by different radiations, nor is there, so far as we know, the least tendency in the central mass to shrink separately, so as to detach itself from the surrounding crust. As deep as we can penetrate towards the centre, we find the heat regularly increase,—just as we might expect, if the only absolute loss of heat be from the surface. [Pg 20]

If the matter now concentrated in the sun, and that which forms the several planets with their secondaries, were all moulded into one mass, and then dilated so as to fill the vast sphere of which the orbit of Uranus forms a circumference, the substance would evidently be in a state of extreme tenuity and diffusion. Immense as the mass of the sun now is, it is but a mere nut at the centre of the grand globe which we are now considering. Expanded to such vast dimensions, we cannot conceive of it as a solid spheroid turning upon its axis, but only as a mass of fluid or vapor, in which a circular motion would generate only vortices or whirlwinds. In such an aggregation of subtile matter, no crust could be solidified on the outer ring, and then detached from the mass within; indeed, any separation of the parts under such circumstances is inconceivable. Even a rotary motion could not be established in it, except by an impulse received from without; for there is every reason to believe, that the movement of a homogeneous fluid towards its centre, if it could take place without disturbing causes, would be in radial lines, and not in a spiral.

Our author brings into view all the mathematical proportions and uniform relations which exist between the constituent bodies of the solar system, in order to indicate the probability of their formation from the constant working of one material cause. Thus he remarks, that the primary planets all move nearly in one plane, and "show a progressive increase of bulk and diminution of density, from the one nearest to the sun to that which is most distant." But he passes over other characteristics of these bodies, equally important, which are quite irregular, and cannot be traced to the operation of one law. Compare the periods of rotation on their respective axes, and we find no correspondence, no indication that the revolving motion was imparted to all by one inflexible law. The first four planets, counting from the sun, perform their rotation in nearly the same time, namely, twenty-four hours. But Jupiter's period is a little less, and Saturn's a little more, than ten hours. Again, Jupiter's axis of rotation is nearly perpendicular to the plane of the ecliptic, while that of Mars is inclined at an angle of fifty-nine degrees forty-two minutes. Another irregularity, still more fatal to the theory, is found in the number of satellites by which the respective planets are attended. Saturn has seven, beside the two rings; Jupiter has four, Mars has none, and the earth has but one. On the single hypothesis, that our system was formed by rings successively thrown off from a central body by a process of refrigeration and contraction, these irregularities are inexplicable. Mars, it seems, did not shrink at all, while Jupiter cast off four separate rings, and the earth produced its single moon. The distances of these bodies from their primaries are also quite irregular; in the case of Jupiter, the outermost of the satellites revolves at a distance which is only twenty-seven times the radius of the primary, and the innermost is distant but six times that radius. This planet, consequently, has shrunk to one twenty-seventh part of its original diameter, and in so doing, has formed four moons; the earth has shrunk to one sixtieth part of its first diameter, and still has produced but one satellite. If the same law had prevailed in the two cases, we ought to have nine or ten moons. [Pg 21]

We need not analyze with any great minuteness the geological facts and hypotheses incorporated into this magnificent history of creation. As will be seen hereafter, the violent and sweeping transformations and convulsions that the earth's crust has undergone directly conflict with our author's theory, and afford the strongest presumption, that an extraneous cause has frequently interfered, at different periods, to repair the desolation produced by the unassisted working of natural laws, to bring order out of chaos, and to people the desert [Pg 22] earth anew with animated tribes. The only general fact of much moment, which our author has drawn from the discoveries of geologists, for the confirmation of his own hypothesis, is, according to his own account, one of the most questionable doctrines in the whole science, —one of a negative character, on which we can never rely with full assurance, till the researches of man have probed every fold, and examined every thread in the texture, of the earth's garment, and thus shown that no evidence can possibly be discovered to the contrary. The alleged fact is that, in the early formations of rock—the first pages in the history of the earth's surface—are found the remains of animals and vegetables only of the lowest type and most imperfect development; while, in the later strata, forms more and more advanced are discovered; so that there seems to have been a constant progress along the line leading to the higher forms of organization. The testimony which goes to support this assertion is wholly negative. The geologist reasons thus: The more perfect organisms have not been discovered in the earlier strata; *therefore*, they do not exist in them. When, in a different connection, it suits our author's purpose to throw doubt on the very postulate which is here admitted, he holds the following language.

> "These, it must be owned, are less strong traces of the birds than we possess of the reptiles and other tribes; but it must be remembered, that the evidence of fossils, as to the absence of any class of animals from a certain period of the earth's history, can never be considered as more than negative. Animals, of which we find no remains in a particular formation, may, nevertheless, have lived at the time, and it may have only been from unfavorable circumstances that their remains have not been preserved for our inspection. The single circumstance of their being little liable to be carried down into seas might be the cause of their non-appearance in our quarries."—p. 95.

In truth, the researches of geologists are every day bringing to light new facts, which compel them to modify or abandon many of the positions they formerly held; so that a considerable portion of the science is a mere quicksand of shifting theories. We need only allude to the various suppositions respecting the origin of drift, and to the numerous modifications of the glacial theory. Important discoveries have been made within a short [Pg 23] time, showing that certain animal tribes had their origin much farther back than was at first supposed. A few years ago, reptiles were believed to be the highest type of life that existed during the era of the new red sand-stone. But Professor Hitchcock's recent discovery in this stone of the footprints of gigantic birds has added a higher class to the zoölogy of the period; and within a few months, in the same red sand-stone of the Connecticut valley, tracks of two or three species of quadrupeds have been found, some of them being probably mammifers of a lower grade. It is true, no fossil remains of these animals have been brought to light; but this want only renders the discovery more significant for our present purpose. It shows that certain animals must have lived at the period in question, though their remains have not yet been found; and from the greater age of the rocks then formed, and the consequent greater number of convulsions of the earth's surface to which they have been subjected, these remains may have entirely disappeared. It is a curious fact, also, that the animal remains of that period, which have come down to us, belong to genera so constituted, that their bodies might well survive, if we may so speak, the shocks which would have destroyed every trace of some more delicate, or more finely organized, beings. We find remains of the flint-shielded animalcules, the hard-shelled mollusca, and the cartilaginous fishes; but the bodies of mammalia, birds, and even the higher species of fishes, some of which we may suppose to have been more tender and corruptible, have

utterly perished. Here and there, an individual of their number left the print of its foot on the sand, which subsequently hardened into rock, and brought down to our times a faint vestige of its past existence.

We are not attempting to impugn the credit of geological science in general, which would be a wholly futile task. The multitude of facts respecting the present constitution of the earth's crust, recently made known by laborers in this department, are among the most curious and most pregnant discoveries of modern times. But when we come to the formation of theories respecting the past history of the earth, in order to account for the phenomena at present visible on its surface, we are evidently afloat on a sea of conjecture, each hypothesis being valid only till a more plausible one is proposed,—which happens very frequently,—or till it is effectually disproved by some new discovery in the rocky strata. A fertile imagination [Pg 24] and a bold face are among the most striking traits of our more daring geologists. Grant to one of this character a few modest postulates,—give him certain millions of years, a sufficient number of earthquakes, a whole battery of volcanoes, a few ocean deluges, and the rise and fall of half a dozen continents,—and he will frame a theory off-hand, which will account for the most perplexing phenomena. Our author is certainly entitled to take his place at the very head of this class of speculatists.

