



THE
✓
PRINCETON
REVIEW.

By Whom, all things; for Whom, all things.

FIFTY-SEVENTH YEAR.

JANUARY—JUNE. *See*

NEW YORK.
1881.

ON CAUSATION AND DEVELOPMENT.

I AM not singular in holding that the whole subject of causation has become confused in the minds of educated men, including scientific men; and that the time has come for reconsidering it in the light which science now furnishes. In our day two or three doctrines have been elaborated which require us to revise (so I think) the statements made as to cause, more especially in its relation to force and energy. It is to be understood that throughout this paper I refer to causation objective, and not subjective; that is, to causation as it acts independent of our mind observing it (an ignited lucifer-match will kindle a rick of hay whether we notice it or not), and not to the special metaphysical question of ages, as to the origin and nature of our belief in the relation of cause and effect. It is further to be borne in mind that in the body of the article I speak exclusively of physical causation; that is, of the forces or activities of bodies; only towards the close showing that there may be mental or spiritual powers operating in our world quite as certainly as there are physical forces. It has been established that,

First, there is a duality or plurality in causation; that there are two or more bodies in all causal action of a physical nature. There were thinkers who had a glimpse of this doctrine from an old date. Aristotle spoke of *συναιτίον*, which Hamilton in noticing it translates concause.* But the truth was first clearly enunciated by Mr. J. S. Mill in his "Logic" (B. IV. c. v.) "The statement of the cause is incomplete unless in some shape or other we introduce all the conditions. A man takes mercury, goes out of doors and catches cold. We say perhaps that the cause of his taking cold was exposure to the air. It is clear,

* Sextus Pyrrh. iii. 15, speaks of *συνεπιτά, συναιτία, and σύνεργα αίτια.*

however, that his having taken mercury may have been a necessary condition of his catching cold; and tho it might consist with usage to say that the cause of his attack was exposure to the air, to be accurate we ought to say that the cause was exposure to the air while under the effect of mercury."

The doctrine had occurred to me before I read Mr. Mill's "Logic;" but as he published it first, I do not claim any credit in it. As approaching it, however, from a somewhat different direction, I believe I can make it more explicit and comprehensive. In all physical action there are two or more bodies, molecular or molar; at the present stage of science I ought to add that this body may be the ether in which the undulations of light take place. Now the cause—by which I mean that which invariably has produced the effect, and will invariably produce it—consists in the mutual action of two or more bodies; that is, their action on each other. Thus in the case adduced by Mr. Mill the true cause of the effect, the cold, was not the air alone or the body alone, but the air and the body under mercury. Without the concurrence, or rather the joint action, of the two, the effect would not have been produced. It is the same in all other cases. A ball at rest is struck by a ball in motion; the one ball is made to move, the other has its motion stayed. The cause consists of the two balls in a certain state, and the effect the balls in another state. A picture-frame falls from a wall and breaks a jar standing on a table below. We say that the frame, or rather the fall of the frame, was the cause of the fracture of the jar. But the true cause, that which forever will produce the same effect, is the frame falling with a certain momentum and the brittleness of the jar. Had the frame come down with less violence or the jar been stronger, there might have been no breakage. In most cases of action a considerable number, in some a vast number, and variety of agents combine to produce the result. Take the sprouting of a flower in spring: in the cause there are the increased heat and light of the sun, the state of the plant in the earth, and the state of the soil. Without the concurrence of all these the effect would not be produced.

Secondly, there is a duality or plurality in the effect. This is a further truth which Mr. Mill has not expounded, but which oc-

curred to me as I was thinking out the doctrine which Mr. Mill preceded me in unfolding. It follows from Mr. Mill's doctrine when it is properly understood, and seems to me to be quite as certain and fully more important and of wider range in its applications. Thus in Mr. Mill's illustration the cause was the state of the atmosphere, and the body as affected by mercury; the effect was the same atmosphere insensibly changed in temperature, and the body under a cold. In the second case the true cause consisted of the two balls, one in motion striking the other at rest; the effect (which would be forever produced by the same cause) the ball which was at rest moving and the ball which was in motion at rest. In the third case the cause was the picture-frame with a certain momentum striking a jar of a certain structure; the effect was the frame losing part of its momentum and the jar broken. In the case of the plant germinating there must have been in the effect changes—it may be incapable of measurement—in all the agents acting as the causes in the sun's heat and light absorbed in the earth and in the plant sprouting.

