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ART. I.—*The Apostles' doctrine and fellowship: Five Sermons preached in the principal churches of his diocese, during his spring visitation,* 1844. By the Right Rev. L. Silliman Ives, DD. LL.D., Bishop of North Carolina. Published by the unanimous request of his Convention. New York: D. Appleton & Co. 200 Broadway. Philadelphia: Geo. S. Appleton, 148 Chesnut street. 1844. pp. 189.

THIS title page is not, we think, remarkable for its modesty. Dr. Ives styles himself Bishop of North Carolina. Are we to understand by this, that he is Bishop to the exclusion of the Bishop of the Moravians at Salem and its vicinity, the validity of whose ordination his predecessor acknowledged; and to the exclusion of all Roman Catholic Bishops? Is it implied that all other denominations are rebels against his authority? Does he claim jurisdiction *in partibus infidelium*? He prefers to call the convention of Episcopal ministers and delegates of North Carolina "his" convention, rather than the Convention of the Protestant Episcopal Church, as has been usual.

The first subject discussed is baptismal justification. We will permit the Bishop to define his own terms. "The term justification," he says, "may be expressed accurately enough for our present purpose, by the terms remission of sins, and regeneration, or, being born from above." In

riously informs us, that when the Apostles preached to the people, as recorded in Acts, no prayers were used, and that the reason was, that there were no persons to make the necessary responses. Equally wonderful is it, that the Bishop should maintain, that saving faith partook largely of a miraculous character, in the Apostolic age. These and other absurdities we must pass over at present. Our aim has been to make our remarks as short as was consistent with a fair and correct understanding of the subject.

Thus have we endeavoured to present our readers with some specimens of the opinions and reasonings of one of the most thoroughly Puseyite productions, which has appeared in our country. Bishop Ives has evidently adopted fully, the spirit and the opinions of the Oxford tracts. His views of religion are radically different from those held by Protestants generally. He can be no longer regarded as standing on the Protestant platform, as to his doctrines. If the book we have reviewed, had been written by any other than one conspicuous for his station and influence in the church, we should have passed it by in silence. We have been surprised at the feebleness with which many of the positions assumed, have been defended; and at the many incautious and absurd expressions and statements the book contains.

ART. II.—*Vestiges of the Natural History of Creation.* New York: Wiley and Putnam. pp. 291, 12mo.

WE have in this work the result of the most elaborate attempt, which has been made in recent times, to establish a mechanical theory of the universe. The author, "working in solitude, and almost without the cognizance of a single human being," has presented us with the fruit of his labours in a compacted theory, for the support of which he has drawn, more or less, from almost every department of human knowledge. Astronomy, geology, chemistry, natural history, ethnography, physical and metaphysical science, are all laid under contribution for the establishment of his theory. His work gives proof of an extensive acquaintance with modern science, and of singular ability to connect together facts in real or seeming support of the su-

perstructure which he attempts to rear. The whole is presented in a style of severe simplicity, and with such a calm confidence as might seem to be inspired by the writer's thorough mastery of his subject and complete conviction of its truth. Even in those parts of his theory which others will feel to be the most astounding, he proceeds with a step, as calm and assured, as if he were dealing only with universal and necessary truths.

His theory commences, like most recent cosmogonies, with the nebular hypothesis of Laplace. This hypothesis, which Laplace gives with great diffidence, as a mere conjecture, our author puts forward with the utmost confidence, declaring that "it is impossible for a candid mind to refrain from giving it a cordial reception." That he himself has however but a confused and imperfect comprehension of it, is perfectly apparent. We propose to give a condensed statement of his account of the primitive condition of matter, and the successive changes it has undergone, although any attempt to abridge it must necessarily deprive it of much of its force. The plausibility which the author has succeeded in imparting to this theory depends very much upon the cumulative force of a number of particulars, no one of which possesses much weight when taken by itself.

The region of infinite space is supposed to have been originally occupied with matter exceedingly diffused, and intensely heated, termed nebulous matter. Whether this matter be created or self-existent, whether its properties are to be considered as inherent, or derived *ab extra*, seems to us of small moment to one who adopts the other parts of the theory set forth in this work. It is but just however to state that the author, though at the expense of his logical consistency, refers the properties of the "Fire-Mist" from which he builds the universe, to the will of a designing Creator. Through the action of the active properties with which this primitive matter was endowed, all subsequent forms and modes of being, organic as well as inorganic, suns, planets, satellites, vegetables, animals, and man himself, are supposed to have been evolved by mechanical laws, without any interference of the will of the Creator. The great law of creation is that of *development*, in obedience to which matter, under certain favourable conditions, passes spontaneously from one form into another,

generating systems of worlds, with all their different orders of inhabitants.

In the first instance nuclei are established at different points in the nebulous mass, around which the neighbouring matter is condensed by the attraction of gravitation. How these nuclei are formed, in the present state of our knowledge of nebulous matter, we cannot determine; but supposing them to be established, we can see how the attraction towards the centres should detach large masses of nebulous matter. And when these masses are detached, the same force which has separated them, our author contends, will have given them a rotatory motion upon an axis. He refers us for illustration of this point to "a well known law in physics that when fluid matter collects toward or meets in a centre, it establishes a rotatory motion; see minor results of this law in the whirlwind and the whirlpool —nay, on so humble a scale as the water sinking through the aperture of a funnel." This is one of many proofs which might be gathered from this book, that the author's acquaintance with science is extensive rather than accurate. He is continually at fault when he attempts to pass from the final results of scientific research and deal with the first principles involved. The rotatory motions of wind and water which he adduces in this instance have no relation to the matter in hand. They are produced by a hiatus and a pressure *a tergo*, and can of course shed no light upon the method by which a similar motion might have been established in a nebulous mass of homogeneous matter acted upon by a simple force. The most elementary knowledge of the doctrine of central forces would have been sufficient to prove to him that no single force acting upon the particles of an isolated mass of matter could communicate to them a rotatory motion. In such a mass a curvilinear motion must necessarily be the resultant of a tangential impulse and a central force. The single force of gravitation could give origin only to a rectilineal motion towards the centre, unless the particles were at the same time attracted by some neighbouring patch of nebulous matter. This mistake does not indeed vitiate the author's theory, but it detracts from the simplicity, which is one of its chief recommendations, inasmuch as two forces must necessarily be assigned to perform the work which he ascribes to one; or a perfectly arbitrary hypothesis must be assumed of the relative size and collocation of different nebulous masses

that their mutual interactions may account for the result.

The rotation having been established there is generated a tendency in the rotating mass to throw off its outward portions. The least excess of the centrifugal force, thus generated, over the central force, would separate the outer parts of the mass which would be left as a ring round the central body, revolving with the same velocity that the whole mass possessed at the moment of separation. This process might be successively repeated, until the mass had attained its utmost limit of condensation. The excess of the centrifugal force, through which this separation takes place, is supposed to be due to the agency of heat.

The condensation of a nebulous mass around its centre is attended by refrigeration, under which the outer parts acquire a solidity which begins to resist the attractive force. The condensation of the central mass, in the meantime, going on, a point is at length reached at which it shrinks away from its outer crust, which is left, like Saturn's rings, revolving around it.

These rings, unless they are composed of matter perfectly or nearly uniform would necessarily break into several masses, the largest one of which would attract the others into itself. The whole mass would then take on a spherical form, and become a planet revolving round the sun, and upon its own axis. The rotatory motion of this planet might, in turn, throw off one or more rings, which by a similar process would become transformed into satellites, having a three-fold motion on their own axes, around the planet, and with it around the sun.

Such was the genesis of our solar system, which shows in the different bodies composing it, all the variations, with one exception, which this law of construction was capable of producing. It contains some planets, which when thrown off were too much solidified, or from other circumstances so conditioned that they throw off no outer crust, and are therefore without satellites, while others are attended by these secondary products of the centrifugal force, in varying numbers. And again, in the space between Mars and Jupiter, where Kepler, listening only to the harmonies of the system, which as he expresses it, "he had stolen from the golden vases of the Egyptians" had prophesied the discovery of a planet, we have in the four asteroids an instance, which might have been expected sometimes to occur, in which the different portions into which

the planetary ring broke up were so situated that no one of them absorbed the others, and hence each became a separate minor planet. In the two rings of Saturn we are also presented with a case of what might rarely happen, in which the particles of matter composing the separated crust were so uniform, that it remained entire instead of breaking up into satellites. These varieties, inasmuch as they lie within the possibilities of the hypothesis, are deemed a confirmation of its truth. So also another apparently anomalous construction, that of solar systems embracing two or more suns, many of which are visible in our firmament, is supposed to render support to the hypothesis which at first sight it seems to threaten. Some of the double stars are found by careful observation to revolve around each other in ellipses, and hence it is fair to infer that they all do. A system of this kind would therefore be generated, precisely like ours, if there were given at the outset two or more nuclei, instead of one, in the diffused nebulous mass.

At this point the author again stumbles in referring the genesis of the motions in such a system to the same law which sometimes produces two or more neighbouring whirlpool dimples upon the face of a river. "These fantastic eddies, which the musing poet will sometimes watch abstractedly for an hour, little thinking of the law which produces and connects them, are an illustration of the wonders of binary and ternary solar systems." We must be permitted to say that the musing poet is much more profitably employed upon the whirling dance of these fantastic eddies, than the thinking philosopher, unless he thinks to better purpose. The one, in the subjective law which determines his musing, reaches a reality, while the other in his scientific search after the actual law of production, finds only a shadow.*

* Another amusing illustration of the carelessness of the author, to call it by no harsher name, is found on p. 24, where he informs us that "the tear that falls from childhood's cheek is globular, through the efficacy of the same law of mutual attraction of particles which made the sun and planets round." Why did he not add that the soap-bubble preserved its spherical form from the action of the same cause which determines Saturn's ring? The attraction of gravitation has as much to do in the case of the bubble as of the tear, that is it has nothing to do with determining the peculiar form of either, that form being due to the superficial action of the particles. Familiar illustrations of ultimate scientific principles are dangerous things in the hands of one who allows himself to think and speak loosely.

We find on p. 28 a still grosser error. "A chemist, we are told, can reckon with considerable precision what additional amount of heat would be required

This error of the author, however, affects his hypothesis only so far as its simplicity is concerned. He has, beyond all question, erred in supposing that he could generate the motions of a solar system, whether with one or more suns, simply by postulating in addition to the other conditions, the property of gravitation in the particles of nebulous matter. His postulates thus far are, diffused masses of nebulous matter filling immense portions of space; this matter intensely heated and endowed with a tendency to throw off its heat under the process of condensation; the origination, in some unknown way, of nuclei or centres of condensation at different points in these nebulous masses; and lastly the existence of a property in virtue of which the particles of this matter mutually attract each other in the inverse ratio of the square of the distance. These postulates though by no means distinctly put forth, are all embraced in the hypothesis, and it is therefore a matter of comparatively small moment that the error which we have pointed out renders an additional one necessary. But it tends to weaken our confidence in one who offers himself as our guide in tracing out the vestiges of creation, when we find him stumbling at the outset among the first elementary principles of physical science. Nor is he always consistent with himself. It has been seen that the hypothesis which he is expounding demands that the condensation of the nebulous mass should be accompanied by a process of cooling, so that Uranus, the outermost planet, was formed when the heat of the matter composing our system was at the greatest, and Mercury when it was at the least. This, the author supposes, will account for the decreasing specific gravity of the planets as we recede from the sun. The outer planets having been thrown off when, in consequence of the greater heat of the mass, its particles were more diffused, would of necessity be lighter than those that were subsequently detached. The greater heat too which these distant planets retain, he thinks, may be sufficient to compensate for the smallness of the portion which they receive from the sun's

to vaporise all the water of our globe—how much more to disengage the oxygen which is diffused in nearly a proportion of one-half throughout its solids; and finally how much more would be required to cause the whole to become *vaporiform*, which we may consider equivalent to its being restored to its original *nebulous* state." This confusion of vapour with nebulous matter is a blunder too gross to have escaped a mind accustomed to accurate habits of thinking. The conception which the necessities of the hypothesis compel us to form of nebulous matter is as unlike to vapour, as it is to granite.

rays. And yet in immediate connection with this exposition he asks, "where, meanwhile, is the heat once diffused through the system, over and above what remains in the planets. May we not rationally presume it to have gone to constitute that luminous envelope of the sun, in which his warmth-giving power is now held to reside? It could not be destroyed—it cannot be supposed to have gone off into space—it must have simply been reserved to constitute at the last, a means of sustaining the many operations of which the planets were destined to be the theatre." We cannot understand why this heat may not be supposed to have passed off into space,—and still less can we comprehend how it can have passed to the sun, when, by the hypothesis, the genesis of the sun with its attendant planets and satellites is to be explained by the continual escape of heat from the contracting mass. We see signalized here the extreme, unscientific haste with which the author frequently leaps to his conclusions. In the first instance he asks, whether we may not presume that the escaped heat has gone to constitute the luminous atmosphere of the sun, the proper answer to which would be, certainly not, unless we presume at the same time that the whole ground-work of the hypothesis, as expounded up to the very sentence preceding this, has disappeared. And then he passes without assigning any reason except the statement of two alternatives, which are by no means exhaustive of the possibilities of the case, to the peremptory conclusion, that this heat *must have been reserved* to constitute a magazine at the centre for the use of the system. But how reserved, and where? and how gathered around the sun after the cooling process had reached its limit?