In accounting for the work of creation by the natural and unassisted development of the inherent qualities of brute matter, the great difficulty is found at the first link in the chain of animated being. How can we explain the commencement of *life*? We must have a clear idea of the whole scope of this problem, before we can make any attempt at its solution. Life, then, is *not* mere organization, though most materialists, philosophers, like our author, willingly confound the two things; to hear them reason, one would almost suppose that there was no difference between a dead man and a living one. Organization is subservient to life, ministers to it, manifests it,—supports it, if you please,—but does not constitute it. He must be a bolder man than we are, who will undertake to say *what it is*; but we can very safely declare *what it is not*; and in any particular form or aggregation of matter, whether organic or inorganic, we can give a shrewd guess as to its presence or absence. It may be said, that we beg the question by assuming that organization is not life; it may be so; but it is quite too much to allow the materialist quietly to take the opposite doctrine for granted. He must know the full extent of his task,—that it is necessary for him not only to construct the machine, but actually to set it in motion, so that it shall afterwards run on of its own accord. It is very easy to frame a partial definition of life, by merely describing one or two of its characteristic functions; and then, because some action can be detected between the particles of brute matter, which resembles the exercise of these functions, boldly to declare that the whole mystery is solved. Thus it is said, that life is nothing but the accretion of similar substances, or the addition of like unto like; and as this occurs in crystallization, which is confessedly a phenomenon of inorganic matter, therefore there is no fundamental difference between the properties of living and dead substances. We deny the first [Pg 25] proposition; nutrition is not the only characteristic of life, and the nutritive process, whether in vegetables or animals, is not mere accretion, but assimilation. It has been said, though the assertion is by no means fully proved, that assimilation is only a finer kind of chemistry, the constituent principles being brought together only by their natural affinities. Even if this were true, if the stomach and the digestive apparatus were only a well furnished chemical laboratory, fit for conducting the most delicate experiments, the great difficulty would still remain. The question might yet be asked, Where is the chemist? And this is the fundamental question, which the materialists never attempt to answer, but quietly evade.

The difference between an inorganic and an organic body has been explained by Coleridge clearly enough for our purpose. In the former,—a sheaf of corn, for instance,—the whole is nothing more than a collection of the individual parts; in the latter,—an animal,—the whole is the effect of, or results from, the parts. In the latter case, the whole is every thing, and the parts are comparatively nothing. One of the great effects of life is to keep the parts in

subjection to the whole, making them contribute to its support and growth, and thus maintaining the unity of the system. The stomach digests, the lungs inhale air, the heart beats, and the blood circulates; and as the joint effect, or as the common supporter,—it matters not which,—of these operations, *life* continues, and the animated being is a unit; it has not merely virtual, but essential unity. The reciprocal action of the respiratory, circulating, and nervous systems is absolutely necessary to life. The animal dies, and this unity, this subservience of the parts to the whole, immediately ceases. In the functions of the living body, it may be that the ordinary laws of chemistry are preserved, and that the elements of carbon, oxygen, and hydrogen combine and separate according to their ordinary affinities, and in no unusual proportions. But after death, at any rate, quite a different set of chemical laws come into play, and produce a result which is the very opposite of that before effected. There is no longer any unanimity or coöperation; instead of sustaining or building up the animal tissues, the affinities now in operation tear down, destroy, and resolve them into their ultimate elements,—each part following out its own law of destruction or resolution, irrespectively of the others. [Pg 26]

> "There is in living organic matter a principle constantly in action, the operations of which are in accordance with a rational plan, so that the individual parts which it creates in the body are adapted to the design of the whole; and this it is which distinguishes organism. Kant says, 'The cause of the particular mode of existence of each part of a living body resides in the whole, while in dead masses each part contains this cause within itself.' This explains why a mere part separated from an organized whole generally does not continue to live; why, in fact, an organized body appears to be one and indivisible. And since the different parts of an organized body are heterogeneous members of one whole, and essential to its perfect state, the trunk cannot live after the loss of one of these parts."—*Müller's Physiology*, Vol. I., p. 19.

The apparent exceptions to this statement—as in the case of the polypes, which multiply by fissiparous generation, or by spontaneous division of their bodies into parts, each part becoming a perfect animal—are only apparent. These creatures, which are low down in the scale of being, exemplify what Mr. Owen calls "the law of vegetative or irrelative repetition," as they have many organs performing the same function, and not related to each other by combination for the performance of a higher function. Thus, a Polygastrian has many assimilative sacs, each performing the office of a stomach irrespective of the rest. In the insect tribe, the respiratory function, instead of being performed by one set of lungs for the whole body, is carried on through a series of minute and highly ramified tubes, which traverse every part of the body, and open to the air by a great number of orifices. In some instances, both respiration and digestion seem to take place over the whole surface of the body; for Trembley found at least one case, in which the animal digested its food equally well, after it had been turned inside out. A number of similar parts being repeated in each segment of the individual, the body can be divided, and the several portions, each still containing some of all the organs essential to the whole, will continue to live separately. The severed parts will even continue to grow, and to develope other organs convenient for individual existence. But most animals, especially the more perfect, do not constitute an aggregate of similar parts united by one trunk, and therefore propagation by division is in them impossible. The ovum, when separated from the parent, is an entire animal only *potentially*; during its development, the essential parts which constitute the *actual* whole are produced. In the case of the polyps, we have only to suppose that the ovum remains connected with the parent being, till all, or nearly all, its essential parts are produced. It is then shed not as a mere ovum, but as an animal nearly or wholly complete. [Pg 27]

Now, all the instances adduced by our author, to show similarity of action in the organic and the inorganic world, are irrelevant. The analogies are not merely imperfect; they are no

analogies at all. Crystals increase by the aggregation of new particles on the external surfaces of the parts already formed; there is no consentaneous operation of the parts on the whole. The molecules of crystals are homogeneous throughout, and the several aggregates of these molecules are independent of each other; while organized bodies are composed of parts perfectly dissimilar from each other, but all of which conspire to one end. "The growth of organized bodies," says Müller, "takes place in all particles of their substance at the same time, while the increase of the mass in inorganic bodies is produced by external apposition." Frostwork on the windows may resemble vegetable *forms*; but it has no resemblance whatever to vegetable *life*. Electricity may counterfeit the *action of life*, for a moment, on a particular limb, by causing the muscles to twitch; but it does not counterfeit *life itself*, by causing all the parts again to contribute to the sustentation of the whole. A French chemist, by electric action, may have produced *globules* in albumen; there is nothing very wonderful in that; any one may blow bubbles in a viscid fluid. The resemblance between these globules and proper germinal vesicles amounts to nothing more than similarity of outward shape; there is no more real resemblance between them than between the oval lump of chalk which farmers sometimes put into a hen's nest, in order to deceive poor Dame Partlet, and the real egg which the hen deposits by the side of it. Certainly, the imponderable agents, heat, light, and electricity, are in some mysterious way *connected with* life, so as to contribute to its support; there is nothing more in this assertion than in the familiar proposition, that a seed will germinate only under the proper conditions of soil and climate; [Pg 28] but that these agents, acting on inorganic matter, ever *create* or *commence* life is a pure hypothesis, not supported even by the shadow of a fact.

Having thus shown how weak are the general considerations in favor of the theory, that animated beings may be created out of inorganic matter by mere natural laws, we should proceed to consider the direct evidence adduced to prove that life has actually been produced in this way. Here the whole question is opened respecting the alleged instances of equivocal generation, and we have neither space nor ability to discuss them at length. Those who are curious respecting the question may find a brief summary of the evidence on both sides in a former number of this Journal.[1] We can mention only a few facts and arguments, which show the extreme improbability of the doctrine supported by our author and a few other theorists.

In the first place, it is remarkable, that all the races of animated beings, which are entirely within the range of our powers of observation,—which have such a size and locality that we can study and accurately determine their organization and habits,—are unquestionably produced from parents of their own kind. Only the minute microscopic animals are now supposed to be generated spontaneously; and this alleged fact rests not on direct proof, but only on our inability in certain cases to trace the process of their production in the ordinary way. As many of these animals, in their perfect state, are not more than the twelve thousandth part of an inch in diameter, it is not much to be wondered at, that we should not be able in all cases to discover their ova, or to follow these ova through all their stages of development into the complete being. It is farther remarkable, that these animalcules, when once produced, whether by spontaneous or natural generation, are all found to be provided with the organs or requisite means for continuing their species, and, in fact, for multiplying their number from themselves with astonishing rapidity. As they certainly have children, it seems reasonable to suppose, according to the analogy of all the higher animated tribes, that they also had parents. The ancients supposed, that the worms and insects which appear in [Pg 29] decaying organic matter were generated there by the decomposition of the substance, without the previous agency of individuals of the same stock. Every schoolboy is acquainted with Virgil's mode of obtaining a new swarm of bees from the decaying carcass of a heifer. Subsequent researches, made with more care, and perhaps with better instruments of observation, have entirely disproved the hypothesis, and show that the maggots were produced in every case from eggs deposited by flies or other insects, and

were afterwards themselves developed into the state of perfect insects. Then it seems reasonable to believe, that the improved observations of future times will clear up the only remaining difficulty, and show how the infusory animalcules also are generated from beings of their own kind.