Taking these views with us, it may be of great use to have appropriate and definite phrases to express them. The word Cause, that which invariably produces the effect, should be reserved for the combination of agencies producing the result. The cause of the man's taking cold is not merely the cold atmosphere or his frame being affected by mercury, but in the two acting on each other. The word Effect should in like manner be applied to the combined result, and comprises the change in the air as well as the colded affection of the body. In the other illustrative cases it implies the movement of the one ball and the staying of the other; the loss of momentum in the picture-frame as well as the breaking of the jar; and the change in the rays of heat and light coming from the sun as well as the germinating of the plant.

As causes are dual or plural, it is proper to have phrases to express the parts. The law is often stated that the same cause always produces the same effect in the same circumstances. But in order to clearness and accuracy it is essential to specify what are the circumstances; it is in fact necessary to put them into the cause, as without them the effect would not follow. In order to the germinating of the flower there is not only the state of the plant

and soil, but the additional heat of the sun. All the acting parts may be called agents or agencies, without specifying what they are. They are bodies in a certain state acting on other bodies.

Very often one of these agents is more important in itself, or in our estimation, or for our present purpose, than the others; this is designated pre-eminently the cause, and little or no evil may arise from this provided always that it be understood that this agent needs one or more co-operating agents which are parts of the full cause. If it be said that the cold air was the cause of the man being colded, it was because his body was disposed towards such an issue by mercury. It is not easy, or perhaps even possible, to lay down a rule as to which of the agents should be called the special, the main, or the prominent cause, for the cause consists in the mutual action of the whole. When man is working he often calls in one agent to produce an intended effect. If he wishes to kindle a heap of straw, the agent he attends to is the fire he applies; if he wishes a good crop from his ground, he looks to the manure; if he wishes to be cured of a disease, he selects his medicine: tho in all such cases there is need of co-operation in the state of the straw, or of the ground, or of his bodily frame. In nature there is often one agent that is particularly potent. When a tree is struck by lightning it is the electricity that is specially noticed, tho the structure of the tree had also to do with the effect produced.

Fixing on the agent that is most prominent in itself or in our eyes as the cause or special force then co-operating, that agent may be called the *Occasion*. This phrase is specially applied to circumstances which cast up to call forth a power into exercise or to work with causes steadily operating. Thus that ill-constructed house fell on the occasion of a storm arising. I was prompted to write a letter to a friend by my affection; but the occasion was his suffering a severe loss; the two actually called forth the letter. Malebranche was the philosopher who brought the phrase "occasional cause" into general use. He represented the will of God as the true cause of all creative action, but the volition of man might be the occasion of the forthputting of the Divine Power. Thus when I move my arm the true cause is the Divine Will, but my purpose is the occasional cause. In

such a case we may allowably give a prominence to the Divine Power, but it should be noticed that while one of the agents is the important one, the other or others, the action of the brain and nerves, are necessary to the production of the precise consequence, which will not follow without the co-operation.

We are thus enabled to give a philosophical explanation of what is meant, or rather what should be meant, by *Condition*, a phrase so often used vaguely and illegitimately in the present day in its application to physical operation. In order to be rid of an agent or to drive it into a corner they say it is simply a condition. In order to the production of a given effect a certain agent is fixed on as producing an end, the other or others are represented as simply conditions. As proving design we show that animals with a stomach for digesting flesh have also claws and strong muscles to catch and hold their prey. But an attempt is made to do away with the force of the argument by urging that these adjuncts are merely the conditions of the machine working. But properly understood the argument lies in the circumstance that the co-operating conditions have met. The presence of strings in a harp is a condition of it producing music, but the evidence of design is in the presence and combination of the necessary strings.

We may legitimately and conveniently use such phrases provided we understand them ourselves and let our readers or hearers understand what we mean by them. But it should be distinctly explained that all the agents acting, whether circumstances, occasions, or conditions, constitute the cause without which the effect would not follow.