A like gross inconsistency appears in his attempt to explain the apparent condition of the moon. The characteristics of the moon's surface forbid the idea that it is at present a theatre of life like the earth, but the author warns us against drawing the inference that it never can become so. "The moon may be only in the earlier stage of the progress through which the earth has already gone. . . Seas may yet fill the profound hollows of the surface—an atmosphere may spread over the whole." The rugged state of the moon is thus to be explained by the earlier stage of growth at which this body now is as compared with the earth. But it has been seen that the hypothesis requires that the moon should have been thrown off long before the

earth had contracted to its present dimensions; and on the page but one preceding this we find it stated that "the time intervening between the formation of the moon and the earth's diminution to its present size was probably one of those vast sums in which astronomy deals so largely, but which the mind altogether fails to grasp." In accounting for the invariable size and temperature of the earth, he again betrays his ignorance of the elementary truths of physical science. "The central heat," he says, "has for ages reached a fixed point, at which it will probably remain forever, as the non-conducting quality of the cool crust absolutely prevents it from suffering any diminution." It is true that there is no process of shrinking now going on in our globe, which we have any means of detecting. A very slight diminution of the diameter would affect the diurnal revolution of our globe, and it is demonstrable that the time of this revolution has not varied the three hundredth part of a second for the last two thousand years. And yet the hypothesis of the author would seem to require that the continual escape of heat from the central fires of the earth should lead to a still further condensation of its mass. This difficulty he meets, with sufficient boldness, by denying any degree of conducting power to the earth's crust, so that all the heat which existed within when the surface acquired, ages ago, this marvellous power, has been retained ever since, and is now imprisoned beyond all hope of escape. There cannot be many of our readers who need the information that this non-conducting quality of the crust is a pure fiction. If the crust be impervious to heat why is it that after we have reached, at the depth of some sixty or eighty feet, the region of invariable temperature, we find the heat increasing upon us with every foot that we descend? It is indeed true that the crust has a very low conducting power. Only a few years since Mairan and Bailly agreed in making the amount of heat received from the interior of the globe to be, in summer twenty-nine times, and in winter four hundred times that received from the sun; a calculation which gave promise of a speedy congelation from the rapid dissipation of the internal heat. But Baron Fourier succeeded in proving that the thermometric effect of the central heat upon the surface of the globe did not exceed the thirtieth part of a degree of the centigrade thermometer. The author of the Vestiges of Creation, however, is the first philosopher who has ventured to affirm that there is

absolutely no escape of heat from the interior, and to assign as the reason the non-conducting quality of the crust. If the interior of the earth is, as many considerations would lead us to suppose, in an incandescent state, there can be no doubt that a portion, however small, of its heat must escape and fly off into space. The unshrinking dimensions of the earth, which would seem to be in opposition to this conclusion, might be better accounted for by supposing that the contraction in some of the elements of the mass, due to this loss of heat, was balanced by an equivalent expansion of others in passing from a liquid to a solid state; or in many other ways, rather than by denying that any heat is lost, and assigning for it a purely fanciful reason.

It ought to be stated, in justice to Laplace, that the author of this work has, in many respects, misapprehended his nebular hypothesis; and that objections therefore may be justly taken against his statement of it, which would not lie against it in the form given to it by its proposer. The method by which he explains the *shelling off* of planets and satellites, through the hardening of the outer surface and the resistance thus opposed to the attractive force of the interior mass, is absurd upon its very face and utterly insufficient for the explanation of the facts of the case. Admitting the action of the principles stated as ruling the case, a spherical shell would be separated, and not an annular ring. The author confounds these together, speaking in one sentence of the separation of "the solidifying crust," and in the next terming this crust "a detached ring;" not only without any explanation of the manner in which the spherical shell has become transformed into a circular band, but apparently without any idea that he is speaking of two very different things. Into this difficulty he has been betrayed by introducing the comparative solidification of the crust as the cause of the separation. This separation is effected, according to Laplace's hypothesis, not by the hardening of the surface, but by the accumulation of matter in the equatorial region. In a fluid body revolving upon an axis, the matter would be heaped up at the equator; and the centrifugal force of the outer portion of the protruding belt thus formed being greater than of any other portion of the mass, a point would at length be reached at which there would be an exact equilibrium between this force and the central attraction. An annular ring would then be separated, which might, as in the case of Saturn's

rings, remain entire, or break up and re-unite in a satellite.

It would be an easy matter to multiply these special criticisms until the reader would be abundantly satisfied, that whatever may be the merits of the nebular hypothesis as expounded by Laplace, in the hands of this author it is hopelessly encumbered with absurdities and contradictions. If this hypothesis admitted of no better statement and defence, we should be compelled to dismiss it at once as one of the hasty, vague guesses so often made by unauthorized intruders upon the scientific domain. But we are willing, so far as this part of his work is concerned, to substitute the sage conjecture of Laplace, for his blundering guess.

We proceed, under the guidance of the author, to trace out the vestiges of creation as they are found upon our own globe. The earth when first separated from the solar mass filled the moon's orbit, its diameter being sixty times as great as at present. At that time it occupied twenty-nine and a half days in rotating upon its axis. After throwing off the moon it continued to shrink and cool, until it became stationary at its present dimensions. At this period the outer crust was a crystalline rock, such as granite, which was the condition into which the great bulk of the solids of the earth passed from their nebulous state. At the same time water was condensed from the atmosphere, and covered the crystalline mass with seas and oceans. These seas, in consequence of the unevenness of the crystalline surface occasioned by local inequalities in the cooling of the substance, were of enormous depth, some of them not less than a hundred miles, however much more. A process of disintegration would, under these circumstances, commence, which would be quickened by the great heat of the water. The matter thus disintegrated would be carried off and deposited in the neighbouring depths, thus giving origin to the earliest stratified rocks, which are composed of the same materials as the original granite, but in new forms and combinations. These sedimentary rocks have not been permitted to remain in their original position. The pressure of the melted mass below has protruded them up in inclined strata, and in many cases the granite in a state of fusion has forced itself through and cooled in irregular masses. As yet there are found no traces of organic life, but these appear when we arrive at the next series of rocks. The oldest remains are of zoophytes, mollusca, and fishes. Later in the history of the earth, and

separated by an immense period from the preceding formation, for all these successive vestiges of creation are supposed to be at a vast remove from each other, land plants and animals begin to appear. As the earth itself undergoes its series of transformations, a corresponding change takes place in the prevalent forms of life. New animals are found when a new condition of things appears adapted to their support. While through vast periods in which a thousand years were but as one day, changes were slowly wrought by the combined action of air, water, and fire, upon the surface of the earth, whenever any new pabulum of life was elaborated, a new race of animals appeared with organs fitted to the existing condition of things. Most of these races became extinct, as the progress of change unfitted the earth for their abode, and left in their fossil remains the data for this primeval history. The author traces these successive changes up to the point at which the land and sea having come into their present relations, and the former having acquired, in its principal continents, the necessary irregularity of surface, the earth became fitted for the occupancy of a tenant equipped like man.

This part of the work, like the account of the nebular hypothesis, is full of blunders. The author writes as if he had been at a geological feast, and come away with the scraps. The most recent discoveries are strangely blended with antiquated blunders, crude hypotheses are mingled with facts, and bold, unqualified assertions are made for which we have not one particle of evidence. It would be easy to sustain each of these charges by abundant specifications, but to go over the geological argument in detail would occupy more space than we can devote to the subject, and we hope to give sufficient evidence, without this, of the unsoundness of the author's hypothesis, and of his incompetency to deal with a scientific subject.

Thus far we have only the ordinary speculations of recent geologists, in accordance with which the matter composing the universe, in virtue of properties inherent, or originally implanted in it without any action upon it from without, is supposed to have passed through successive changes until it has reached its present form. But we now arrive at a startling peculiarity in this author's hypothesis, his account of the origin and development of vegetable and animal life. His position is, in brief, that life, in all its forms and with all its endowments, is evolved through the

action of mechanical and chemical causes. The fundamental form of organic being is supposed to be a globule, having a new globule forming within itself, by which it is in time discharged, and which is again followed by another and another in endless succession. The production of this globule is a purely chemical process, which may be any day discovered and repeated in the laboratory. But the rudimental vesicle, which is the simplest form of organization, not only propagates itself, it gives birth also to the next higher grade of being. There is an inherent tendency in matter, working itself out through mechanical and chemical laws, to ascend from the inorganic to the organic, and then through successive degrees of organization from the lowest to the highest. The most complex form of vegetable life was evolved in a direct line of natural succession, from the simplest,—the most perfect vegetable besides perpetuating its own type, gave birth to the rudest animal, and each form of animal life again evolved a form superior to itself until the appearance of man, the foremost of animals, arrested as yet the progress of improvement. But we have no good reason to conclude that this process is consummated. The present race suits the existing condition of our planet,—but the world is undergoing changes which may make it a fitting field of action for a higher race than the rude and impulsive one which now inhabit it. "There then may be occasion for a nobler type of humanity, which shall complete the zoological circle on this planet, and realize some of the dreams of the purest spirits of the present race."

The genealogy of man extends thus in a direct line back to the original nebulous matter of which the universe was composed. All his attributes of body and of mind are so many modifications of matter, produced without any extraneous interference, by the regular operation of natural causes. Thought is but the highest form as yet known to us of the same substance which in its rudest form composed the nebulous masses of infinite space; and the passage from one of these states to another, was effected solely by the inherit qualities of matter. What further capabilities of matter may be now lying dormant, it is impossible to say. The great law of development, in obedience to which the universe has passed from a chaotic state to its present ordered forms and motions, has not yet completed its work. New heavens and a new earth, with new races of beings

fitted to occupy them, may be contained within the undeveloped capacities of the present order of things. The universe, with its organic as well as inorganic forms, has reached its present state, and will pass on through all future changes, without any creative act or guiding control on the part of its Maker. When created, it was created complete in itself.

In support of the hypothesis that the organic world has been created, as the author expresses it, by law, or in other words, that it has been successively evolved by the operation of natural causes from the primitive form of matter, we have, in the first place, the analogy of the inorganic world. We have evidence that different solar systems, with their suns, planets, and satellites, have been built up and set in motion through the inherent qualities of matter, without the aid of any directing intelligence. In like manner we see that our globe has passed spontaneously through successive changes of state, in each of which it has been tenanted by such forms of vegetable and animal life as it was fitted to support. As the construction of the earth, and the different changes it has undergone, are the result of natural laws, why should we not suppose that the contemporaneous changes in the organic world were produced in like manner? "Why should we suppose that the august Being who brought all these countless worlds into form by the simple establishment of a natural principle flowing from his mind, was to interfere personally and specially on every occasion when a new shell-fish or reptile was to be ushered into existence on one of these worlds? Surely this idea is too ridiculous to be for a moment entertained."