These minute creatures are prolific to a degree that transcends all calculation; and they exist, either in the egg or maturely developed, in inconceivable numbers. A single wheel-animalcule, *Hydatina senta*, which was watched for more than eighteen days, and which lives still longer, is capable of a fourfold increase in twenty-four or thirty hours; a rate of propagation which would afford in ten days a million of beings. From their tenacity of life, extraordinary powers of reproduction, and incalculable numbers, their united influence may be said to be far more important, in all the great operations of nature, than that of the larger and more perfectly developed organisms. They swarm in all the seas, and play an important part in choking up harbours and forming great deposits at the mouths of rivers. The remains of those which have perished form great beds and strata in the crust of the earth. The silicious stone, called Tripoli, is entirely composed of such remains; at Bilin, in Bohemia, there is one stratum of this substance, fourteen feet thick, one cubic inch of which is estimated to contain forty-one thousand millions of individuals. Their extreme tenacity of life is evinced by the fact, that many of them may be entirely desiccated, and preserved in pure sand for several years, after which, on the application of a drop of water, they may be restored to life. In this dried state, M. Doyère exposed some of them to a heat equal to that of boiling water, and afterwards revived them; though, in an active state, if subjected to a much lower temperature, they perish. If, then, the fully developed and mature can resist such powerful extraneous causes of destruction, how much more must the ova possess the [Pg 30] power of enduring them without losing their latent life! The following extract from Professor Owen's Lectures shows the bearing of these facts upon the question of equivocal generation.

> "The act of oviparous generation, that sending forth of countless ova through the fatal laceration or dissolution of the parent's body, is most commonly observed in the well-fed *Polygastria*, which crowd together as their little ocean evaporates; and thus each leaves, by the last act of its life, the means of perpetuating and diffusing its species by thousands of fertile germs. When the once thickly tenanted pool is dried up, and its bottom converted into a layer of dust, these inconceivably minute and light ova will be raised with the dust by the first puff of wind, diffused through the atmosphere, and may there remain long suspended; forming, perhaps, their share of the particles which we see flickering in the sunbeam, ready to fall into any collection of water, beaten down by every summer shower into the streams or pools which receive or may be formed by such showers, and, by virtue of their tenacity of life, ready to develope themselves wherever they may find the requisite conditions for their existence.
>
> "The possibility, or, rather, the high probability, that such is the design of the oviparous generation of the *Infusoria*, and such the common mode of the diffusion of their ova, renders the hypothesis of equivocal generation, which has been so frequently invoked to explain their origin in new-formed natural or artificial infusions, quite gratuitous. If organs of generation might, at first sight, seem superfluous in creatures propagating their kind by gemmation and spontaneous fission, equivocal generation is surely still less required to explain the origin of beings so richly provided with the ordinary and recognized modes of propagation."—pp. 31, 32.

Recent accounts show, that the dust collected from the atmosphere at sea, many miles from land, generally contains some of these dried animalcules and their ova. Many of these germs

can be developed only in particular localities, or under certain conditions which are rarely fulfilled. Consequently, if there were but few of them, the species might perish, because those few might not find their appropriate home. But such an accident is guarded against by the vast multiplication of these germs and their wide dispersion; for, unlike all the higher tribes of beings except man, the same species is often found in all regions of the globe. Very few, in comparison with the whole number, may find a proper *nidus*; but these few then [Pg 31] propagate with such marvellous rapidity, as fully to replenish, if not to increase, the original stock. Thus they have been enabled, as species, to survive even those destroying causes which exterminated all the higher forms of animals. Several species still exist, which were in being at the time of the cretaceous formation, though all the other animated races belonging to that period have perished. "These animalcules," says Ehrenberg, "constitute a chain, which, though in the individual it be microscopic, yet in the mass is a mighty one, connecting the organic life of distant ages of the earth."

In view of facts like these, we may surely say, that the existence of the infusory animalcules, and even of the entozoa, is conceivable, supposing they could only have been produced by parents of their own kind, and without having recourse to the anomalous and hypothetical doctrine of equivocal generation. We may not be able to trace their line of parentage, for our imperfect vision cannot follow the motes which play in the sunbeam, nor track them from their birth-place to their final home. But we know that they must be deposited in every layer of dust that falls from the atmosphere, that they must be inhaled with every breath which an animal draws, and be swallowed with every morsel and drop of its food. The experiments which seem to prove that living beings may be produced from pure inorganic matter are all explicable on the supposition, that adequate precautions were not taken to exclude every animal and germ capable of development from the substances experimented upon, and from the air which was admitted into the apparatus. On this ground, the experiments of Crosse and Weekes, cited by our author, have been quite generally rejected by scientific men, as hardly deserving of notice. We learn that the former was "discouraged by the reception of his experiments," and "soon discontinued them";—with good reason, for it does not appear from our author's account, that he adopted any precautions at all. Mr. Weekes seems to have been a little more cautious, and the consequence was, that he did not observe any appearance of life among the substances experimented upon for "eleven months," at the end of which time we may reasonably suppose, that his precautions ceased to have perfect effect. The only experiment, in which adequate means to guard against causes of error were taken, was that of Professor Schulze, [Pg 32] of Berlin, which had a contrary result. We extract Mr. Owen's account of it.

> "He filled a glass flask half full of distilled water, in which were various animal and vegetable substances: he then closed it with a good cork, through which were passed two glass tubes, bent at right angles, the whole being air-tight: it was next placed in a sand bath, and heated until the water boiled violently. While the watery vapor was escaping by the glass tubes, the Professor fastened at each end an apparatus which chemists employ for collecting carbonic acid: that at the one end was filled with concentrated sulphuric acid, and the other with a solution of potash. By means of the boiling heat, it is to be presumed that every thing living, and all germs in the flask or in the tubes were destroyed; whilst all access was cut off by the sulphuric acid on the one side, and by the potash on the other. The apparatus was then exposed to the influence of summer light and heat; at the same time, there was placed near it an open vessel, with the same substances that had been introduced into the flask, and also after having subjected them to a boiling temperature. In order to renew constantly the air within the flask, the experimenter sucked with his mouth several times a day the open end of the apparatus, filled with the solution of potash, by which process the air entered his mouth from the flask through the caustic liquid, and the atmospheric air

> from without entered the flask through the sulphuric acid. The air was of course not at all altered in its composition by passing through the sulphuric acid in the flask; but all the portions of living matter, or of matter capable of becoming animated, were taken up by the sulphuric acid and destroyed. From the 28th of May until the beginning of August, Professor Schulze continued uninterruptedly the renewal of the air in the flask, without being able, by the aid of the microscope, to discover any living animal or vegetable substance; although, during the whole of the time, observations were made almost daily on the edge of the liquid; and when, at last, the Professor separated the different parts of the apparatus, he could not find in the whole liquid the slightest trace of *Infusoria* or *Confervæ*, or of mould; but all three presented themselves in great abundance a few days after he had left the flask standing open. The vessel which he placed near the apparatus contained on the following day *Vibriones* and *Monads*, to which were soon added larger Polygastric *Infusoria*, and afterwards *Rotifera*."—pp. 32, 33.

For readers who are not familiar with these subjects, it may be well to mention, that the weight of authority is decidedly against this doctrine of spontaneous generation. It is [Pg 33] rejected by Müller, who ranks among the first physiologists of Germany; by Ehrenberg, one of the most distinguished microscopists in the world; and by Owen, who stands at the head of the school of comparative anatomy in England, if not in Europe. The remark made by Cuvier, more than thirty years ago, is still true at the present day, that, "although the impossibility of spontaneous generation cannot be absolutely demonstrated, yet all the efforts of those physiologists who believe in the possibility of it have not succeeded in showing us a single instance."