It is needful to make like explanations and come to the same understanding as to the Effect. In all cases of physical action the effect is also dual or plural; it consists of two or more agents changed—I hope to show the same agents as are in the cause. These constitute what has been, and what will always be, produced by the cause. But it often happens that a special end is contemplated when we set an agent or agencies aworking; and when this is effected it is regarded as the proper or the only effect. But there may be other consequences which we did not consider or look for, or which we regard as minor or irrelevant ones. We wish for a shower to refresh the ground; as it falls it

accomplishes that end, but it may also so swell a stream that it works destruction as it overflows its banks. A new machine is invented which produces a greater amount of work, but it throws a number of people, who followed the old methods, out of employment. It is desirable to have a phrase to denote these secondary effects, as they are regarded; and they may be described as *Concomitants*, or more expressly as *Incidents* or *Incidentals*. Perhaps some would call them Accidents, and they may be so called as they were not intended, as when one fires an overcharged gun and is wounded by its striking backward. But these accidents are quite as much caused by the agents as the others that were expected. In all cases the effect properly understood consists of the whole of the agents that have been acting put in a new state. Any one who sets new agencies agoing, say starting a new trade or passing a new law, is bound to look not merely to one but all the consequences that must follow.

Thirdly, there is the grand doctrine established in our day of the Conservation of Energy. It has long been known and acknowledged that the sum of matter in the cosmos is always one and the same. We burn a piece of paper and it disappears from our view, but is not annihilated; one portion of the matter has gone down in ashes, the other has gone up in smoke, and if we could bring the scattered particles together they would constitute the original paper. It has been established in our day that the same is true of the energy in matter. This doctrine was anticipated by Leibnitz and established in our day by Meyer, by Joule, Grove, and others. According to this doctrine the sum of energy, actual and potential, in exercise or ready to be exercised, is always one and the same. It cannot be increased and it cannot be diminished by any human, indeed by any mundane, agency. When any portion of it leaves one body it enters into another. The sum of energy in the two balls have in them the same amount of energy before they strike and after they strike. When the energy disappears in one form, say in mechanical force moving a mass, it appears in another, say in heat, which is molecular motion. But the sum is always one and the same.

It is an integrant part of this doctrine that the physical forces are all correlated, a truth which has been beautifully ex-

pounded by Grove. The energy may take various forms, say the purely mechanical, the chemical, the electric, the magnetic. These forms are capable of being transmitted into each other, and this in definite quantity, so much mechanical force into so much chemical force, which chemical force may be reconverted into the mechanical. This shows the whole physical forces of our cosmos to be correlated and capable of being transmitted into one another; the sum always remaining the same.

It may be difficult to point out the full relation between these three doctrines which I hold to be severally established. But there is no inconsistency between them. Perhaps the full doctrine may be so stated as to embrace all the three and make them aspects of one grand truth. Our cosmos may, as the Pythagoreans supposed, be like a closed globe with an immensely large but definite number of bodies in it. Each of these bodies possesses a certain measure of physical force or forces. These act and react upon each other, producing all the activity, all the movement, in our world. The bodies act on each other, forming a cause. In doing so they modify each other, and the result is the effect. Meanwhile the sum of matter and the sum of the forces in the bodies continue one and the same, and both are incapable of increase or diminution. This is at least an intelligible enough doctrine, and embraces the three truths which have been separately stated, and seems in perfect consistency with all that has been established in regard both to the persistence of matter and the persistence of energy, as Herbert Spencer calls it.

Meanwhile the conservation of energy may be regarded as an established doctrine. Savans do indeed continue to assert that some of the most eminent among themselves do not understand it, or have not expressed it properly, or have illegitimately applied it. But it is universally admitted that the doctrine is a true and an all-important one.