A presumption having been thus established in favour of an organic creation by law, the author proceeds to inquire whether science can furnish any facts to confirm it. Such facts he thinks he has found, though he admits that they are comparatively few and scattered. The character of some of these facts shows strongly the difficulty under which he felt himself to labour in this part of the subject. Crystallization, we are told, is confessedly a phenomenon of inorganic matter, and its forms have a mimic resemblance, in some instances beautifully complete, to vegetable forms.* Electricity also, in its passage, leaves behind it

* Under this head the author gives without authority, but we suppose from Brande's Journal, an account of the old and now repudiated experiment of the *Arbor Dianae*.

marks which resemble, in the positive direction, the ramifications of a tree, and in the negative, the bulbous or the spreading root. "A plant thus appears as a thing formed on the basis of a natural electrical operation—*the brush* realized." This argument of course admits of no reply. There is no reasoning against a metaphor. We should as soon think of attempting to refute the man who declared that he had such a cold in his head that it froze the water with which he washed his face. There can be no surer mark of an unphilosophical mind than this hasty grasping after vague analogies.

In collecting his few and scattered facts in support of his hypothesis, the author next adduces the production of urea and alantoin by artificial means, and infers hence the possibility of forming in the laboratory all the principles of vegetable and animal life. It is also ascertained that the basis of all vegetable and animal substances consists of nucleated cells, that is cells or globules having a granule within them. All nutriment is converted into such cells before the process of assimilation; the tissues are formed from them: the ovum is originally only a cell with a contained granule. "So that all animated nature may be said to be based on this mode of origin, the fundamental form of organic being is a globule, having a new globule forming within itself, by which it is in time discharged." If then these globules could be produced artificially from inorganic elements, the possibility of the commencement of animated creation by the ordinary laws of nature might be considered as established. "Now it was given out some years ago by a French physiologist, that globules could be produced in albumen by electricity. If, therefore these globules be identical with the cells which are now held to be reproductive, it might be said that the production of albumen by artificial means is the only step in the process wanting." We must leave all comment upon this conclusion to the inimitable Touchstone; "your If is the only true philosopher: much virtue in If."

The next class of facts upon which the author relies are those which go to support the doctrine of spontaneous, or as he terms it, aboriginal generation. This doctrine, exploded for many years, has been recently revived, and is of course warmly espoused by the author of the treatise under review. In support of it he contends that animalcules and vegetable mould may be produced under circumstances

that exclude the presence of ova or seeds. Entozoa, or internal parasitic animals are also found within the viscera of other animals, where it is impossible that the living animal or the ova of such as are oviparous, could have been conveyed through the blood-vessels. How can their existence be accounted for, except upon the hypothesis of their spontaneous generation? And still further, organic life has actually been produced in the laboratory. Mr. Crosse, in the course of some experiments made a few years since, had occasion to pass a current of electricity through a saturated solution of silicate of potash, when he observed to his surprise insects appearing at one of the poles of the battery. He repeated the experiment with nitrate of copper, with the same result. Discouraged by the reception his experiments met with, he discontinued them; but they were subsequently repeated, with precisely similar results by Mr. Weekes, of Sandwich. Here then we have an instance in which an organized being has been produced by the operation of natural laws from inorganic elements. It is true this creature of the laboratory was but a microscope insect, but it is sufficient to decide the question of the aboriginal creation of a living organism.

This experiment will doubtless have all the force claimed for it by the author in its bearing upon his system, with all who can receive his interpretation of it. There is no question about the facts of the case. These no doubt occurred precisely as related by Messrs. Crosse and Weekes. That is, animalcular insects of the *acarus* kind, appeared in the different solutions through which an electric current was passed. The only question is respecting the proper interpretation of these facts. The author contends that it was a true creation of organic life from inorganic elements. This interpretation is favoured by the fact that the experiment was made by two independent observers, and in both cases resulted in the production of a hitherto unknown insect: that every precaution was taken by distilling the water, heating the substance of the silicate, and baking the wood of the apparatus, to destroy any ova which they might contain, and the atmosphere was effectually excluded during the course of the experiment; that one of the solutions employed, nitrate of copper, is a deadly poison and would have destroyed therefore the vitality of any ova which might be contained in it. In reply to this we remark, that Mr. Crosse's experiments have been repeated by others,

and without success in every instance except that of Mr. Weekes, a name known as yet to science only through this dubious experiment. The insect produced, instead of being a new one, is only a hitherto undescribed variety, among myriads, of a well-known species. The nitrate of copper could not be expected to destroy the ovum, if the insect lived in it; and some species of the acarus are known to be so tenacious of life that they will live in boiling water, and in alcohol. These experiments moreover occupied several weeks, in one case, eleven months, for their completion. It seems to us much more rational to suppose that notwithstanding the precautions taken to destroy and then to exclude the ova of the insect, some of them lived through the heat applied for their destruction, or gained access afterward, during the long course of the experiment, than that a result was produced not only perfectly novel, but in palpable contradiction to every other experiment upon the law of cause and effect. That a living being should be produced by mechanical causes acting upon inorganic matter, is not only a "novelty in science," without any kindred or relative phenomena lying in the same direction, but it is opposed to the whole body of our positive knowledge. That organic life can be produced only by organic life, is a law of nature generalized from innumerable instances. There is no law which rests upon a more general induction. It may possibly be found hereafter that this is but a particular case of some more general law, but no candid or philosophical mind, will be prepared to abandon it for such experiments as those of Messrs. Crosse and Weekes. To invalidate it upon such slender and doubtful ground, betrays a hasty credulity or an over-anxious zeal to support a foregone conclusion, utterly inconsistent with a philosophical mind. The truth is, Mr. Crosse's manufacture of insects was one of those blunders of the laboratory, of which like instances are not wanting, in which the result was hastly announced before it had been subjected to a sufficiently careful scrutiny. It has been rejected by every man of science in both hemispheres, and we suspect that Mr. Crosse himself laid aside his creative battery, not because of the unfavourable reception given to his discovery by the scientific public, but because he himself became satisfied of its unsoundness and was glad to abandon it as speedily and quietly as possible. We know nothing of his merits save from this one essay, but if he possesses any scien-

tific claims, as we are rather disposed to think he may from his hasty abandonment of this experiment, he will hardly thank the author of the Vestiges of Creation for dragging it forth from the obscurity into which it was passing, and placing it in the foreground of his theory.

The passage from inorganic matter to organized forms, having been thus accounted for, the author proceeds to explain and defend his theory of the progressive development of superior from inferior forms of being. There is an obvious gradation among the families of the vegetable and animal kingdoms from the simple lichen and animalcule up to the highest order of dicotyledonous trees and the mammalia. Though this gradation does not ascend uniformly along a single line upon which all forms of life can be regularly placed, yet it is incontestable that there are general appearances of a scale beginning with the simple and ascending to the complex. However different the external forms of animals, it is very remarkable that they are all but variations of a fundamental plan, which can be traced through the whole as a basis. Starting from the primeval germ which is the representative of a particular order of full-grown animals, we find all others to be merely advances from that type, with the extension of endowments and modifications of forms which are required in each particular case. Different organs are found to fulfil analogous purposes in different animals. Thus the mammalia breathe by lungs, the fishes by gills. In mammifers the gills exist and act at an early stage of the foetal state, but afterwards go back and appear no more, while the lungs are developed; while in fishes, on the other hand, the gills only are fully developed, and the lungs appear only in the rudimentary form of an air-bladder. In many instances, too, a particular structure is found advanced to a certain point in a particular set of animals, as feet in the serpent tribe, although of no use, but being carried a little forward becomes useful in the next set of animals in the scale. Such are the undeveloped mammae of the male human being. One species thus hints at or prophesies another higher on the scale. The higher also often bears traces of the lower from which it has come. Thus the *os coccygis* in man is neither more nor less than the bones of a tail, or as our author phrases it, a caudal extremity, existing in an undeveloped state.

But the most interesting class of facts connected with the laws of organic development yet remain. It has been

found 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."

Thus the brain of man resembles in the early stage of foetal growth the form which is permanent in the fish. It then passes successively through stages which represent the brain of the reptile, the bird, the mammalia, until it finally takes on a form which transcends them all, and becomes the brain of man. The heart also passes through a similar set of changes, in which it seems to rehearse the history of the process by which through a series of ages it has become transformed from the heart of an animalcule to that of a man.

We are thus led to the supposition that the first step in the creation of life was a chemico-electric operation by which simple germinal vesicles were produced, and that there was then a progress from the simplest forms of being to the next more complicated, and this, through the ordinary process of generation. It is true indeed that what we ordinarily see of nature would lead us to suppose that each species invariably produces its like. But our observation of nature covers but a limited period. The time that has elapsed since the appearance of man upon this planet, is but a small fraction of the geological periods which preceded his birth. The law that like produces its

like, is in all probability only a partial generalization which would give place to a higher law upon a broader induction. We may borrow an illustration here from the celebrated calculating engine of Mr. Babbage. This machine is so constructed that while in motion it will present successively to the eye of the observer, a series of numbers proceeding according to certain laws. The machine may be so adjusted that the numbers shall follow each other according to a regular law up to any assignable point, and then the next number shall vary from the law, which shall be restored again in the succeeding one. Thus it may present in succession the natural numbers up to the one hundred millionth term, the next term shall depart from this order, and the next return to it again. The observer who should watch the operation of this machine would surely conclude that the law which governed it was the series of natural numbers. The space for the induction of this law may be made of any assignable extent; it may be made to include as many particular instances as there have been of the production of organized beings since the observation of man commenced; and yet it is found that this law, instead of being the governing idea of the machine, is but a partial expression of the method of its operation. So it may be in nature. Though each vegetable and animal brings forth only after its kind, so far as our observation has extended, yet through immense periods, such as geology deals with, it is probable that one species gave birth to a different and higher one. The gestation of a single organism is the work but of a few days, weeks, or months; but the gestation, so to speak, of a whole creation is a matter probably involving enormous periods of time. "All that we can properly infer therefore from the apparently invariable production of like by like, is, that such is the ordinary procedure of nature in the time immediately passing before our eyes. Mr. Babbage's illustration powerfully suggests that this ordinary procedure may be subordinate to a higher law which only permits it for a time, and in proper season interrupts and changes it."

As we do not wish to recur again to this mechanical illustration, we interrupt our account of the author's system to make a passing comment upon it. The introduction of this illustration for the purpose to which it is applied, is of itself enough to settle his standing as a philosopher. A man of true genius and of high attainments may some-

times blunder, but this is such a blunder as no mind accustomed to that accuracy of movement without which truth can never be discovered, though it may be occasionally stumbled upon, could by possibility have made. It is not by those who fight thus uncertainly, as one beating the air, that the cause of sound philosophy is to be advanced. In Mr. Babbage's machine, the effects produced are all alike, so far as causation is concerned in their production. Certain numbers are presented to the eye, marked upon dial plates, moved by wheels which are themselves set in motion by the action of a spring or weight. The numbers presented have no *real* differences from each other; they are distinguished by certain abstract relations which the mind establishes among them. When the varying term is presented, the *real* effect produced is precisely akin to all that have gone before it. And yet this is brought forward to prove that the law by which monkeys produce monkeys, may be only a particular instance of a more general law in accordance with which at the end of some immense period a monkey may produce a man. Let us suppose that while watching Mr. Babbage's machine, presenting to us successive numbers by the revolution of its plates, we should suddenly see one of those plates resolving itself into types, and these types arranging themselves in the order of a page of the Paradise Lost, or even of the Vestiges of Creation, is there any man in his senses who would not immediately conclude that some new cause was now at work? The argument drawn from this illustration is really too absurd for refutation. Its fallacy lies upon the surface. And it is by such considerations that men are to be persuaded to exchange the well-settled faith of ages for the great law of development!