Passing over, then, our author's theory of the origination of life from inorganic matter as utterly untenable, we come to the next point in his system,—the most chimerical of all,—the gradual development of the higher orders of being out of those next beneath them in the scale. It is not pretended, that there is *any known instance* of the transmutation of species, or of the evolution, in the ordinary way, of any being specifically different from its parents. The same animal, indeed, may pass through different grades of development; but these changes affect only the individual, not the race. The progeny of this animal must begin at the same point where its parent did, and run precisely the same cycle. The tadpole becomes a frog, but the young of that frog are tadpoles; the worm becomes a winged insect, but the eggs of that insect are hatched into nothing but worms. These changes in the life of the individual, like the successive periods of the embryotic state, of infancy, and manhood in the human being, are perfectly consistent with persistence of type in the race, and do not indicate even the possibility that a new species may be developed out of an old one. On the contrary, the germ must be considered as *potentially* equivalent to the whole future being, for it is invariably developed into that being. If there be any one fact unquestionably established by observation, it is that each species invariably produces its like. "All the phenomena," says Müller, "at present observed in the animal kingdom, seem to prove that the species were originally created distinct, and independent of each other. There is no remote possibility of one species being produced from another."

The doctrine of our author, then, is confessedly a pure hypothesis, and, as such, it might be summarily dismissed into the region of cloud-land and dreams, where it had its origin. The [Pg 34] burden of proof is upon him, and as he has failed to produce a single instance in which his theory is exemplified, he may be rightfully debarred the privilege of discussion. But waiving this point, if we look into the grounds of his conjecture, we find bold assumptions more than once substituted for the plain statement of facts, which would destroy every shade of credibility in his doctrine. True, there is an appearance, both in the animal and vegetable kingdoms, of an ascending scale of being, from simply organized forms and imperfect developments up to the complex arrangements and nice adaptations of the

advanced tribes. But the progress is not regular, nor are the intervals of constant length. The line is often broken and doubled, and, in fact, the individuals are far more naturally arranged in a number of parallel lines, beginning successively at a somewhat lower point, than in a single series. Man, of course, is placed at the head of the animal tribes; but the interval which separates him from the chimpanzee cannot easily be cleared at one bound. He forms but one genus, and that genus is the only one of its order. But even if the line of gradation were single and perfect, the fact would be of no service to the hypothesis we are now considering; for the interval between two species most nearly allied to each other seems to be quite as impassable as the broadest gulf of separation.

The point chiefly relied upon to show the credibility of this doctrine is the fact, according to our author, that the higher animals pass through a series of changes resembling the permanent forms of the lower tribes. The first form of man himself "is that which is permanent in the animalcule"; and thence he comes to resemble successively a fish, a reptile, a bird, and the lower mammifers, before he attains his specific maturity. It is held, then, that a premature birth from an animal of a higher kind might have instituted a new race of a lower type; and that a birth unusually delayed, permitting an embryo to be still farther advanced in the line of organization, might have created a new species of a higher order than the parent. Here, every thing depends on the *absolute identity* of the germs of all animals, in the lower stages of their growth. General resemblances and analogies are of no weight whatever; the essential internal organization of the ova of different species must be the same; otherwise, however ripened into a mature being, whether the birth be advanced or [Pg 35] postponed, the individual must still belong to its parents' species, of which it possesses the distinctive peculiarity. Now, this point of *the identity of germs is a mere assumption*; not only is it destitute of proof,—the whole evidence is against it. There is a degree of outward resemblance, but there is no sameness. When we trace the origin of life back to the remotest point to which our powers of observation extend, when we come to microscopic vesicles that can be discerned only by the highest magnifiers, general similarity of outward shape is all that can be predicated of them. The specific differences lie below this general resemblance of outward form; we cannot discern them, but we *know* that they must exist, and that they are *essential* differences, for each one of these vesicles is invariably developed, if at all, into an individual of the species to which its parent belongs. The germinal vesicles of a tree and a quadruped are somewhat alike, outwardly; so, to the hen's eyes, there is no difference between her own eggs and the duck's eggs which the farmer's wife has put into her nest. But when she has hatched her brood, part of them are found to be web-footed, and these, to her great astonishment and distress, immediately take to the water. Our author commits the same blunder as the poor hen. This want of consciousness that he has got to the end of his tether, this inability to believe that any difference can exist where he is not able to see it, though it is invariably indicated by future consequent differences of the most striking nature, is perfectly characteristic of the rash theorist in science.

The assertion, that man's "first form *is* that which is permanent in the animalcule,"—even if we do not look to the potentiality of development into a higher being, which experience shows to exist in the human germ, but not in the infusorial,—is a positive misstatement. The lowest monad has a mouth and means for propagating its kind, which do not belong to the primitive ovum of any higher animal. About the succeeding stages in the growth of the embryo our author's language is more cautious. He only says, that they *resemble*, or *typify*, some of the lower orders of being; and this is virtually admitting a specific difference, and giving up his own theory for all the conditions posterior to that of the germ. The brain and heart of the embryo successively *resemble* the corresponding organs in a fish, a reptile, a bird, and a quadruped; but they are not identical, *even in outward appearance*, with those [Pg 36] organs. Of course, if arrested at any stage of its growth, and prematurely born, the embryo would not be one of the lower animals, but only something resembling it in outward shape; and conversely, if it were possible for the birth of a bird to be delayed till it had reached a higher stage of development in the same line in which it was proceeding, it would not

become a quadruped, but it would be an anomalous creature somewhat like one. Consequently, no one species now on the earth can have been evolved out of any other existing race; because the germs of any two, at a very early stage in their history, according to our author's own confession, are specifically unlike.

To avoid this difficulty, he is driven to a further supposition, still more gratuitous and improbable; namely, that the germ destined to become one of a different race from its parents, having advanced along its usual line of development so far as that line coincides with the one belonging to the new species, there diverges, and follows a different path up to the period of its birth into a new creature; that is, the embryo of a reptile, having grown for a certain time as if it were to be a reptile, suddenly turns aside, like a young man changing his mind about the choice of a profession, and for the rest of its fœtal life follows the proper line of progress in order to be developed into a bird. This is mere dreaming, and reminds one only of the wonderful transformations effected by enchantment in an Arabian tale. We might just as plausibly suppose, that the reptile, after it became mature, was suddenly transformed into a bird, as that it underwent this change before it was hatched. All the evidence attainable goes to show, that the law of development is as immutable before as after birth, the several stages of progress succeeding each other in a constant order, and affecting the individual only, not the race. A young monkey is no more likely to be transmuted into a man than an old one; nor is such a metamorphosis at all more probable in the course of its fœtal life.

The view we have now obtained of the specific differences between distinct races of being at separate periods of their existence is precisely what might have been anticipated from the law of gradual development, which holds throughout the organic kingdoms. Between two mature animals, these differences are perfectly obvious and well marked. As we go a step [Pg 37] back in their history, the distinction becomes a little more obscure; two worms may resemble each other very closely, though the two winged insects subsequently produced from them may be very unlike. Receding still farther, some of these specific differences may entirely disappear, the organs or parts which should exhibit them being not yet developed. And when we come to the primitive germs, so minute as to be visible only through the microscope, no outward distinction, perhaps, is any longer perceptible, and the radical difference of their internal organization is indicated only by the fact, to be verified by subsequent observation, that the two are invariably developed into perfectly distinct animals, belonging respectively to the same races with their parents. A theorist, whose whole system is based upon the invariable operation of natural agencies, cannot reasonably object to this conclusion.

That our statements in the course of this argument may not appear of the same questionable character as those advanced by our author, we will fortify them with a few brief citations from a work of such unquestionable authority as the Lectures of Professor Owen.