But let us properly understand and explain it and keep it within its proper limits. It will be admitted by all at once that we are not entitled to affirm that the law extends beyond our cosmos or knowable universe. For anything we know there may be other worlds beyond our world, and we have no right to say that in these worlds there is only a definite amount of energy which cannot be increased or diminished. God may, or

may not, be creating suns or earths or living beings beyond our ken and altogether beyond our science. The doctrine of the conservation of energy, as I understand, holds only on the supposition that our cosmos is like a closed globe. It is conceivable that our world may not be so closed in; that the dissipated heat which is passing into space may travel into other worlds and influence them without our being able to notice it.

This restriction of the doctrine is so obvious that it is scarcely worth noticing it. But there are other limitations which it is of vast moment to bring into prominence, as they are being overlooked by some of our scientific men. There is clear evidence that there are other potences or powers in nature besides the mechanical or physical forces. It is not proven that the doctrine of the conservation of energy applies to these.

Take Life. So far as I understand him, Herbert Spencer seems inclined to hold that the doctrine applies to all the powers in the world, even to the vital and mental; indeed, he seems incapable of distinguishing between nerve force and mental force. But he brings no proof that physical force and psychical force can be transmuted into each other. The language of most of our scientific speculators is hesitating. Huxley and Tyndall resolutely maintain that there is no proof that living beings can proceed from non-living. Darwin calls in three or four live germs, which he ascribes to God, before he can account for the development of vegetable and animal life. I have observed that those who reject a separate life or vital force are obliged to bring it in under another form. Thus Darwin calls in a pangenesis pervading organic nature, and Spencer has physiological units which play an important part in generation and heredity, and these are certainly vital forces. Then the arguments and experiments of Beale have to be met, and they have not yet been met by those who would deny the existence of a vital potency of some kind different from mechanical force.

But there are other agents in our world more clearly distinguished from the physical forces than the vital powers are. I refer to the psychical or mental; to those, of which we are conscious, which in fact we know immediately; such as our sense perceptions, our memories, our judgments, our reasonings, our desires, our emotions, our resolves. These we know as directly

and clearly as we know the affections of body, such as extension and resistance, and we have quite as good evidence of the existence of the one as of the other. Are these mental powers to be included in the physical forces which can neither be increased nor diminished? Can the physical forces be transmuted into the mental, say mechanical, or the chemical into thoughts, inclinations, and volitions? Nearly every scientific man in the present day admits, nay, maintains, that there is no proof of this. Many affirm that they cannot even conceive it to be so. Tyndall, no doubt, in his Belfast address hastened on to a high vaporous generalization, and declared that it looked as if all things could be brought under the potency of matter; in the mean time declaring, however, that he could not conceive how matter could produce mind, or mind matter. Mr. Fiske talks of our now needing to assume only one universal assumption, "the principle of continuity, the uniformity of nature, the persistence of force, or the law of causation;" but then he is obliged to add that "in no scientific sense is thought the product of molecular movement, and that the progress of modern discovery (correlation), so far from bridging over the chasm between mind and matter, tends rather to exhibit the distinction between them as absolute." The contradiction is here evident, and has been pointed out by scientific men; but I need not dwell upon it, my object being simply to show that thoughts and mental affections have not yet been reduced to physical forces. No doubt mind and body do so far affect each other. If a person is told that his dearest friend has died suddenly, his pulse will be apt to rise. Prof. Barker attaches a great importance to an experiment of a person first reading easy English, when his pulse was not affected, then reading Greek, when it rose several degrees. Such cases, and they might be multiplied indefinitely, show that mental thoughts and feelings do affect the brain-action, but they do not show that they add to or diminish the physical forces in the brain, or that the mental feeling or thought has been transmuted into a movement of the pulse. A man standing by a stream pushes a big stone in the water aside and the stream flows a little more rapidly for a minute or two; but he has not thereby added to the quantity of water. Just as little does mental

action, reasoning or feeling, add to or diminish the amount of physical force in the cerebro-spinal mass.