The law of development, the author contends, is still daily seen at work, though the effects produced are somewhat less than a transition from species to species. Thus bees, when they have lost their queen, manufacture a new one by simply changing the conditions of the larva, so that it shall give birth to the insect in sixteen instead of twenty days. The same embryo will become a female, a neuter, or a male, according as it remains sixteen, twenty or twenty-four days in the larva state. Another instance, approaching more nearly to the production of a new species, is found in the changes which different tribes of the human family undergo from a change in their physical conditions. Poor

diet and other hardships will in course of time produce a prominence of the jaws, a recession and diminution of the cranium, and an elongation and attenuation of the limbs; and on the other hand, these peculiarities will disappear under favorable treatment. These facts fall indeed far short of the transmutation of species. But there is one reported case in which this has been effected in the vegetable world. It is said that whenever oats, sown at the usual time, are kept cropped down during summer and autumn, and allowed to remain over winter, a thin crop of rye will be presented at the close of the ensuing summer.

The idea then of the progress of organic life is, that the simplest and most primitive type, under a law to which that of like production is subordinate, gave birth to the type next above it, and so on to the very highest. Whether the whole of any species was at once translated forward, or only a few parents were employed to give birth to the new type, must remain undetermined. If an entire species was advanced, the place vacated would be immediately taken up by the one next below, so that the introduction of a new germinal vesicle at the bottom of the scale, would be all that was necessary to fill up the vacancy.

After attempting thus to establish his theory by facts in natural history, the author finds further confirmation in the history of the human race. He enters into a philological discussion to prove the identity of the different families of mankind, and then inquires in what part of the earth the race may most probably be supposed to have originated. Tracing back the history of each of the great human families, we find their lines converging to a point somewhere in the region of Northern India. This is true at least of all except the Negro; and, the author adds, "of that race it may fairly be said, that it is the one most likely to have had an independent origin, seeing that it is a type so peculiar in an inveterate black colour and so mean in development." We find thus that history is in harmony with the theory which generates man from the monkey, as it traces the origin of the race to that part of the world where the highest species of the quadrumana are to be found.

The race at their origin must of course be supposed to have existed in a rude and barbarous state, from which they gradually emerged and passed through the various forms of civilization which have appeared. Here as ev-

ery where, the author makes the facts of history bend to his purpose. There is not in all history one well authenticated case of an indigenous civilization. We have instances upon instances of nations and tribes that have declined from a comparatively high state of civilization into semi-barbarism, but not one in which a savage people, without intercommunication with others, has spontaneously risen from a rude to a civilized state. But in the face of this uniform historical testimony the author seizes upon an account which Mr. Catlin has given of a small tribe of Mandan Indians that were able to construct fortifications and had made some progress in the manufacturing arts, and builds upon it his argument for the inherent tendencies of the race to advance from barbarism to civilization. This account is given by a single observer of a tribe that has now passed from existence, and that was seen by him under circumstances which would naturally lead his imagination to make the most of the differences between them and surrounding tribes. If the facts were as reported, of which we stand in great doubt, we have no hesitation in saying that the history of that tribe, if it could be traced, would lead back to a state of still higher civilization. To this conclusion we are forced by the concurrent testimony of all history, in cases where it can be distinctly traced. That which is clearly known should be made to illustrate that which is doubtful; though this is a principle which our author continually tramples upon in his reckless grasping after support for his theory. A fanciful resemblance, an extemporaneous blunder of the laboratory, a rough guess of some early geological explorer, an exaggerated tale of some imaginative traveller, these are eagerly seized and employed to establish real relations, to oppose the most mature conclusions of scientific research, and to contradict the uniform testimony of history.

The historical argument is followed by one drawn from the mental constitution of animals. And here of course the grossest materialism opens upon us. Thought, and feeling too, are real material existences, akin to the imponderable bodies in nature. The rapidity of mental action is explained by the velocity with which light and electricity are transmitted. The alliances between man and the brute are strongly insisted upon. The human intelligence is pre-figured in the instinct of the lower creation, and is different from it in degree only, not in kind.

The affections and passions of the human heart all had their previous manifestations in brutes. "The love of the human mother for her babe was anticipated by nearly every humbler mammal, the carnaria not excepted. The peacock strutted, the turkey blustered, and the cock fought for victory, just as human beings afterwards did, and still do."

There is no act of the mind, no affection of the heart, in man, which may not be found in a ruder form in some one or more of the lower animals. That which is recognised as free-will in man is only "a liability to flit from under the control of one feeling to the control of another, nothing more than a vicissitude in the supremacy of the feelings over each other."

The absurdities of phrenology, as might have been anticipated, are fully endorsed; and we are told that the system of mind invented by Dr. Gall, is "the only one founded upon nature, or which even pretends to or admits of that necessary basis." In the most unqualified contradiction to this, we assert that phrenology is the only account of mental operations with which we are acquainted that has not one particle of support from induction. It purports to be a science of observation and yet flatly rejects all observation, and founds itself upon the purest constructions of the fancy. It maintains the existence of nearly forty separate organs of the brain, devoted to distinct functions, when every man who has ever dissected a brain, or seen one dissected, knows that there are no such organs there. As a physiological hypothesis it is as absurd and groundless, as that one particular spot in the stomach secretes the gastric juice for the digestion of beef, another that of mutton, and so on through the whole list of digestible articles. And as a "system of mind," as our author terms it, it never has risen above contempt in the judgment of any one competent to form an opinion upon the subject. It professes to make distinction between mental acts, and assign these to their several organs, without pretending to furnish any test of the degree of difference necessary to constitute a difference of organs; and as the organs themselves have no existence except in the supposed necessity created by the great diversity of the mental operations, rendering it impossible that such different work should be performed by the same instrument, it is fatal to its claims as a system of mental philosophy that it gives us no criterion of mental acts. If phrenology be true, its truth can only be es-

tablished by being preceded by a complete system of mental philosophy. No one who has made the human mind his study could be for an instant cajoled by the fooleries of this pseudo-science. There is not a single problem in the whole range of metaphysical science, upon which, if true, it would shed the least light. It has accordingly never received the sanction of one name of note in metaphysics; and it is equally destitute of authority from physiologists. It has received a certain degree of consideration from the populace, for reasons which it would not be difficult to explain to any one who has ever been in the track of one of the itinerant lecturers upon its mysteries; and it has been adopted by a few third or fourth-rate thinkers because it has furnished them a basis on which to build up a system of materialistic fatalism. But it has yet to receive its first sanction from any man, whose attainments in physiology or in mental science have placed him in the rank of those entitled to speak with authority. Its place has long since been settled by the only competent tribunal; and if in reply to this, we are referred to Gallileo, Copernicus, and sundry others who were rejected by their generation, we have only to say that we accept the issue of an appeal to posterity. The fate of the true seers of the race, who have been in their day cast out and afterwards exalted to the highest places of honour, constitutes the stock in trade of all adventurers, from Mesmer down to the last discoverer of a perpetual motion; and we have no desire to deprive the phrenologists of any consolation which they may draw from it.

The author shows the grossest ignorance in dealing with metaphysical questions. His language, which is not ordinarily deficient in precision, becomes here so loose and vague as to lead us to doubt whether he has ever mastered the simplest facts in mental science. Thus he defines perception as "the *access* of such ideas (viz: of the external world) to the brain." With still more vagueness and barrenness of meaning he says, "Conception and imagination appear to be only intensities, so to speak, of the state of brain in which memory is produced." And memory itself is said to be "a particular state of each of the faculties, when the ideas of objects once formed by it are revived or reproduced, a process which seems to be intimately allied with some of the phenomena of the new science of photography, when images impressed by reflection of the sun's

rays upon sensitive paper are, after a temporary obliteration, resuscitated on the sheet being exposed to the fumes of mercury." More senseless jargon than this we will venture to say was never uttered respecting mental phenomena. Imagination, an intensity of that state of the brain in which memory is produced! If this be not to darken knowledge with words, we know not where it can be found. Does he mean that imagination is only a more intense kind of memory? It would seem to be impossible that any man could perpetrate such an absurdity, and yet it is the only meaning which we can educe from his words.

When the author comes to treat, at the close of his work, of "the purpose and general condition of the animated creation," he is, as might have been foreseen, sadly at fault. What has a mechanical system of the world to do with purposes? Upon what part of his theory can he graft any general or ultimate ends? How can it furnish any standard to discriminate between superior and inferior, better and worse? It is an ontology, deprived of deontology, and its highest affirmation must of necessity be, whatever is, is. The highest conception to which it can reach is pleasure; and yet if the pleasurable feeling of a sensitive being and the cloud that hangs in the atmosphere, are alike products of nature, who shall say which is better, this or that? That we may not here do injustice to the author we will quote his account of the purpose of creation.

"That enjoyment is the proper attendant of animal existence is pressed upon us by all we see and all we experience. Everywhere we perceive in the lower creatures, in their ordinary condition, symptoms of enjoyment. Their whole being is a system of needs, the supplying of which is gratification, and of faculties, the exercise of which is pleasurable. When we consult our own sensations, we find that, even in a sense of a healthy performance of all the functions of the animal economy, God has furnished us with an innocent and very high enjoyment. The mere quiet consciousness of a healthy play of the mental functions—a mind at ease with itself and all around it—is in like manner extremely agreeable. This negative class of enjoyments, it may be remarked, is likely to be even more extensively experienced by the lower animals than by man, at least in the proportion of their absolute endowments, as their mental and bodily functions are much less liable to derangement than ours. To find the world constituted on this principle is only what in reason we would expect. We cannot conceive that so vast a system could have been created for a contrary purpose. No averagely constituted human being would, in his own limited sphere of action, think of producing a similar system upon an opposite principle. But to form

so vast a range of being, and to make being everywhere a source of gratification, is conformable to our ideas of a Creator in whom we are constantly discovering traits of a nature, of which our own is but a faint and far-cast shadow at the best."

The author confesses the difficulty which he finds in reconciling this view with the many miseries which we see all sentient beings, ourselves included, occasionally suffering. After much talk about general laws, which has very little bearing upon the difficulty which he is seeking to relieve, he arrives at the consolatory conclusion that "the individual is left to take his chance amidst the *melée* of the various laws affecting him. If he be found inferiorly endowed, or ill befalls him, there was at least no partiality against him. The system has the fairness of a lottery in which every one has the like chance of drawing a prize." We are thus at the close fairly landed without any disguise, "in the sty of Epicurus."

We have given as full an account of this remarkable work, as our limits would permit, accompanied by such special criticisms as we wished to dispose of in passing. Our first general remark upon the system which it teaches is, that no one can be at a loss in determining its place. It is the Epicurean system defended and embellished by modern science. This system, though it has received the name of Epicurus, existed before his day, and has since continually re-appeared under slightly differing forms. We find it taking a distinct form at the earliest period to which we can trace the Greek philosophy. It was clearly taught by Anaximander, of the Ionian school, the friend and disciple of Thales. His great difficulty, like that of the mechanical philosophers of all ages, was to account for the construction of organic beings; but it appears to us that he was quite as successful in overcoming this difficulty, as our author has been with all the appliances of modern geology and chemistry. He supposes that our globe was originally composed of a mixture of land and water, and assumed its present condition from the action of the sun, evaporating a portion of the original moisture. So long as the earth was more moist than at present, the sun's action was greater; and by a process similar to what may even now be witnessed on a smaller scale in marshy regions, it produced fermentous bubbles in the humidity, which being outwardly enclosed by filmy bladders, were converted within, into living creatures by the solar heat. In progress of time these living

creatures burst their shells, and came forth upon the dry ground, where however, they lived but a short time. These first animals were rude and imperfect, and a progressive development was necessary, before higher species could be produced. Man, he teaches, did not come at once, in his perfect shape and complete equipments, upon the earth. He was originally a fish, and reached gradually his perfect development. The genesis of organic life was supposed to be effected by a long and composite series of natural processes; and the higher forms of life to be evolved from the lower.* And we see not why the filmy bladder of Anaximander, engendered by the solar heat, is not as good and philosophical a starting point as the germinal vesicle of the author of Vestiges of Creation, produced by a chemico-electrical operation. The same system, in substance, was taught by Anaxagoras. It was indeed the prevailing system of the Ionian school of philosophy. It would be easy to trace this mechanical theory down through history, and show that it has never been for any considerable period, without its advocates. It is one of the possible forms of philosophy, and we must expect to find it re-appearing, however often refuted, whenever any philosophical movement takes place. In more modern times its most noted defenders have been Gassendi, Hobbes, the French school of Encyclopedists, Darwin, and Lamarck. The only novelty in our author's exposition of it, consists in the diligence with which he has collected and arranged the fragments of various sciences in its apparent support.