> "No doubt the minute infusoria, which seem to have their development arrested at the first or nearest stage from the primitive cell formation, offer close and striking analogies to the primitive cells out of which the higher animals and all their tissues are developed; but the very [first] step which the infusoria take beyond the primitive cell stage invests them with a specific character as independent and distinct in its nature as that of the highest and most complicated organisms. No mere organic cell, destined for ulterior changes in a living organization, has a mouth armed with teeth, or provided with long tentacula; I will not lay stress on the alimentary canal and appended stomachs, which many still regard as 'sub judice'; but the endowment of distinct organs of generation, for propagating their kind by fertile ova, raises the polygastric infusoria much above the mere organic cell."—pp. 25, 26.

> "In comparing the several stages in the very interesting development of the *cyancæa aurita* to the infusoria and polypes, it must be understood that such comparisons are warranted only by a similarity of outward form, and of the instruments of locomotion and prehension. The essential internal organization of the persistent lower forms of the *zoöphyta* is entirely wanting in the transitory states of the higher ones. A progress through the inferior groups is sketched out, but no actual transmutation of species is effected. The young medusa, before it attains its destined condition of maturity, successively resembles, but never becomes, a polygastrian, a rotifer, and a bryozoon."—p. 112.

[Pg 38]

> "Thus every animal in the course of its development typifies or represents some of the permanent forms of animals inferior to itself; but it does not represent all the inferior forms, nor acquire the organization of any of the forms which it transitorily represents. Had the animal kingdom formed, as was once supposed, a single and continuous chain of being, progressively ascending from the monad to the man, unity of organization might then have been demonstrated to the extent in which the theory has been maintained by the disciples of the Geoffroyan school."—p. 370.

If these similarities of structure in the germ had any bearing on the subject, they would indicate the possibility only of retrogression in the scale. Of course, the immature ovum, arrested in its development, could not form a more perfect being than its parent. There is no pretence that the embryo, at any stage of its progress, images an animal of a higher grade than its own family. Then what aid do these similarities of structure afford to the theory, that all the higher organisms have been evolved by successive steps out of the lowest monad? At the best, you have only shown, that a *retreat* is possible; you have still to point out any likelihood, even the remotest, of an *advance* in the scale of being. There is no fact whatever to confirm the supposition, that birth may possibly be delayed till the animal be developed into one of a higher species; and the law of immature births seems to be, that, if the offspring escapes at all—for there is great risk consequent on such an accident,—it becomes as perfect as its progenitors. Nature seems to guard the distinctions between the several races with peculiar care; so far as we know, monsters either do not survive their birth, or are incapable of continuing their kind, or in the course of a single generation are reunited to the original family.

To say that these laws, distinct and invariable as far as the observation of man has extended, may possibly have been superseded in the lapse of ages by a higher principle, manifesting itself only at long intervals, is again to have recourse to a blank hypothesis, incapable alike of proof or disproof, and unsupported by the faintest intimations from the world of experience. To build up a theory in this way is not to account for the work of creation by the natural agencies and inherent qualities of matter, *as at present observable*, but to fly off to the wild supposition, that matter and life were more richly endowed ages ago than they are in our own day. You affirm, that this higher principle of development did not override the inferior laws at the earlier periods in time's history, because, in the infancy of the universe, the conditions were wanting which are requisite for its manifestation,—because the earth was not ready, the atmosphere was not purified, for the nobler races of being. Very well; but these conditions are answered *now*. All things are ready at the present day for the innate energies of matter to put forth their utmost strength. Why do not fishes generate reptiles, and birds produce mammifers, *now*? Ah! but "the earth being now supplied with both kinds of tenants in great abundance, we could only expect to find the life-originating power at work in some very special and extraordinary circumstances." It seems, then, that these inherent qualities of matter, once supposed to be blind, absolute, and invariable in their operation, are really very judicious and reasonable; they suit the supply to the demand, and actually cease working when the market is likely to be overstocked. The results of such

[Pg 39]

"*natural* agencies" as these are very like the effects produced by the volitions of a wise and thinking being.

It happens that we are not obliged to grant to our author an indefinite lapse of ages for the sake of bringing all his higher principles into action. One of the latest events in the geological history of the earth was a great submersion of the land, by which "terrestrial animal life was extensively, if not universally, destroyed"; so that the creation of the species now in being—at least, all the higher species—was "a comparatively recent event, and one posterior, generally speaking, to all the great natural transactions chronicled by geology." Science does not contradict, it rather confirms, that voice of revelation or tradition, which assigns about six thousand years as the period of man's residence upon the earth. The action of the drama, then, is restricted within moderate limits as to time, and the "natural agencies" [Pg 40] and "higher principles" must work fast in order to accomplish their task within the prescribed period. One condition for the creation of a new and permanent species, belonging to any of the higher orders, seems to have escaped our author's notice; at least two individuals, a male and a female, must have been evolved out of the next lower race, before the new species could continue its kind. Apply these considerations to the creation of man, who, according to our author's Scripture, was born of a monkey. To suppose, that, at the first trial, an Adam and an Eve were born near each other, so that they might have a chance of meeting in the course of their lives, would look too much like the operation of intelligence and design. On the theory of an organic creation by law, as the monkey race is spread over large regions of the globe, we must suppose that many of each sex were produced, and died childless, before any Adam was happy enough to find an Eve. Then, at no very distant period, within a few thousand years, the birth of a man from an animal of a lower type was no very strange event. Probably it occurred so often, that the monkeys themselves ceased to be astonished at it. And yet, this tribe of animals, with all the benefit of large experience, with increased numbers, and with all the requisite conditions fulfilled at least as perfectly as they were at the earlier period of their history, have not succeeded, in the three or four thousand years during which they have been subject to the observation of intelligent beings, in producing even a decent semblance of a man.

With the exposure of this crowning absurdity, we must close our direct examination of this "History of Creation." We have not room to consider some of the appendages to the theory, such as the assertion of the essential unity of the human and the brute intellect, the denial of the immaterial nature of mind, and the advocacy of the system of phrenology. These absurd and degrading doctrines are naturally connected with the atheistic hypothesis we have been considering. They are its legitimate children. But they have already been refuted so often and so conclusively, that any revival of them at the present day is hardly deserving of notice. If we should stop here, then, it may fairly be left to the judgment of our readers, whether we have not fulfilled the pledge given at the outset, by showing that this theory is [Pg 41] faulty at every point, even when viewed from the author's own ground. The proposal of it is no new thing. In one or another form, varying in particulars, but agreeing in substance, it has been before the world ever since the days of Democritus, and more especially of his follower, Epicurus. Lucretius clothed it in sonorous and majestic verse, for it is a theme fitted above all others to excite the fancy, and to receive the richest embellishments from the imagination. Modern authors have promulgated it again and again, with little other change than what was requisite to adapt it to recent improvements in science, and to engraft upon it some of their own favorite hypotheses and fancies. The version of it by the French naturalist Lamarck was the latest and the most in vogue, till the appearance of the present volume. So frequently has it been confuted, that the revival of it at this late period seems little more than a harmless exercise of ingenuity, a poetical and scientific dream, and one need hardly take the pains to expose its assumptions and fallacies. The violent suppositions which it involves only remind one of the remark quoted from Pascal on a former page, that "unbelievers are the most credulous persons in the world." If set forth only as a novel and pleasing fancy, it may be classed with other ingenious fictions, that are published without a thought of

deception. But if seriously proposed, it can be fitly characterized only by borrowing the homely but energetic language of Dr. Bentley.

> "And now that I have finished all the parts which I proposed to discourse of, I will conclude all with a short application to the atheists. And I would advise them, as a friend, to leave off this dabbling and smattering in philosophy, this shuffling and cutting with atoms. It never succeeded well with them, and they always come off with the loss. Their old master, Epicurus, seems to have had his brains so muddled and confounded with them, that he scarce ever kept in the right way; though the main maxim of his philosophy was to trust to his senses, and follow his nose. I will not take notice of his doting conceit, that the sun and moon are no bigger than they appear to the eye, a foot or half a yard over; and that the stars are no larger than so many glow-worms. But let us see how he manages his atoms, those almighty tools that do every thing of themselves, without the help of a workman. When the atoms, says he, *descend* in infinite space (very ingeniously spoken, to make high and low in infinity), they do not fall plumb down, but decline a little from the perpendicular, either obliquely or in a curve; and this declination, says he, from the direct line is the cause of our liberty of will. But, I say, this declination of atoms in their descent was itself either necessary or voluntary. If it was necessary, how then could that necessity ever beget liberty? If it was voluntary, then atoms had that power of volition before; and what becomes then of the Epicurean doctrine of the fortuitous productions of worlds? The whole business is contradiction and ridiculous nonsense."—*Bentley's Works*, Vol. III., pp. 47, 48.