There is no evidence, but the very opposite, that our mental actions are identical or correlative with bodily motions or activities of any kind. Take as example, the discoveries of science, the reasonings of mathematicians, the visions of poets, the penetration of such philosophers as Aristotle, the ardor of the patriot, the beatific vision of the Christian, the sacrifices made by the poor for honor and honesty's sake. What savant will estimate for us in quantitative expressions of physics or chemistry the depth of affection in the mother's bosom when she incurs death herself to save her son, or the height of genius reached by Shakespeare when he conceived Hamlet or Lady Macbeth? There is no one proper quality of matter, such as the occupation of space, or resistance, or elasticity, that can be predicated of thoughts or affections. There is no one quality of mind, such as perception, thought, reasoning, or love, that can be applied to this table or that chair. The instrument has not yet been invented that can weigh or measure our intellectual or voluntary operations. When a tree dies it carries into the ground not only the particles of matter which composed it, but the forces in the tree to add to the forces in the ground. It is the same with the body of brute or of man when it is buried, it carries with it into the grave all the physical forces; but were there any new physical forces added to the earth when Plato, Milton, Bacon, or Newton died?

It thus appears that in the very midst of the physical forces and their correlations there may be other operations, mental or spiritual, and against this science has and can have nothing to say. I mean to refer to these farther on in the article. Meanwhile let us look at the physical forces acting according to the principles laid down.

1. Without attempting to explain their exact nature, or to enumerate them, let us designate the physical agencies operating in our world by the letters of the alphabet and inquire how they act. A ball at rest is struck by a ball in motion. Let us call the ball at rest A, and the ball in motion B. The two constitute the cause, which is

The cause A B.

As they act the effect follows: A moves while B's motion is stayed, and as the effect we have bodies changed,

The effect A' B'.

But in its motion A strikes C, and B is struck by D, and we have

Two causes A'C and B'D,

and the

Double effect A³C' and B³D'.

But these agents come to act on other agents, E, F, G, H, and we have a

Complex result, A³E, C²F, B³G, D²H.

On the supposition that these agencies are in a closed ball and act on each other and on nothing else, the sum of energy would be one and the same, while each body might be gaining or losing energy, one or both.

In the first action of A B, A gains energy from B and moves, while B loses what energy it gives and is stayed. But A going through the air and over a surface loses the energy it gained, imparting it to the air and surface, and comes to rest; and B is struck by D and gets the energy it has lost and moves. There is thus a continual action kept up among the bodies. The energy in each body varies, it may be from moment to moment, but the amount among all the bodies continues the same.

2. We see that the effects come to act as causes. Thus if we represent the cause as A B and the effect as A'B', we see that each of the agencies A and B is ready to act always when combined with some other agency, such as C and D. These last acting as causes become effects which may again become causes in combination with other or the same things. The conservation of energy thus keeps the world the same through ages, while these constant changes give it its activity: the one as it were constituting an unchanging ocean, the other the tides that agitate it. It is thus, as the Eleatics held, that everything is fixed and immutable, but equally true, as Heraclitus and the *φιλοσοφοι ρεοντες* taught, that everything is becoming.

3. We see that in physical nature (and I speak of no other) the effect consists of the agencies which have been the causes appearing in a new form. When the cause is A B, the effect is A'B'. When the cause is more complex, A, B, C, D, E, F, G, H, all of these agencies are changed or modified; and these as

changed constitute the effect that will forever follow the cause. This makes all physical causation a kind of evolution or development, a favorite doctrine with certain theosophists who derived all mundane things from other mundane things, and all things from God. This doctrine was apprehended and expressed in a mystical way, but contains an important truth which can be separated from the error with which it was associated and put in a scientific form. It is not that the effect emanates from the cause; but the effect consists in the agencies constituting the cause being put in a new state.

4. It is altogether wrong to represent with Hume the relation of cause and effect as being merely or essentially invariable antecedence and consequence. It is something deeper in the very nature of things. The effect which is always dual or plural consists of the things that constituted the cause in a new condition. There is and always must be invariable and unconditional antecedence and consequence, but prior to this and producing this there is the conservation or persistence of force which comes out from the agents acting as the causes, goes into the effect, and thus necessitates antecedence and consequence.

5. We see what is the inertia of body. Newton's First Law of Motion follows from the principles we have laid down. A body at rest will continue at rest forever unless it is acted on by some other body; a body in motion will continue in motion in the same straight line unless stayed or deflected by some other body. All this is a corollary from the principle that causal action is the action of two bodies, and that a body will not act unless acted on by some other body.