Some difference of opinion, we perceive has existed respecting the atheistic character of this work. The author cannot we think, with propriety be branded as an atheist. He recognises the existence of a Deity. He speaks of a personal God, distinct from the active energy implanted in matter. He sometimes breaks forth into apparently truthful and hearty expressions of reverence towards the Creator. It is indeed true that in his system we can discern no ground for this reverence. We cannot see why we should be called upon to adore and praise a Being who has manifested no moral ends in our creation; who has made us for gratification only, and left us so insecure of that, that in the chance melée we fail as often as we succeed; and to whom it is impossible we can be bound in any duty. But if the au-

* See Ritter's History of Philosophy, Vol. I., p. 275.

thor, even while expounding this heartless, bestial system, remains so far under the influence of better things that his moral feelings respond to their influence, we see not why he should be termed an atheist. That the system which he teaches, however, is an atheistic system, there can be no doubt. It has been so recognised in all ages of the world. It makes the senses the only inlet of ideas, and induction the only instrument for reaching the truth. From this beginning atheism is the necessary conclusion. When we have reasoned back from the phenomena presented to our senses until we have arrived at the primary nebulous matter so disposed and endowed as to evolve itself into all the forms which have subsequently proceeded from it, upon what principle of reasoning are we warranted in inferring the existence of anything antecedent to, or aside from this primary matter? If we are acquainted with no phenomena but those of matter, then the hypothesis of an original matter, endowed with certain forces, the nature and extent of which we learn by reasoning backward from their effects, is amply sufficient to account for the universe. As Laplace has said, "we do not need the hypothesis of a Deity." An original, uncaused, self-existent matter, capable of becoming all that we have seen it become, and of taking on in the future such forms as our science is able clearly to predict, this is the ultimate point which can be reached by the philosophy of induction, generalizing its conclusions from the phenomena presented to the senses. Every effect must have a cause, or rather every phenomenon must be preceded by an antecedent, adequate to its production, this principle will carry us back from the state of the universe to-day, to its state yesterday, and so on through the teeming days of the interminable geological periods, until we have arrived at the simplest condition to which we are able to trace the complicated phenomena by which we are surrounded. Here our progress is arrested. Of a creation strictly so called we have had no experience, and it is of course impossible that it can be established by any empirical principles of reasoning. If the principle that every effect must have a sufficient cause, is a general truth which we have reached by induction, nothing can be more illogical than to apply this principle under circumstances entirely different from those within which it was generalized. It was gathered from observation upon changes in existing matter; what application then can it have in explanation of the origin of mat-

ter? It is evident that the materialist cannot get beyond the reduction of the matter with which he starts, to its most elementary form, except by the sacrifice of his logic.

The author of this work does indeed admit an original creation, but every intelligent reader will feel that this is a needless and bungling superfluity in his theory. If matter, during the indefinite period which has elapsed since its creation, a period only not eternal, has maintained itself in being, and by virtue of its inherent properties formed itself into systems of worlds, and clothed these worlds with vegetable and animal life, there will be no difficulty in dispensing with the idea of creation. And while we see a logical necessity for surrendering this idea, we cannot perceive any moral or other advantage to be gained by retaining it. Of what avail is it to give us the idea of a Creator, if He who created does not govern us? The Creator in this system created necessarily, and all things are bound together in the necessary chain of cause and effect. The universe, in all its parts and beings, in all its processes and results, is but a stupendous machine, whirled about by its own inherent tendencies and driving on to we know not what end. In what relation then do we stand to the Creator? Shall we magnify Him for the power and intelligence displayed in His work? But power and intelligence are not proper objects of adoration except when directed to worthy ends. Shall we praise Him for his wisdom and goodness? But of these we can find no sufficient traces. We cannot pronounce upon His wisdom, while in utter ignorance of the end of creation, and of His goodness we are left equally in the dark. Abandoned to the operation of general laws, that without any discernible purpose or feeling work out their results,—left to take our chance amid the prizes and blanks, and worse than blanks, distributed by a stern undiscriminating necessity,—we see not that there is any occasion for admiration, reverence, or love towards the Creator. To love Him would be, as Spinosa says, to deny His nature. To pray to Him would be as idle as a dog baying the moon.

It is instructive to observe how a pure materialism, and a pure idealism meet in the same final result, though reaching it by such different roads. The system constructed by the author of the Vestiges of Creation is destitute of all moral purposes and aims,—man is only a self-conscious wheel in the machine,—and God can be nothing higher

than the active energy which works through all. In like manner Spinosa, starting with his "*unica substantia*," a pure mental abstraction, an *ens rationis*, constructs a system in which morality is identified with gratification, and God with the principle that permeates and acts through all things.

With most of our readers we trust it would be deemed an ample refutation of any system to show clearly that it was atheistic in its essential character. But we propose to make a further examination of this system upon its merits as a scientific hypothesis. And here we have a preliminary word to say upon the relations existing between science and revelation. The author of this work affects to consider the common notions entertained of the agency of the Deity in the creation, as grossly anthropomorphic and degrading. That He should put forth his power for the creation of man, that He should be summoned to interfere whenever a new species of animalcules or zoophytes was to be called into being, this is to take a very mean view of the creative power. That the august Being, who called all worlds into existence, was "to interfere personally on every occasion when a new fish or reptile was to be ushered into existence on one of these worlds,—surely this idea is too ridiculous to be entertained for a moment." It shows a singular obliquity of vision that he should not have seen that the only anthropomorphism here is in his own conception. It is not unworthy the Divine Being to have created even the minutest insects, for he supposes Him to have created them in the original act of will by which He created matter. But it is derogatory to suppose that He created them successively, by separate acts of will! Why it should be deemed so, we cannot conceive, except by transforming the idea of God into conceptions framed according to the standard of our own capacity of thought and action. From the limited nature of our faculties we are incapable of attending, without such distraction as impairs our efficiency, to more than one object at a time. Hence we feel when we see a man perpetually occupied with trivial affairs that he is acting an unworthy part, because we know that, from the infirmity of his nature, while thus employed he must be neglecting weightier matters. Shall we judge the Almighty by the same standard? Shall we conclude that while he is numbering the hairs of our head, he is failing to guide Arcturus and his sons,—that while inter-

fering to create a reptile or a fish, he is suffering some world to rush to ruin, or some angel to perish, from neglect! Reason teaches us to infer at once from the idea of God, that his infinite thought comprehends alike the great and the small, that his power and his goodness, omnipresent and almighty, act with undivided care in the production and government of the minute as well as the vast. It is only when men attempt to frame conceptions of the Divine Being from their gropings among dead matter, when they resolve freedom into necessity, will into law, the infinite into the indefinite, and the absolute into the conditioned, that they shrink from the irreverence of supposing that God notices the fall of every sparrow, and brings forth every lily of the field, and numbers every hair of our heads.

The author of this work is evidently fearful, after all his glosses, that his views will not be considered altogether consistent with the scriptures; for he adds, "I freely own that I do not think it right to adduce the Mosaic record, either in objection to, or in support of any natural hypothesis." It is undoubtedly true that the scriptures were not given to teach us natural philosophy; but it is equally plain that some truths of natural science are so distinctly asserted, and so interwoven with the moral system therein revealed, that they must stand or fall together. Such are the original creation of matter and the subsequent creation of man, by the fiat of the divine will. Such too we regard the descent of all mankind from one original pair, though the author says "this is an open question." The scriptures not only plainly assert this as a historical fact, but it is so connected with the doctrine of the depravity and redemption of the race, that if it should be disproved it would discredit the pretended revelation which teaches it. As a general proposition, it may be granted that the Bible teaches us no physical truth except in subserving to some moral end, but some such truths it does teach us, and these we are satisfied can never be set aside by the ultimate results of any true science.

In passing the chief points of the Vestiges of Creation under review, we are led in the first place to examine the foundations of the nebular hypothesis. This hypothesis the author says "is supported by so many ascertained features of the celestial scenery, and by so many calculations of exact science, that it is impossible for a candid mind to refrain from giving it a cordial reception, if not to repose

full reliance upon it." This he says, as we have already shown, without having mastered this hypothesis in its statements or in its principles, and while giving ample evidence of his utter incompetency to decide upon what is necessary to legitimate a scientific hypothesis. Hypotheses, as distinguished from theories, may very fitly be made by the natural philosopher to assist and guide him in his investigations. Indeed they are essential to the successful prosecution of scientific research. Without an hypothesis, by which the philosopher supposes some explanation of an observed fact by which it may be related to other facts, he could only make his experiments at hazard, instead of putting to nature the "*prudens questio*" of Bacon. If his experiments are not made at random, it must be for the purpose of testing something which he has beforehand supposed, that is of determining the truth or falsity of some hypothesis which he has framed. The more general this hypothesis becomes, that is, the greater number of dissimilar but analogous facts it explains, the more important it becomes as a guide to further experiment and reasoning. But a sound philosopher will always preserve the just boundary between hypothesis and theory. He will never confound a supposition with a real truth, a suffiction with a substance. He will use his hypothesis only as a suggestive contrivance, which classifying together certain facts, in an artificial relation, puts him upon the search after others which may confirm or modify the supposition already made. It was only in this light that the nebular hypothesis was proposed by Laplace, and subsequent observation has tended to diminish instead of increasing the evidence in its favour. "The features of celestial scenery," which suggested this hypothesis, were the appearances presented by the different nebulæ which are found distributed through celestial space. The powerful telescope of the elder Herschel first disclosed the fact that these remarkable objects, one or two of which are visible to the naked eye, existed in immense numbers, and presented very different appearances. Some of them appear like luminous clouds, irregular in shape, and with spots of varying degrees of brightness. Others are spherical or elliptic in form, and increase in brightness towards a central point. Sir William Herschel suggested that these brighter spots were centres of condensation around which the nebulous matter was slowly collecting, and this suggestion was the foundation of La-

place's hypothesis. Assuming the existence of a nebulous mass with a condensation going on towards the centre, and a rotation round an axis, he showed that such a condition of things might exist as would lead to the separation of successive rings, revolving round the central mass; which rings might in turn break up and form into planets, with satellites, generated in like manner, revolving around them. This hypothesis pretends to nothing higher than to show the physical possibility of such a construction of our solar system. It is a brilliant imagination; and no man who understands the difficulties of the problem, of which this is a conjectural solution, would venture to give it at present any more substantial character.

It is said that the first fruits of discovery with the great telescope of Lord Rosse has been the resolution of many of the hitherto unresolvable nebulæ into distinct stars. This, if true, weakens and goes far to destroy the chief evidence in favour of the hypothesis. It was conjectured from the different appearances which these objects presented that they were composed of nebulous matter existing in different states of condensation, and undergoing changes which are but a rehearsal of what once occurred in our system. If it turns out that these appearances were fallacious, and that the nebulæ which were supposed to exhibit the successive stages of condensation are composed of distinct bodies already formed, the ground for this conjecture is greatly weakened.