[Pg 42]

Custom and convenience lead us to speak of the "laws" of nature, and of the "powers and forces" of brute matter; and few persons, in adopting these phrases, are aware that they are using a figure of speech. Yet nothing is more certain than that all the researches of science have not been able to point out with certainty a single active cause apart from the operation of mind. We discern nothing but regularity and similarity of sequences; and the attribution of these effects to some occult qualities in the atoms or molecules in which they are manifested is wholly hypothetical, and even, when closely examined, is inconceivable. For this reason we affirm, that the theory of our author, professing to account for the whole work of creation "by the operation of law," is not only unsound and baseless in its particulars, but, when scrutinized as a whole, is absolutely unintelligible. *He attempts to account for a string of hypothetical effects, such as spontaneous generation and the transmutation of species, by a series of hypothetical and inconceivable causes, such as the energies of lifeless matter.* Let any one conceive, if he can, of any *power*, *energy*, or *force* inherent in a lump of matter,—a stone, for instance,—except this merely negative one, that it always and necessarily remains in its present state, whether this be of rest or motion. Let him point out, if he can, the *nexus* between what are usually denominated cause and effect in matter,—as when two bodies are drawn towards each other, if they are in opposite states of electricity. When he says that it is the *nature*, or *law*, of bodies thus electrified to attract each other, he offers no explanation of the phenomenon; he only refers it to a class of other results, of a similar character, previously observed. It is not pretended, that all or any of these results, formerly known, are more intelligible or explicable than the one in question. But the latter is classed with them, because, from their general similarity, from their taking place under the same outward circumstances, it is reasonably supposed that *one* cause, whatever it may be, is common to them all. And this is the whole business of the student of nature, to place together results which are so similar, that we may attribute them to a common cause, without assuming to know what that cause is. The sole office of science is the theory, not of causation, but of classification. It is all reducible to natural history, the essence of which consists in arrangement.

[Pg 43]

We are not attempting to perplex a plain matter of science by introducing into its discussion a metaphysical subtilty. The principle here contended for is one of the first dictates of the inductive philosophy, and as such it has been frankly acknowledged and acted upon by all the great improvers of science in modern days. When Newton discovered that the planets circle round the sun in the same manner in which a stone thrown by the hand describes a curve before reaching the earth, he may be said to have *explained* the former phenomenon by bringing it into the same class with certain results which have long been familiar to us. But the explanation was only relative, not absolute. The latter phenomenon is, in reality, no more explicable than the former; he did not pretend to know the *cause* of the stone's falling to the ground, any more than of the revolution of the planets. It was something to be able to arrange these apparently heterogeneous results in the same class, and gravity was a convenient name to apply to the whole. But the supposition, that gravity was an occult cause, inherent in matter, he earnestly repelled, and declared that it was "inconceivable."[2] Franklin showed, that a thunder-cloud and the charged conductor of an electrical machine manifested the same phenomena, and might therefore be classed together; sparks were obtained from both, Leyden jars were charged from them, other bodies were attracted and [Pg 44] repelled in a similar way, so that it was reasonable to believe that the same agency was acting in both cases. What this agency was he did not even guess. The *cause* of electric action, whether in the excited cloud, or the excited tube, was just as obscure as ever. Chemists observed, that different substances, when brought into close contact, sometimes remained distinct, and sometimes united with each other in various but regular proportions; and these capacities of coalescing with one class of bodies, and of remaining unaffected by another, are called chemical "affinities." This is a convenient generalization, and has properly received a specific name; though the common appellation throws no light on the *cause* of the phenomena, which remains an impenetrable secret. To say that certain action is *caused* by the operation of chemical affinities is only to arrange it with a large class of other observed appearances, equally obscure as to their origin and essential character.

Let us go a step further, and suppose that the progress of discovery has made known certain facts lying behind the phenomena in question, to which they may all be referred. Let us suppose, that all bodies which gravitate towards each other are found to be embosomed in a subtile, ambient fluid, which connects them, as it were, into one system; that the positive and negative states of electricity are resolvable into the presence of two fluids standing in certain relations to each other; and that substances show chemical affinity for each other only when they are in opposite electrical conditions. Still, we have only advanced a step in the generalization, and the real, efficient *cause* of the appearances is still hidden from us by an impenetrable veil. Gravitation is now referred to the communication of motion by impulse; electricity, to the combination and separation of different fluids; affinity, to the attraction or repulsion of these fluids. The latter classes of phenomena are more general, but not a whit more explicable, than the former. We have now fewer causes to seek for, but not one of these few has been discovered. When we have resolved electricity or gravitation into the presence of an elastic medium, it is a mere figure of speech to say, that we have discovered the *cause* of the electric phenomena or of gravity. That is just as far off as ever; for we have yet to discover the principle whence flow *necessarily* all the phenomena [Pg 45] observable in fluids. It is the sole end and the highest ambition of science to discover as many as possible of the relationships which bind facts together, and thus to carry the generalization to the farthest point. Its office is not to discover causes, but to generalize effects. The investigation of real causes is quite given up, as a hopeless undertaking.

Observe, now, how all the phraseology employed in speaking of these successive generalizations of science is borrowed from the action of mind. The word *action* itself has no real significance, except when applied to the *doings* of an intelligent agent; we cannot speak of the doings of matter, as we could if the word *action* were applicable to it in any other than a figurative sense. Again, in speaking of the similarity of facts and the regularity

of sequences, we refer them to a *law* of nature, just as if they were sentient beings acting under the will of a sovereign. Parts of pure matter—the chemical elements, for instance—do not *act* at all; being brute and inert, it is only by a strong metaphor that they are said to be subject to law. Again, we attribute *force*, *power*, &c., to the primitive particles of matter, and speak of their natural *agencies*. Just so, we talk of *tone* in coloring, and of a *heavy* or *light* sound; though, of course, in their proper significance, tone belongs only to sound, and heaviness to gravitating bodies. These modes of speech are proper enough, if their figurative character be kept in view; but it is a little too bad, when a whole scientific theory is made to rest upon a metaphor as its sole support. *Agency* is the employment of one intelligent being to act for another; *force* and *power* are applicable only to will; they are characteristic of volition. It is a violent trope to apply either of these words to senseless matter. Chemical *affinities* are spoken of, as if material elements were united by family ties, and manifested choice, and affection or aversion.

An obvious corollary from these remarks is, that all *causation* is an exertion of mind, and is only figuratively applied to matter. It necessarily implies power, will, and action. An efficient cause—we are not speaking now of a mere antecedent—is that which is necessarily followed by the effect, so that, if it were known, the effect might be predicted antecedently to all experience. Cicero describes it with philosophical accuracy. "*Causa ea est, quæ id efficit, cujus est causa. Non sic causa intelligi debet, ut quod cuique antecedat, id ei causa* [Pg 46] *sit; sed quod cuique* EFFICIENTER *antecedat. Causis enim efficientibus quamque rem cognitis, posse denique sciri quid futurum esset.*" Now, in the world of matter, we discover nothing but antecedents and consequents; the former are the mere signs, not the causes, of the latter; no necessary connection—no connection at all, except sequence in time—can be discerned between them. Consequently, from an examination of the former, we could not determine *a priori*, that they must be followed by the latter, or by any other result whatever. Our knowledge here, if knowledge it can be called, is wholly empirical, or founded on experience. As we have seen, it is absurd to say, that one atom of matter literally *acts* on another. On the other hand, in the world of mind, we are directly conscious of action, and even of causation. All mental exertion is true action; every determination of the will implies *effort*, or the direction and use of power. The result to be accomplished is preconsidered, or meditated, and therefore is known *a priori*, or before experience; the volition succeeds, which is a true effort, or a power in action; and this, *if the power be sufficient*, is *necessarily* followed by the effect. Volition is a true cause; but in a finite mind it is not always an *adequate* cause. If I will to shut my eyes, the effect immediately follows as a necessary consequence. But if I will to stop the beating of my heart, or to move a paralyzed limb, the effect does not follow, because the power exerted is inadequate to the end proposed. The action of the will is still *causative*, but it is *insufficient*.