6. We see the nature of the law of action and reaction. A body will not act unless there is some other body acting on it. Under this view matter is passive. It acts only so far as it is acted on. In another sense it is active. One body acts on another body; thus two bodies are A and B, and A and B are both changed. A at rest moves and B is stayed. What B loses in being stayed, A gains and moves. This gives us Newton's Third Law of Motion, that Action is always equal to and the opposite of Reaction. B gives what it loses to A, but the sum of energy of the two is the same after action as before action. It follows that the energy given to A is equal to that lost by B.

7. It is sometimes stated that the same effect may be produced by different causes. This is not true or it is true according as we understand it. A jar may be broken by a picture falling on it, but it may also be broken by a stone flung at it. The breaking of the jar may thus be produced by two different processes. But in both cases the breaking of the jar is only part of the effect. The full effect in the one case was the jar broken and the picture stayed; in the other, the jar broken with the stone stayed.

8. It is often said that great effects follow from small causes. A cow kicks a kerosene-lamp, and first the shed is ignited and then the half of a great city is burned. The British Government denies Colonial America a comparatively small claim; and a revolution breaks forth which separates Great Britain and the United States forever. But it is not quite correct, it is not the full truth, to say that one cause did all this. In all such cases there is a co-operation and succession of various causes. The fire is carried on by there being all around inflammable materials to propagate it, and the separation of the countries was really produced by a widespread discontent. In like manner a mighty agency may often issue in a very insignificant effect, because there are no conspiring powers.

Finally, we see what a complexity there is in the activities in our world. There are two or commonly more agents in every act of causation, two or commonly more in all effectuation. What a variety of powers at work in the great natural occurrences, say in the seasons, say in the production of spring, with its increased heat, its buds and leaves and blossoms! What a complication in the production of the great epochs of history: in the spread of Christianity; in the revival of learning in the fifteenth century; in the great Reformation; in the English, American, and French revolutions! This complexity is vastly increased by the circumstances that the agents in combination possess properties which they did not exhibit in their separate state. Water exercises qualities which did not appear in the separate action of the oxygen and hydrogen. When combined in living plants and animals the elements exhibit powers, such as absorption and assimilation, not shown by the oxygen, hydrogen, carbon, and ammonia. I feel that there is need in this compli-

cation of a regulating power to produce order and beneficence. Without this all these powers might work capriciously and injuriously and have formed only powers of evil, mosquitoes, serpents, flaming meteors and burning worlds, destructive machines, and pestiferous creatures devouring each other and arresting all forms of beauty and beneficence, and yet incapable of dying. We find instead those millions of agencies combining to accomplish good and benign ends. All this seems to me to show that there has been a mind disposing and a wisdom guiding them.

To prove this it is not necessary that we should settle what are the original constituents of the universe: some suppose them to be atoms, some represent them as centres of force, some will allow them to be only centres of motion. Some of our most distinguished physicists, such as Helmholtz and William Thomson, are favoring the idea of Descartes, somewhat modified, that they are vortices in perpetual whirl. Whatever they be, they need a wise and good disposal to make them perform bountiful ends. I discover traces in nature of various kinds of design.

I. There are concurrences of agents to accomplish special beneficent ends. Take the eye. What a combination of independent agencies before we can see the smile on that friend's face! There are vibrations coming from the sun ninety millions of miles away; these have passed at various rates through an ether, they touch and are reflected from the countenance; some of them reach the corner of an optical instrument called the eye; they go through an aqueous humor, thence through the gateway of iris into the crystalline lens; they are there refracted and pass through the aqueous humors to the retina, where they impact on thousands of rods and cones, and are sent on to the optic-nerve and the brain; and we now see the smiles on our mother's face. Let any one of these be absent or fail, and nature would remain forever in darkness. Take the ear. A sister utters a word, a vibration is started, it reaches our ear, is collected by the outer ear and knocks on the tympanum, is propagated into the middle-ear, where it sets in motion the hammer and the anvil and the stirrup, thence it penetrates into the inner ear, where it vibrates through a liquid, affects the thousand and

more organs of Corti, is sent round the semicircular canals into the cochlea, on through the auditory nerve into the brain; the silence is broken, and we are cheered by a voice of love.