But M. Comte claims to have given a mathematical verification of the nebular hypothesis, and this claim is fully endorsed by our author. M. Comte is a bold and brilliant writer. Many of his generalizations show the divination of genius; and, on the other hand, under the show of great profundity, he is not seldom exceedingly shallow and superficial. In this matter, as in some others in his "*Philosophie Positive*," he has leaped to his conclusion. He has done nothing more by his parade of mathematical analysis than to prove, under another form, the well known theorem, that a body revolving around another, in obedience to a central force, is affected by the mass but not by the magnitude of the central body. Kepler's law he has not proved, nor is it possible that he should, without making assumptions as to the law of density of a nebulous mass, in making which he could have no other guide than the fact to be explained by it; that is, he must reason from the facts

to the conditions necessary to account for them, and then assuming these conditions offer them in explanation of the facts. M. Comte has not made the first step towards a mathematical confirmation of the nebular hypothesis; nor do we believe that the problem can ever be brought within the compass of mathematical analysis. It never can become a theory until we are in a condition to explain why so many and no more planets were thrown off,—why they were separated at the precise distances at which we find them from the sun—why the ring which separated between Mars and Jupiter formed itself into four planets instead of one—why Saturn's ring did not break up and form a satellite—why some of the planets have satellites and others not—and why some of these satellites move from east to west in orbits exceedingly oblique. And if all this were done, so as to establish it as a scientific theory, it would by no means follow that it gave us the true history of creation. Unless we can bring existing nebulæ sufficiently near to obtain our data from them, we can only arrive at the necessary data by suppositions derived from the phenomena to be accounted for. The primitive constitution of the nebulous mass to which we are thus led can never be aught else than an abstraction. If we could by postulating a nebulous mass of defined extent, density, and velocity of rotation on its axis, show that the present solar system is the necessary result, it would assuredly be the most splendid triumph which science has yet achieved. But it would by no means prove that the system had actually been constructed after this fashion. It would be a true theory, but whether it would be truth of fact or not is an entirely distinct question. The nebular hypothesis, which our author makes his point of departure, is as yet entitled to no higher consideration than a conjecture; and should it in the progress of science be established, which seems to us impossible, it will be only an analytical explanation of how the universe might have been constructed.

It will be found upon a careful examination of the argument drawn from geology, that our author has failed as egregiously in translating the records of the earth, as in deciphering the truths written upon the heavens. We have no intention of following him through this part of his argument. Whatever else may be proved by geological facts, it is certain that when placed in their proper order they lend no aid to the two points which he is most anxious to

establish, the origination of life, by natural laws, from inorganic matter, and the transmutation of one species into another. To seek for evidence of these truths in the fossil remains of an extinct world, while there is nothing to warrant them in the living processes which are now going on, is another illustration of the singular tendency of this author to interpret the clear by the obscure. The laws of life surely ought to be sought among the living, not the dead. If it can be shown that there is no ground, in any of the living operations of the present economy, for supposing that life is ever produced by the agency of mechanical or chemical laws from inorganic matter, or that one form of life ever begets other than its like, we may rest satisfied that these conclusions will never be set aside by any reasoning founded upon the exuviae of extinct generations.

We proceed then to inquire into the reasons which the author has given us for believing that living organisms may be constructed from inorganic materials by the inherent properties of matter. The resemblances given by crystallization and the electrical brush to some forms of vegetable life we have already dismissed as puerile conceits in the discussion of such a subject. His next argument is that urea and alantoin have been made in the laboratory. To discern the bearing of this upon the question in debate, it will be necessary to consider with more precision than he has done, what are the phenomena comprised in organization. In the lowest form of life we find two perfectly distinct operations, the production of an organic material, and the construction of the vital organs out of this material. The earliest observation which can be made of the germs of plants or of animals, presents a small globule or disc of albuminous matter, in which we can discover as yet no forms or attributes of the future being. The organs through which life is to be manifested and maintained have as yet no existence. Haller, and others after him, supposed that all the parts of the plant or animal existed already in miniature in its seed or ovum; but this is an assumption of a material existence against the evidence of the senses, the only authorized judges, and for which there is no reason except the metaphysical necessity created by a particular hypothesis of life. The most powerful microscopes have failed to detect in different seeds any such difference of structure as may furnish ground for a prediction of the genus or species which will be developed from it. This fact alone

is sufficient to destroy the theory that life is only the harmonious co-operation of the different organs of the living body, and that death is the result of their discordant action. There is in a living structure a mutual dependency of parts and functions, any serious interruption of which is the occasion of death. But to make life consist in this harmony is to put the effect for the cause. The harmonious play of the organs is itself the result of some principle which pervades and regulates the whole machine, and which must have preceded the machine, inasmuch as its agency is concerned in the construction and collocation of its different parts.

In tracing the progress of vegetable organization, we find, when the requisite physical conditions of heat, moisture and oxygen are supplied, that an action commences, the first observable effect of which is the appearance, in the fluid of the seed, of minute granules, among which are soon seen some of larger size and more sharply defined than the others. These increase in size apparently from the coagulation of the smaller ones around them. From these granules the cells are formed; and the different tissues which make up the plant are all developed from the cells thus constructed. The *nuclei* formed by the aggregation of the minute granules, and the cells into which these are transformed, are each of them "a living organism, analogous in its vital attributes to the simplest forms of vegetables and animals. It imbibes or is penetrated by the surrounding *plasma* (organizable matter) that serves for its nutriment, acts on, modifies, and metamorphoses it, appropriates what is fitted to its own particular nature, and rejects what is not adapted to its nature or function as excrementitious."* The construction of all the elementary tissues of which both vegetable and animal bodies are composed is by development from cells. In some pre-existing organizable material, which may be situated either within or without a cell already formed, new cells are developed, and these cells by various changes and transformations are converted into the elementary organic tissues.

Here are obviously two processes, going on contemporaneously, which ought to be distinctly observed. The first is the formation of the material from which the different organs are made, the other the disposition of this material, the shape and collocation given to it so as to fit it to play

* Introductory Lecture, by Samuel Jackson, M. D. Philadelphia, 1844.

its part in the living structure. The organizable material of which the vegetable tissues are composed is *gum*, produced directly by a formative process or through the intermediate state of *starch*, from inorganic elements. The proximate principles of animal tissue are fibrin, albumen, gelatin, ozmazome, and fatty matter. Each particle of the elementary organ attracts to it particles which it assimilates to its own substance, and endows with its own vital properties. While this process of nutrition is going on, the organ, which is growing up, receives at the same time its shape and proportions. The principle which determines each particular organ and builds up the entire structure, with each part complete in itself and harmoniously adapted to the whole, may and ought to be clearly distinguished from the assimilating power by which the organic material is elaborated. It may admit of question whether these are different methods of operation of the same fundamental law, or whether they must be traced to distinct causes, but they are obviously very different phenomena, and any theory, physiological or metaphysical, which does not separate between them must involve itself in inextricable confusion.

In the process of assimilation a striking change is wrought in the properties of matter. The vegetable, seizing upon carbon, hydrogen, oxygen and nitrogen, converts them into its own tissues, which again furnish the proximate principles of animal organization. These are in all cases at least ternary compounds of chemical elements; and, what is singular, the most important of them, fibrin and albumen, when analyzed in the laboratory are found to consist of precisely the same organic elements, combined in the same proportion. The materials thus furnished when taken up by the particular organs of the body are not only assimilated to them, but receive the like power of assimilating other particles. This process of transmutation bears a resemblance to those which are effected in the laboratory. The changes wrought in the organic material furnished, may be due to nothing more than modifications made in the arrangement of its ultimate particles. We are not disposed, therefore, to deny the possibility that fibrin or albumen may be some day manufactured by the chemist, though we fear not, for reasons which we have not space now to give, to hazard the prediction that they will forever elude his grasp. Urea and alantoin, it is said, have been thus made, and our author founds upon this a confident augury

that all the proximate principles of organization will ultimately be compounded at will in like manner. His theory then quietly proceeds as if this work had already been accomplished. The absurdity of this is apparent, when it is remembered that urea and alantoin, though they are products of living organisms, make no part of the material which enters into any organic structure; they are elaborated in the production of other things and thrown off as excrementitious. Let it be marked, too, that this refuse of the organic laboratory has been imitated only by using other animal products in its manufacture; and it will be seen how much ground the author has for his augury that albumen, which, in his utter and shameful ignorance, he declares to be "a perfectly co-ordinate compound" with urea and alantoin, may any day be produced in the laboratory.

But let us suppose that the hourly expectation which our author encourages us to cherish has been fulfilled, and that "some French physiologist has given out" that the art has been reached of compounding albumen and fibrin and all other organic elements. What progress shall we even then have made towards the organization of life? Precisely the same progress that was made towards the construction of the Parthenon when the marble was lying in shapeless masses, out of which the shapely temple was to be built. The power is yet to be evoked that shall give form to these materials and build them up into a structure in which each part shall be fitly fashioned and placed for the discharge of its functions in its ministry to the design of the whole. From matter prepared for that purpose, a cunningly devised mechanism is to be framed, giving evidence of the highest skill in the precise adjustment of its complicated members, and their harmonious co-operation to the production of a common end. Can we suppose that the power through which this is wrought is a property of matter! We confess that nothing seems to us more incredible and absurd, though this opinion we know has been maintained by many eminent physiologists.

It should be observed, however, that the question now under discussion does not lie within the proper province of the physiologist. It is his vocation to observe the phenomena of organization and trace the relations subsisting between them. His science deals only with phenomena, and the laws at which he arrives are, in no proper sense of the

term, causes of the effects ascribed to them. They are but generalizations of particular facts. When the further inquiry is made, after the substance which underlies the phenomena, the law-giver who has established the law, and the agent by whom it is executed, the physiologist has no advantage over other men. The course of his studies may rather have tended to make him an unsafe reasoner upon these higher questions. The habit which he has acquired of explaining one material phenomenon by a reference to some other of a like kind, disposes him to rest satisfied with the complete analysis of matter, and to feel when he has succeeded in determining the law under which any given fact falls as if he had arrived at its efficient cause. Intent upon his own science, in which he traces the ever-shifting forms and states of matter, until he has succeeded in reducing them to order, by classifying them under one or more general abstract terms, he pronounces the word *law*, and declares that herein we have arrived at the limit of human intelligence. It is not permitted to man to know more; all beyond is conjecture and doubt. Physiologists are apt, in the bigotry produced by exclusive devotion to a single science, to sneer at the mazy dreams of metaphysical speculation, forgetful that the moment they undertake to pronounce what *is*, as distinguished from what *appears*, they are themselves trespassing upon the department of metaphysics. We would not debar the physiologists from the discussion of these questions, but we would have them understand that when they take them in hand they have laid aside the scalpel and the microscope, and stand only upon equal terms with other metaphysical reasoners. The "*Metaphysic*" of Bacon, which is as veritable a science as any other, and the true and proper end of all the rest, can be reached by no man while he confines himself within his own particular department. We return therefore to the discussion of this point, unawed by the prestige of any physiological authority that may be arrayed against us.

In every organized being we have, in the entire structure, and in each member of it, a peculiar form evolved and maintained, at the same time that the material which enters into its composition is elaborated. To suppose that this peculiar material, necessary for the manifestation of life, and the wondrous shapes into which it is fashioned, each one instinct with intelligence and design, are the spontaneous products of matter, or the results of blind and un-

intelligent forces, seems to us in plain contradiction to every sound principle of reasoning. Wherever we find form, we have the evidence of a pre-existent idea of which it is the realization. To make matter the cause of form is as absurd as to make it the cause of its own existence. Matter as it exists in amorphous masses, or under the geometrical forms, given to us in inorganic nature, might be supposed the result of a concourse of atoms impelled by necessary laws. A blind unreasoning power is all that is necessary to account for it. But the mind at once perceives when organic forms are presented that these involve a previous intellectual conception. It is impossible for any mind that has not been bewildered by sophistry, to contemplate a plant thoughtfully, without receiving the impression of a pre-existing idea, the thought that when yet but begun in the germ it had a perfect existence somewhere, and that the elements of which it is composed, and the mechanical agencies employed in its construction, are but the instruments of a power which is itself the agent of and dependent on the organic whole. The assimilating, plastic power which transmutes the inorganic into organic matter, cannot itself be the cause of the organism, for it is one of its attributes. The dynamic forces, the chemical agencies of nature so far from producing life and organization, cannot operate to effect organism without the presence of life, or to destroy it except in its absence. We are driven thus to the conclusion that there is a specific principle of organization of which the vital or assimilative agency is the actuating power. Whether this principle is the creative idea of Plato, the constitutive form of Aristotle, the plastic nature of Cudworth, the *anima* of Stahl, the *nisus formativus* of Blumenbach, or the vital force of some modern physiologists, it is not needful that we pause to inquire. We are desirous not to explain the best method of conceiving it, but to make manifest the necessity of conceiving it under some form.