It was from overlooking the distinction here made, that Hume, Kant, and other metaphysicians were led to deny all knowledge of causation even in the action of mind. They confounded sufficiency with efficiency, and supposed, because the power did not always accomplish the end proposed, that it did not tend towards it, or exert any effect upon it. As the sufficiency of the volition can only be known *a posteriori*, or after experience, they imagined that there could be no cause but that which is infinite, or one which is invariably followed by the whole effect contemplated. They overlooked the fact, that, in the consciousness of *effort*,—as in the attempt to control the action of mind, to command the attention, &c.,—we have direct and full evidence of *power in action*, which is necessarily [Pg 47] causal in its nature. The mental *nisus* is true force, exerted with a foreknowledge of the effect to be produced, and necessarily followed by a result,—a partial one it may be,—but one which is a true effect, whether it answers the whole intention, or not. Here, then, we discern that necessary connection between two events, that absolute efficient agency, which was vainly sought in the world of matter.

If these considerations are well founded, the whole framework of what are called "secondary causes" falls to pieces. The laws of nature are only a figure of speech; the powers and active inherent properties of material atoms are mere fictions. Mind alone is active; matter is wholly passive and inert. There is no such thing as what we usually call the course of nature; it is nothing but the will of God producing certain effects in a constant and uniform manner; which mode of action, however, being perfectly arbitrary, is as easy to be altered at any time as to be preserved. All events, all changes, in the external world, from the least even unto the greatest, are attributable to his will and power, which, being infinite, is always and necessarily adequate to the end proposed. The laws of motion, gravitation, affinity, and the like, are only expressions of the regularity and continuity of one infinite cause. The order of nature is the effect of divine wisdom, its stability is the result of divine beneficence.

> "Estne Dei sedes nisi terra, et pontus, et aer,
> Et cœlum, et virtus? Superos quid quærimus ultra?
> Jupiter est quodcunque vides, quocunque moveris."

It may be asked, if divine power, instead of operating immediately throughout the universe, might not have endowed material atoms at the outset with certain properties and energies, the gradual evolution of which in after ages would produce all the phenomena of nature, without the necessity of his incessant presence, agency, and control. Certainly, we may not put bounds to omnipotence; though we may assert of a given hypothesis respecting its exercise, that it is inconceivable, or involves wholly incongruous ideas. The necessary attributes of matter, according to our conception of it, are extension, figure, impenetrability, and inertness; the properties of mind are thought, sensation, activity, and will. These attributes are essential, not arbitrary or contingent; for they make up our whole idea of the substances in which they inhere. We can no more suppose them to be interchangeable, than [Pg 48] we can literally attribute dimensions to an odor, or capacity to a sound. To speak of an extended thought, an impenetrable sensation, an inert activity, is to talk nonsense; it is equally absurd to attribute thought to extension, sensation to figure, activity to inertness,[3] or causal agency to matter. True, mind may be superadded to matter, without being confounded with it, and without any exchange of properties. And in fact, this is the only conceivable form of the hypothesis now before us; namely, the theory of the ancient metaphysicians, that every particle of matter and every aggregate of it is accompanied, or animated, by a distinct mind. "*Ea quoque [sidera] rectissime et animantia esse, et sentire atque intelligere, dicantur.*" If this be a more intelligible and plausible supposition than that of one infinite mind, pervading the universe, and producing all physical changes by its irresistible power, the materialist is welcome to the benefit of it.

As respects the manner in which all physical effects are produced by the direct action of the Deity, we are not bound to offer any explanation, as the subject confessedly transcends the limit of the human faculties. It is enough for us, that the supposition is the only conceivable one, the only mode of accounting for the phenomena of the material world. But as man is made in the image of his Creator, in the union for a time of his spirit with his corporeal frame we may find at least an intelligible illustration of the connection of God with the universe. Discarding the word *mind*, as the fruitful source of vague speculation and error, let us look for a moment at that of which it is a mere synonyme,—at the man himself. The sentient, thinking being, which I call *self*, is an absolute unit. Duality or complexity cannot be predicated of it in any intelligible sense. Personality is indivisible; *I* am *one*. This being is capable of acting in different ways; and for convenience of speech and classification, these modes of action have been arranged as the results of different faculties; though, in [Pg 49] truth, it is no more proper to attribute to the person distinct powers and organs for comparison, memory, and judgment, than to give to the body separately a walking faculty, a lifting faculty, a jumping faculty, and so on. In the one case, these faculties are but different

aspects of mental power; in the other, but different applications of muscular strength. Of course, the complex material frame, with its numberless adaptations and arrangements, in which this being is lodged, is truly foreign from the man himself, having a kind of connection with him, in reality, but one degree more intimate than that of his clothes. The body is the curiously contrived machine through which the man communicates with the material world. The eye is but his instrument to see with, the ear is his trumpet for communicating sound to him, the leg is his steed, and the arm his soldier. Many of these instruments and parts may be removed, or become unfit for use, without impairing, in the slightest degree, his distinct personality and intelligence. The particles of all of them are in a state of constant flux and renovation, so that man changes his body only a little more frequently than he does his coat. His whole corporeal frame is connected with him but for a while, and is then thrown aside, like an old garment, for which he has no farther use.

But during the period of its existence, how close and intimate in appearance is this union with the body! Sensation extends to every part of it, every fibre is instinct with life, and the direction of the will is absolute and immediate over every muscle and joint, as if the whole fabric and its tenant were one homogeneous system. The will tires not of its supremacy, and is not wearied with the number of volitions required of it to keep every joint in action, and every organ performing its proper function. It would not delegate the control of the fingers to an inferior power, nor contrive mechanical or automatic means for moving the extremities. Within its sphere, it is sole sovereign, and is not perplexed with the variety and constant succession of its duties, extending to every part of the complex structure of which it is the animating and directing spirit. Sensation is not cumbered with the multitude of impressions it receives, nor is the fineness of perception dulled by repeated exercise. The sharpness of its edge rather improves by use, and we become more heedful of its lightest [Pg 50] intimations. Is it irreverent, then, to suppose that this union of body and soul shadows forth the connection between the material universe and the Infinite One? How else, indeed, can we attach any meaning to the attributes of omnipresence and omnipotence? The unity of action, the regularity of antecedence and consequence in outward events, which we commonly designate by the lame metaphor of *law*, then become the fitting expression of the consistent doings of an all-wise Being, in whom there is no variableness, neither shadow of turning. The Creator, then, is no longer banished from his creation, nor is the latter an orphan, or a deserted child. It is not a great machine, that was wound up at the beginning, and has continued to run on ever since, without aid or direction from its artificer. As well might we conceive of the body of a man moving about, and performing all its appropriate functions, without the principle of life, or the indwelling of an immortal soul. The universe is not lifeless or soulless. It is informed by God's spirit, pervaded by his power, moved by his wisdom, directed by his beneficence, controlled by his justice.

> "Spiritus intus alit, totamque infusa per artus
> Mens agitat molem, et magno se corpore miscet."

The harmony of physical and moral laws is not a mere fancy, nor a forced analogy; they are both expressions of the same will, manifestations of the same spirit.