II. We may discover a plan and purpose in development as it is carried on in our world. Development is evidently not a simple power in nature like mechanical force or chemical affinity or gravitation. It is clear that there is a vast, an incalculable number and variety of agencies in the process, whether it be the development of the plant from its seed, of the bird from the egg, of the horse from its dam, of the threshing-machine from the flail, of the reaping-machine from the reaping-hook, of our present kitchen utensils from those used by our grandmother.

Development is essentially a combination of causes fulfilling a purpose. It is an organized causation for ends, a corporation of causes for mutual action: It has been admitted for ages that causation works through all nature; not only divine causation, the source of the whole, but physical causation; that is, the ordinary occurrences of nature are all produced by agents working causally; in other words, fire burns, light shines, and the earth spins round its axis and rotates round the sun, and the consequence is that we have heat and light and the beneficent seasons. Men of enlarged minds do now see and acknowledge that in the doctrine of causation, in the doctrine of God acting everywhere through second causes, there is nothing irreligious. On the contrary, the circumstances that God proceeds according to laws is evidently for the benefit of man, who can thus from the past anticipate the future and prepare himself for it. On the same principle I hold that there is nothing irreligious in development, which is just a form of causation. It was my privilege in my earliest published work to justify God's method of procedure by natural law. I reckon it a like privilege in my declining life to defend God's method of action by development, by bringing the present out of the past.

There is an arranged combination necessary to produce evolution. The present is evolved out of the past and will develop into the future all under an arrangement. The present is the fruit of the past and contains the seed of the future. The configuration of the earth, its hills and dales, its rivers and seas, which determine the abodes and industries of men and the

bounds of their habitation, have been produced by agencies which have been working for thousands or millions of years. The plants now on the earth are the descendants of those created by God, and the ancestors of those that are to appear in the coming ages. There is through all times, as in the year, a succession of seasons; sowing and reaping, sowing in order to reap, and reaping what has been sown in order to its being sown again. This gives a continuousness, a consistency, to nature amidst all the mutations of time. There is not only a contemporaneous order in nature, there is a successive order. The beginning leads to the end, and the end is the issue of the beginning. This grass and grain and these forests that cover the ground have seed in them which will continue in undefined ages to adorn and enrich the ground. These birds that sing among the branches and these cattle upon a thousand hills will build nests and rear young to furnish nourishment and delight to our children's children in millennial ages. Every naturalist has seen a purpose gained by the nutriment laid up in the seed or pod to feed the young plant. I see a higher end accomplished by the mother provided for the young animal. That infant is not cast forth into the cold world unprotected: it has a mother's arms to protect it and a mother's love to fondle it. Development is not an irreligious process; every one who has been reared under a father's care and a mother's love will bless God for it.

"Evolution," says Herbert Spencer, "is a change from an indefinite, incoherent homogeneity to a definite, coherent homogeneity through continuous differentiation and integration." He has sufficient philosophy to refer all this to a power supposed by him to be unknown working behind the known phenomena. A deeper philosophy will discover a so far known divine power producing these effects.

In development there is usually progression. At times there is degeneracy, chiefly the result of human sin, as we see in the degeneracy of the Indians. But as a whole there has been an advance in our earth from age to age. The tendency of animal life is, upon the whole, upward—from all-fours to the upright position, in which men can look up to the heavens. Agencies have been set agoing to produce these evidently intended ends. Causes that operated ages ago have called in other causes to co-

operate with them, and have thereby added to the power and riches of the product. The geological changes have made our earth fit for the abode of man. Human beings have taken the places which in earlier ages were handed over to wild animals. There is a greater amount of food produced on our earth than at any earlier stage. There has been, as the ages rolled on, a greater fulness of sentient life and a larger capacity of happiness. The intellectual powers have been made stronger and firmer like the trunk of the tree, and the feelings like the flowers have taken a larger expansion and a richer color by culture.