Every theory which refers the phenomena of organization to the properties of matter must leave the principal fundamental facts unexplained. If we admit that the vital processes are carried on by a species of chemistry, we still need the chemist. If electricity, as our author contends, is identical with the nervous power, we still need the electrician who, instead of leaving this fluid to range and burst in lawless disorder, directs it with evident purpose

and infallible precision to the accomplishment of the ends of the animal economy. What reason then have we for supposing that the attractions and repulsions of inorganic nature, however directed by human skill, can ever generate the organizing power which is necessary to the construction and maintenance of a living structure? Every *a priori* presumption is against it, and all experience contradicts it. We cannot indeed prove the abstract impossibility of such a genesis of life. The mode in which the organic principle has been conditioned for its manifestation in matter we can learn only from observation. But observation conducts us to the conclusion, that the necessary condition of its manifestation is the existence of a germ, which is the product of a previous organism; and that in the absence of this the production of a living being, either fully developed or in embryo, is as strictly a creative act as the calling new matter into existence. We cannot prove a priori the impossibility of generating matter by transmitting an electrical current through a vacuum, or by operating on existing matter, so that it should increase by the aggregation of new particles. We cannot prove this impossibility, because we know not, prior to experience, how the will of the Creator, the true efficient cause, has conditioned the introduction of new matter into the universe. But all experience has proved that, abstraction being made of the creative cause, *de nihilo nihil fit.* So with equal conclusiveness experience has proved that the organic power can never be called into action except by means of a germ which has been elaborated by an organized being.

To oppose this induction, which is sustained by instances without number, what has our author to produce? Mr. Crosse's experiment upon the manufacture of animalcules, already sufficiently noticed; the report given out, some years ago, by some French physiologist, that globules might be produced in albumen by electricity, and *if* albumen could be made artificially, and *if* these globules were identical with the reproductive cells of physiology, the process would be complete; and lastly, a few obscure facts in vegetable and animal economy. These facts demand a brief notice. In the first place we are told that white clover, under certain circumstances, will spring up in soils where we have every reason, except the growth of the clover itself, to suppose that there were no seeds; and that mushrooms may be made to spring up in an artificial compost

in which no seeds have been sown. In both these cases the presumption certainly is that the seeds, though unsown and undiscovered, were present. It is known that seeds may remain for ages without losing their vitality—some have come down to us from the days of the Pharaohs—and as in all other cases clover and mushrooms spring from seeds, and this is seen to be the law of vegetable creation, we are led to infer that in these cases also the lime and the prepared compost do but supply the favouring circumstances to stimulate to germination seeds already existing in the soil.

His next facts in favour of equivocal generation are founded on observations upon the production of the vegetation called *mould*, and the infusory animalcules. Into the details of these observations we cannot enter. They are to us entirely unsatisfactory. The infusoria or mould may have arisen from dried animalcules or their germs, borne in the air; the water may have contained the ova, which have afterwards multiplied rapidly; they may have found their way through some of the gases used in the experiment. The accuracy necessary to exclude such minute bodies is scarcely possible. That in all these cases the generation was by means of the pre-existing germs is rendered almost certain by Ehrenberg's experiments. He succeeded in detecting the real germs of the vegetable mould, and thus rendered it probable that, as this substance, like all other vegetable productions, grew from a germ, in the cases of its unexpected appearance, it also arose from germs, that had been diffused through the air or water, having found the situation requisite for their germination. He succeeded too in showing that the smallest animalcules, only the two thousandth of a line in diameter, possessed a complicated stomach, and organs of motion in the form of cilia, and thus overthrew one great argument in favour of their spontaneous origin. In others he detected the ova, and the propagation by means of ova. He found also that no animalcules were produced, when in addition to other precautionary measures, the air used in the experiment was passed through sulphuric acid. The result of his experiments, conducted with a view of testing the validity of those upon which the exploded doctrine of equivocal generation was revived, was decidedly, at every point, in favour of the universal law, *omne vivum ex ovo.*

The only other class of facts that calls for notice is the

existence of *entozoa*, or internal parasitical animals. The ova of these animals, it is said, are too large to be conveyed in the air, or to be absorbed by vessels from the food and carried to their nidus in the viscera. Such worms have even been found in the viscera of embryos. The existence of these parasitic worms is, we admit, exceedingly obscure and difficult of explanation.* In many cases we can trace the process by which the ova are introduced, and in those where we cannot, the hypothesis of their origin ought to be in analogy with all else that we know of the production of life.

We have on the one side an induction comprising innumerable instances, deciding that the fixed law of organic production is "*omne vivum ex ovo*;" we have on the other side a few obscure facts, in some of which it is difficult to trace the prevalence of this law, but not one of them of such a nature as necessarily to exclude it. There can be little doubt that a sound philosophy must lead us here to pronounce in favour of the law.

The other corner-stone of our author's theory, the transmutation of species, need not detain us long. The chief fact which he brings forward in support of the supposed transmutation, is the passage of the highest forms of life through successive states that are permanent in inferior animals. We cannot now enter into the anatomical details involved in this question; but we refer to the paper of Dr. Clark, already quoted, for evidence that the author has misconstrued and falsified the facts of the case, to establish the desired resemblance. But grant the analogy to be as complete and as strict as possible, what inference are we warranted in drawing from it? Nothing more than that we find, in organic nature, gradations of an original power, manifesting different energies under different conditions, and working out results that are similar after a general plan. The resemblances traced, however close, are only the adumbrations of the unity of organic nature. To construct a history out of these resemblances is to found a science upon a fancy.

But we have one instance in nature, the author contends, of an advance in species, and that the more interesting because it is effected, so to speak, "by a prolongation of the

* "Entozoa have been found in embryos, and in the eggs of birds: so also have pins and small pieces of flint." See Dr. Clark's paper, in the Reports of the British Association, vol. 3, p. 113.

gestation at a particular part of its course." It has been found that oats, if kept cropped down through the summer and autumn will yield a crop of rye the next summer. In the first place we doubt the fact, and in the second, if true it is nothing to his purpose, unless it be first proved that the rye is borne by the identical roots which sent up oat stalks the previous year.

In addition to these facts we have the account of the method pursued by bees to raise a queen from the same larva, which under other conditions would have produced a neuter or a male: this needs no comment for there is here nothing like a change of species. For the same reason we pass by the account of the changes produced in the human species by exposure to privation and hardship. It is a familiar truth that imperfect diet combined with other unfavourable physical conditions will, in course of time, affect injuriously the features and proportions of the body. But communities and tribes of men have been for ages, exposed to such hardships, they have suffered through successive generations all that debasing physical conditions could inflict on them, and yet we have never seen the slightest tendency towards a loss of species. The Greenlander, and the Hottentot, and the pigmy tribes of Ethiopia, have not only kept the human heart which responds to the "touch of nature that makes the whole world kin," but they have preserved a body, in no other sense approaching to the brute, than that it is less symmetrical and perfect than it would have been under better culture.

Upon such grounds as these the author would seduce us into the belief that we who now stand at the head of creation, have grown up from the simplest form of vegetable, by successive translations of species, until we have reached our present state. It will be seen that we have not a single fact that bears definitely and certainly upon the theory which he aims to establish, while in opposition to it we have an unvarying experience from the beginning of recorded time until now. The earth is full of seeds, the air is full of them; no sooner does the work of the coral insect, far off at sea, rise above the water and collect a soil, than it is covered with vegetation. Countless myriads of seeds are continually germinating, and yet it has never been found that the seed borne by one plant produced a species different from its parent. The same law, without exception, governs the propagation of animals. Experiments

without number have been made to effect a change of species, but without success. Individual varieties have been produced, but strictly limited by the essential character of the species. There is no law of nature more firmly established than that like produces like, in the vegetable and animal world. The two points upon which the author's theory turns, spontaneous generation, and the transmutation of species, are alike destitute of foundation. They are wild guesses among the possibilities of things, as far removed as possible from the prescient surmises which often point out the path of discovery. The author himself says of Lamarck's system, which differs from his only in being less conjectural and more consistent, that "we can only place it with pity among the follies of the wise." He has good reason to fear that his theory is not destined even to as long a life as is accorded sometimes to the mistakes of genius in its random divinations.

We confess that there is one argument for believing that man may have come from the brute, stronger to us than any he has adduced; it is that men exist who are capable of maintaining such a theory. The author indeed becomes quite sentimental in his censure of the common feeling that there is any degradation in such an origin; but if he will devise an explanation, of how this feeling came to exist so universally, and also why it is that the nearer the brute approaches the human form, the greater is our aversion, he will be driven to a deeper philosophy than he has yet reached, and may learn to know and reverence the sacred distinction between a person and a thing. If man were the creature that his theory makes him, if he possessed no faculties except such as are found in an inchoate form in the brutes, if he were designed for nothing higher and better than gratification, though we should still reject his theory as a scientific blunder, we should feel no aversion to it.

This brings us to the true point from which this system should be viewed, the phenomena of man's intellectual and moral nature. The author finds that man is "bound up, by an *identity* in the character of his mental organization, with the lower animals,"—and he is naturally led to seek for evidence of a common origin; we also find in man a certain resemblance to the brute, but co-existing with this, in palpable contrast and most evident superiority to it, we find quite another image, even the image of God,—and we

therefore in seeking for his origin are driven at once to some different line of derivation from that by which the lower animals have come. His system, while it professes to render a full account of man, owes all its plausibility to the suppression of the chief facts to be accounted for. It is as if a man in constructing a theory of the vegetable world, should confine himself to an account of the material elements which enter into the composition of plants, neglecting the assimilating process by which these elements are transmuted and the shaping power by which they are fashioned. There is a ground which is common to the organic and the inorganic world, but there is also a distinctive peculiarity by which the plant is differenced from the stone; and he would deserve small thanks at the hands of philosophy who should overlook this capital fact in constructing his theory. So in man, though there are common points between him and the lower animals, there are other features in which the only resemblance is one of contrast; and to omit these or what is quite as bad, if not worse, to mistake their true character and debase them into bestial qualities, in a theory, which aims to explain the origin and destiny of man, this to say the least of it, is the very extreme of ignorance. The man who in attempting to give a theory of electricity should seize only upon the fact that electrical attraction is in inverse proportion to the square of the distance and the attraction of gravitation in the same ratio, and hence infer their identity would justly expose himself to the ridicule which would assign him a place among the philosophers of Laputa. What better place does he deserve who sinks the attribute of free-will into a "liability to flit from under the control of one feeling to the control of another," who maintains that reason in man is nothing more than the educated instinct of a brute, who confounds obligation with interest and makes virtue synonymous with agreeable sensations, and after this shameful degradation finds sufficient likeness between man and the lower animals to warrant the conclusion that his perfections are but the full-blown flower which in them is seen in the bud? It is indeed easy for the gipsy, after he has stained the skin of the stolen child and clothed it in rags, to establish its likeness to his own brown and tattered offspring.

The sacred scriptures apart, which give a different account of man's origin, we should be perfectly willing now to yield every position which we have taken against this

author's theory, and grant that man's body may have been derived, as he supposes, by a regular line of succession through the brute creation; still we contend that he has that within him which never could have been thus derived. It is by certain analogies existing between him, and the lower animals that this descent is established, but we find that that which distinguishes man, that which constitutes and denominates him what he is, is out of all analogy with anything that appears in the brute creation; and if we are led therefore to seek for the origin of his body, together with those qualities which are found in a less degree in irrational animals, by transmission from them, we are compelled by the same analogical argument to conclude that the higher qualities, 'the nobility of reason, the infinity of faculties, the apprehension, like a god,' by which he is contra-distinguished from them, are to be sought, not by tracing a line of ascent from below, but a line of descent from above. If man's body with its appetites and powers came from the gradual improvement of the bestial form and nature, we must nevertheless conclude that God met this body and implanted in it a soul stamped with his image. To establish this conclusion we have only to show that man is possessed of faculties of which no rudimentary types are found in the inferior animals.