The objection, that it is beneath the dignity of the Almighty—αὐτουργεῖν ἅπαντα—to put his hand to every thing—is founded on a false analogy, as is seen by the form in which Aristotle states it. "If it befit not the state and majesty of Xerxes, the great king of Persia, that he should stoop to do all the meanest offices himself, much less can this be thought suitable for God." The two cases do not correspond in the very feature essential to the argument. An earthly potentate, unable to execute with his own hand all the affairs of which he has control, is obliged to delegate the larger portion of them to his servants; selecting the lightest part for himself, he gratifies his pride by calling it also the noblest, though the distinction is factitious, there being no real difference, in point of honor or dignity, between them. Omnipotence needs no minister, and is not exhausted or wearied by the cares of a

universe. Power in action is more truly sublime than power in repose; and surely it is not derogatory to divine energy to sustain and continue that which it was certainly not beneath [Pg 51] divine wisdom to create and appoint. Rightly considered, to guide the falling of a leaf from a tree is an office as worthy of omnipotence, as the creation of a world. "Are not two sparrows sold for a farthing? and one of them shall not fall on the ground without your Father. But the very hairs of your head are all numbered."

Equally lame is the oft-repeated comparison of the universe to a machine of man's device, which is considered the more perfect the less mending or interposition it requires. A machine is a labor-saving contrivance, fitted to supply the weakness and deficiencies of him who uses it. Where the want does not exist, it is absurd to suppose the creation of the remedy. Human conceptions of the Deity are for ever at fault in imputing to him the errors and deficiencies which belong to our own limited faculties and dependent condition. Hence the idea of the Epicureans, that sublime indifference and unbroken repose are the only states of being worthy of the gods. Viewed in the light of true philosophy, no less than of Christianity, how base and grovelling does this conception appear! The sublime description of the pagan poet becomes the fitting expression and defence of the very theory it was designed to controvert:—

> "Nam (proh sancta Deûm tranquillâ pectora pace,
> Quæ placidum degunt ævum, vitamque serenam!)
> Quis regere immensi summam, quis habere profundi
> Indu manu validas potis est moderanter habenas?
> Quis pariter cœlos omneis convertere? et omneis
> Ignibus ætheriis terras suffire feraceis?
> Omnibus inque locis esse omni tempore presto?
> Nubibus ut tenebras faciat, cœlique serena
> Concutiat sonitu? tum fulmina mittat, et ædeis
> Sæpe suas disturbet?"

Returning to the theory of our author, may we not now characterize it as at once unfounded in its details, inconceivable in its operation, and vulgar and mechanical in its design? Considered in their proper aspect, and by the light of a sound philosophy, whatever well accredited facts or legitimate deductions he has gleaned from the whole field of modern science afford the most striking evidence and illustration of that view of creation which is directly at variance with his own hypothesis. He has, in fact, exposed the insufficiency of what are called organic or mechanical laws to supply the losses, and bridge over the interruptions, that have occurred in the world's history. Geology has rendered at least one [Pg 52] signal service to the cause of natural religion, by effectually doing away with the old atheistic objection, that, for aught we know, the present constitution of things never had a beginning, but has gone on for ever renewing itself in an endless series of generations. Science now tells us distinctly, that time was when "the earth was without form and void," no animated thing appearing "upon the face of the deep"; that afterwards, "the waters were gathered together unto one place, and the dry land appeared." Then "the earth brought forth grass, and herb yielding seed *after his kind*, and the tree yielding fruit, whose seed was in itself, after his kind." Next was fulfilled the command, "Let the waters bring forth abundantly the moving creature that hath life, and fowl that may fly above the earth in the open firmament of heaven." Then appeared "the beast of the earth after his kind, and cattle after their kind, and every thing that creepeth upon the earth after his kind." Last of all, "God created man in his own image, male and female created he them." We are not merely quoting Scripture; we are repeating the facts positively affirmed by the geologists, and incorporated by our author into his "history"—as authentic leaves taken from the "stone book"—*in the same order* in which they are narrated in the first chapter of Genesis. The coincidence in the order of succession is certainly remarkable.

Geology farther informs us, that, at different times, all the animated tribes which had peopled the earth's surface passed away, or became extinct, and were replaced by new species of different organization and characteristics; and probably at many other periods, as well as on occasions of some great catastrophe in the earth's crust, races wholly unlike any that had preceded them were introduced, from time to time, as new inhabitants of the globe. Here, then, was an absolute necessity for the continuous operation of an intelligent creative power, apart from the blind mechanical laws, which, at the utmost, could only allow each species, once introduced, to continue its kind. The marvellous adaptations of these new races to the altered conditions of the earth's surface when they appeared, then, become additional proofs of the wisdom and constant oversight of a designing Creator. They came not till all things were ready; they appeared when the extinction of former tribes had left a [Pg 53] gap for them in the scale of being. The gradual development of what are called the powers of nature,—or, to speak more intelligibly, the successive improvements in the habitations intended for higher and higher races of animated life,—and the similarity of plan on which these races were organized, the scheme being preserved in all its essential features through countless generations, show unity of design, and prove that the works of creation, however separated in time, must be attributed to *one* intelligent author. The same conclusion follows almost irresistibly from the gradations at present observable both in the animal and vegetable kingdoms, so that all the races may be arranged, not indeed in a linear series, but in families or groups, bearing analogous relations to each other, and showing a general progress from the more simple to the more complex forms. Surely, these facts, so clearly explained by our author, instead of sustaining the corpuscular philosophy, directly militate with it, and afford the most satisfactory proof of the doctrine of the theist, and the theory of continuous divine agency. We have hardly ever met with a book that furnished more complete materials for its own refutation.

After all, the question is a very simple one. We have only to decide whether it is more likely, that the complex system of things in the midst of which we live,—the beautiful harmonies between the organic and inorganic world, the nice arrangements and curious adaptations that obtain in each, the simplicity and uniformity of the general plan to which the vast multitude of details may be reduced,—was built up, and is now sustained, by one all-wise and all-powerful Being, or by particles of brute matter, acting of themselves, without direction, interference, or control. We cannot now say, that possibly the system never had a beginning, but has always existed under the form in which it now appears to us; geology has disproved *that* supposition most effectually. Choose ye, then, between mind and matter, between an intelligent being and a stone, for the parentage and support of this wonderful system. For our own part, we will adopt the conclusion of one of the most eloquent of those old pagan philosophers, on whose eyes the light of immediate revelation never dawned:—"*Hic ego non mirer esse quemquam, qui sibi persuadeat, corpora quædam solida atque individua vi et gravitate ferri, mundumque effici ornatissimum et pulcherrimum* [Pg 54] *ex corum corporum concursione fortuitâ? Quòd si mundum efficere potest concursus atomorum, cur porticum, cur templum, cur domum, cur urbem non potest, quæ sunt minus operosa, et multò quidem faciliora? Certè ita temerè de mundo effutiunt, ut mihi quidem nunquam hunc admirabilem cœli ornatum, qui locus est proximus, suspexisse videantur.*"

FOOTNOTES:

[1] *N. A. Review*, Vol. LVI., pp. 339–351.

[2] "It is inconceivable, that inanimate brute matter should, without the mediation of something else, which is not material, operate upon and affect other matter without mutual contact, as it must, if gravitation, in the sense of Epicurus, be essential and inherent in it. And this is one reason why I desired you would not ascribe innate gravity to me. That gravity should be innate, inherent, and essential

to matter, so that one body may act upon another at a distance through a *vacuum*, without the mediation of any thing else, by and through which their action and force may be conveyed from one to another, is to me so great an absurdity, that I believe no man, who has in philosophical matters a competent faculty of thinking, can ever fall into it. Gravity must be caused by an agent acting constantly according to certain laws."—*Newton's letter in Bentley's Works*, Vol. III., pp. 211, 212.

[3] And yet, so strong is the propensity to metaphor, that scientific men talk of the *vis inertiæ* as a true force, though the ideas expressed by the two Latin words are certainly incongruous. The mistake here arises from confounding inertness, or resistance to force,—a merely negative idea,—with the true force which is necessary to overcome it; or rather, since force can only be measured by its results, and must always be adequate to the effect produced, inquirers have adopted the convenient hypothesis of two antagonistic forces, not always recollecting that one of them is merely passive.

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