This the author denies. He carries out the philosophy of sensation to its legitimate conclusions, with fearless consistency. "It is hardly necessary, to say, much less to argue, that mental action, being proved to be under law, passes at once into the category of natural things. Its old metaphysical character vanishes in a moment, and the distinction usually taken between physical and moral is annulled as only an error in terms." It is difficult to reply to such shallow dogmatism as this. It is true that there is regularity and order in human action, so that a sagacious man may often predict far-off results. It is true, as this author asserts, that statistics have shown that in large cities about the same number of mistakes is committed annually in the direction of letters; and, he might have added, that in France it has been ascertained that the number of suicides and murders is the same from year to year, and not only so, but the different methods of death by poison, strangulation, drowning, and deadly weapons, have each its nearly constant number of victims; so that in cases where we might most certainly expect to find the wildest irregu-

larities of caprice we detect the operation of constant causes. But it is surely most extraordinary reasoning to infer from this regularity, the existence of a physical law by which it is secured. This is another instance still of the disposition which this author shows to seize upon superficial and partial resemblances in different objects, and conclude upon their perfect identity. "No man can say what may be the weather of to-morrow; but the quantity of rain which falls in any particular place in any five years, is precisely the same as the quantity which falls in any other five years in the same place." "So also, the number of persons taken in charge by the police of London for being drunk and disorderly on the streets, is, week by week, a nearly uniform quantity, showing that the inclination to drink to excess is always in the mass about the same, regard being had to the existing temptations or stimulations to this vice." We have in these cases a uniform result; and the immediate inference is, that the same law of causation prevails, and that the human heart with all its affections and passions is controlled and determined to a specific course of action by the same kind of influence which distils the rain from the clouds. Has the author no eye for the differences between these phenomena which he so unceremoniously identifies? Are the inward misgivings of the drunkard, the awful struggles with which he attempts to break from an indulgence which he knows is destroying him, the sense of shame and self-reproach, and the dread feeling of responsibility which prey upon his soul, are these of no account in determining whether the influence which prevails over them is the same in kind with that which determines physical events? Is the difference between physical and moral to be annulled, as only an error in terms, simply because we find that in one case as well as the other, like causes produce like effects? Are the facts given us by human consciousness to be thrust aside in determining this question?

This is, after all, the ground upon which the contest between this philosophy and a higher one, must be decided. It is doubtless important to detect and expose the scientific blunders of every particular system of materialism that is at any time set forth, with sufficient pretension and plausibility, to make it dangerous. But though we may thus refute one, we leave the way still open for the introduction of another. We have shown that the author of this work has failed at every point, in establishing his different posi-

tions, but we have not shown that some other explorer in the same direction may not be more successful. It is among the facts of consciousness that we must find the evidence which sets aside this, and all other systems of like kind. We are undoubtedly subject, in a degree, to the same kind of restraint which governs the physical world. We are placed within the range of the law of cause and effect, and form thus a part of nature. If we are entirely subject to this law, then we have no philosophy possible, but to etherealize matter and become ideal pantheists, or to make mind only an error in terms and run into materialistic fatalism. These are the only two courses left open to us, and it seems to us a matter of small moment which is taken. We see little to choose between the spectre world of Spinosa, and the sty of Epicurus. When a man has taken away virtue from us we care not what also he takes or leaves. But if besides the world of necessity there exists also a world of freedom, and if these two worlds manifest their interpenetration in man's consciousness, then another philosophy is not only possible but necessary, and materialism and idealism are both discredited as partial and incomplete.

This author maintains that "all mental phenomena flow directly from the brain," a fact which we learn, as he says, from observation. We contend, on the other hand, that this observation, inasmuch as it is limited to the external conditions of the phenomena, without regard to their intrinsic character, must necessarily lead to an erroneous conclusion. As fitly might we conclude that the air which by its vibrations conveys some ravishing strain of melody is the cause of music, because the presence of the one is essential to the existence of the other. Observation proves that the brain is the organ upon which the manifestation of mental phenomena is more immediately dependent, and this is all that it proves. To learn whether the brain is the proper cause of mental states, or only the necessary condition of their manifestation, we must extend our observation beyond the brain itself and consider the character of the effects of which we are seeking the explanation. The moment this is done consciousness decides the question. We feel that in every mental act a percipient agent is involved. Matter can only give us phenomena, and that which *perceives* must necessarily be different from that which *appears*. The simplest case of perception, the transformation of an external object into an act of thought or

will, is sufficient to overthrow every system of materialism.

But brutes perceive no less than men. They manifest intelligence, affection, and will. Here again, if instead of confining ourselves to rude outward resemblances, we look calmly into our own consciousness, we discover abundant evidence that we possess something different, not in degree only, but in kind, from any thing that is found in the brute creation. In the highest development of instinct we find nothing more than a kind of intelligence which selects and uses means adapted to secure immediate ends; and all the purposes and acts of the animal are strictly determined by its organization. The beaver, the bee, and the bird, each build according to a law impressed upon them, and if thwarted or placed under circumstances demanding some variation from the type, their contrivances are limited to an approximation to the original plan. Man too builds, but he builds after no type. He is free from all law except that which is self-imposed. He builds not only for convenience and use, but often for no purpose but the pleasure of giving expression to an idea. Instead of being restricted by types, he is himself a creator of types. Here he stands in direct opposition to the brute. If we compare together the dam of a beaver, and the Apollo Belvidere, we find the rude resemblance, that they are both constructions. But when we look more closely we find that the resemblance vanishes, and that they stand in marked contrast. The beaver builds according to a predetermined type, and for immediate use. The sculptor, without any regard to use, and in the exercise of perfect freedom, forms a conception which he feels to be beautiful, and then transfers this conception to the marble, in which the idea is so inwoven that it lives through all time, and speaks intelligibly to all hearts. In giving expression to his idea the artist is no copyist of a type that has been set him, either by previous labourers, or by nature herself. Neither the secret of his power, nor the source of our pleasure, lies in imitation. Had the sculptor who gave us the Laocoon group, copied the writhing and contorted limbs, the livid cheek, the agonizing struggles of some father, with his sons, crushed in the convolutions of a huge serpent, we should have felt, while looking at it, such painful sympathy as the sight of the actual scene would awaken. But instead of this he has so subdued the suffering, that it becomes the translucent medium through which

we see the "brave resolve of the firm soul alone;" nor is this all, but the fortitude itself is so consummately expressed that the mind rests not in that, but is borne inward until it is lost in communion with that humanity, of which fortitude is one of the attributes.

> "Here, lovely as the rainbow on the dew
> Of the spent thunder-cloud, to Art is given,
> Gleaming through grief's dark veil, the peaceful blue
> Of the sweet Moral Heaven."

Here is manifested a creative power, like in kind, though infinitely less in degree, to that which the Divine Creator put forth, when he fashioned chaotic matter into shape, weaving through it his thought, and giving it expression that made the angels sing over it for joy. It is a part of that image of God in which man was made; and he only deludes and degrades himself who seeks a kindred faculty among the brutes.

It would be easy also to show that man is contra-distinguished from the inferior animals by his possession of a faculty which gives him necessary truth, independent of all experience. He is capable not only of generalizing, from the notices of the senses, but he has intuitions of truths that are universal and necessary. We pass this, however, and ask the attention of the materialist to another fact in human consciousness. Besides the perception of the useful and the agreeable, which we have in common with the brute,—the beautiful and the true, which we have in contra-distinction from them,—we find ourselves possessed with the idea of the good. This idea is not subordinate to that of "gratification," as our author makes it. An act is never good because it gives us pleasure,—on the contrary, it pleases us because it is good. It is written, "blessed are they that hunger and thirst after righteousness," and not, righteous are they that hunger and thirst after blessedness. Goodness is not a means but an end. We not only have this idea, but we feel its supremacy over all our other ideas. It is for the perception and realization of goodness that we have been made and endowed with all our powers of whatever kind. Hence in connection with this we find the feeling of moral responsibility, involving in it the consciousness of freedom of will. This is the capital distinction of man, his capacity to perceive moral excellence and to feel its power. It is through this that he be-

comes a partaker of the Divine nature, and feels himself to be immortal.

Of this part of man's nature it cannot be pretended that we find any anticipative prophesy in the lower animals; and hence the difficulty is met by denying substantially the validity of moral perceptions and qualities in man. Man is made for gratification, the distinction between moral and physical is an error in terms, free-will is a liability to flit from one feeling to another, virtue is of course but a name or a sound, and the feeling of moral responsibility a delusion of the weak and ignorant. Here is the proper turning point of this whole system. If these conclusions to which the author is driven, and which he does not hesitate to embrace, be true, then let his whole system be true. It is no longer worth a contest. But if they are false, then is his theory a falsehood and a foul libel upon human nature. If the sense of freedom which springs up amid the earliest play of our spontaneous impulses, and accompanies us onward through their regulation and control, in the exercise of which we feel ourselves standing over against nature, exempt from the law of necessity which binds all things else together by an adamantine chain,- -if this be a delusion, interposed to cheat us out of the knowledge that we are no more free than the river that seems "to flow by its own sweet will," then let us like the old Egyptian, feel and cherish our brotherhood with the bat, the beetle and the crocodile, nay with the ocean and the air, the storm and the pestilence. If the feeling that we were made for something higher than gratification is a superstition, if the visions of good that sometimes break in upon us, pure and glorious as the light of Heaven, are the unrealities of a distempered imagination, then let us dismiss our feelings of remorse, since in the perpetration of the greatest crimes we only make an unprofitable investment of capital, and the simple regret which might even be due to this as a blunder, defeats us of the happiness which might yet be at our command. But if, on the other hand, the peremptory truths of reason and conscience within us are realities—if we feel them to possess objective validity, so that we are constrained to believe in the real existence of things that are honest and fair and lovely—then the system gives the lie to our consciousness, and we know that it must be false whether we are able or not, to detect its scientific fallacies. Every man knows that the cause of his determination to any particular

course of action is different in kind from that which sends the cannon ball along its path. This is a plain and decisive fact, than which none other can be more certain. By the mass of mankind it is never called in question. We never hear the criminal excusing himself on the ground that his brain was badly organized, unless he has been under the tuition of some phrenologist. It is indeed possible for a man to deny the primary truths of consciousness; he may call in question the existence of any higher virtue than prudence, and obliterate the distinction between physical and moral as an error in terms. He may do this, for it is impossible to set limits to the capabilities of a vicious theory, or a vicious life. But after he has succeeded in proving that we are subject to the same necessity which governs other creatures, and that the notions of right and wrong, of merit and demerit, which are entertained by the whole human race are but universal delusions, the *idola tribus* of Bacon, he will still, when off his guard, involuntarily betray, by his admiration of self-sacrificing virtue, and his sharp indignation against wrong, his recognition of the morality which he has disproved. The denial of this power does not destroy it. At a thousand points the will, which he has thrust aside, rushes in and tears to atoms the conclusions of his puny logic.

Here then we leave this system, effectually discredited at the bar of human consciousness. In order to establish the derivation of man from the brutes, it is driven to overlook or to deny the very qualities by which man is constituted what he is, a rational and immortal being, and to set at naught the plainest of all facts, the most certain of all knowledge.

ART. III.—*The Vaudois: Comprising observations made during a tour to the Valleys of Piedmont, in the summer of* 1844: *together with remarks, introductory and interspersed, respecting the origin, history, and present condition of that interesting people.* By E. Henderson, D.D. London: 1845. pp. 262.

THE chief interest which this narrative possesses, arises