I am inclined to see purposes in the very forms of animals and plants, and the manner in which they grow into their type; while the type ever advances as if to realize an idea. Our roses are all supposed to be derived from the common dog-rose, and I see a beauty in that rose as it grows by the roadside. But I discover a higher manifestation of skill in the way in which the rose becomes more fully expanded in our gardens. God, who rewards us for opening our eyes upon his works, bestows higher gifts on those who in love to them bestow labor upon them. Dogs, it is said, have all descended from some kind of wolf, and I see a fitness in their primitive forms; but I discover a fuller development in the shepherd's dog and the St. Bernard dog with their wondrous instincts. I discover a fitness of parts in the old eohippus which used to tread with its five toes on marshy ground; but I discover an advance in the pleiohippus, and still higher perfection in the animal we ride on, so useful and so graceful, so agile and so docile.

III. I discover an end in the manner in which plants and animals are produced. Two systems of development are necessary to effect this. First, the tendency of every living thing to produce a seed or germ. The powers necessary to accomplish this are very numerous and very complex, but all conspiring towards this one end, as if it were one of the purposes for which the plant was created. Secondly, there is the development of the plant and animal from the seed or germ. This, too, implies an immense combination of arranged elements and forces. It looks excessively like an end contemplated, an idea to be realized. It looks all the more like this when we notice that the seed or germ is after its kind and produces a living being after

the same kind. There is thus a double development in all animated nature; we see it in the oak producing the acorn, and the acorn the oak.*

These are mainly operations of the ordinary physical forces which are all correlated with each other, needing only a disposing power. But there are in our cosmos other and higher powers. In closing let us look at these.

First. There is evidence of new and these higher powers appearing in the progress of nature. I have shown at an earlier part of this article that in physical causation there is merely a changed state of the agents acting as the causes. There is no power in the effect which was not in the causes. If heredity has a gift committed to it, it may transmit it from parent to offspring and from one generation to another. But if there be a new power appearing, it must be from superadded causes. But there are products in our world which cannot be developed from the original elements or powers of nature.

Was there Life in the original atom, or molecule formed of the atoms? If not, how did it come in when the first plant appeared? Was there sensation in the original molecule? If not, what brought it in when the first animal had a feeling of pleasure or of pain? Was there mind in the first molecule, say a power of perceiving an object out of itself? Was there consciousness in the first molecule or monad—a consciousness of self? Was there a power of comparing or judging, of discerning things, of noting their agreements or differences? Had they a power of reasoning, of inferring the unseen from the seen, of the future from the past? Were there emotions in these first existences? say a hope of continued life or a fear of approaching death? Perhaps they had loving attachments to each other, perhaps they had some morality, say a sense of justice in keeping their own whirl and allowing to others their rights and their place in this dance! Had they will at the beginning, and a power of

1 "When will apologists begin to perceive that the best apology for the universe would lie in the belief that it was not designed at all?" This is the melancholy conclusion reached by Mr. Grant Allen in a review of Prof. Cleland's recent work. Some are regretting that Mr. Allen should have become so slavish a follower of Spencer, and be using his power as a critic in the *London Academy* to depreciate those who have the courage to avow that they see design in nature.

choosing between pleasure and pain, between the evil and the good? Perhaps they had some piety, and paid worship of the silent sort to God!

It is needless to say that there is not even the semblance of a proof of there being any such capacities in the original atoms or force-centres. If so, how did they come in? Take one human capacity: how did consciousness come in? Herbert Spencer, the mightiest of them, would have us believe that he has answered the question, and yet he has simply avoided it. In his "Psychology" he is speaking of nerves for hundreds of pages; he shows that in their development there is a succession of a certain kind; and adds simply that "*there must arise a consciousness*"! This is all he condescends to say, bringing in no cause or link or connection. Thus does he slip over the gap—a practice not uncommon with this giant as he marches on with his seven-leagued boots.

It is pertinent to ask, How did these things come in? How did things without sensation come to have sensation? things without instinct to have instinct? creatures without memory to have memory? beings without intelligence to have intelligence? mere sentient existence to know the distinction between good and evil? I am sure that when these things appear, there is something not previously in the atom or molecule. All sober thinkers of the day admit that there is no evidence whatever in experience or in reason to show that matter can produce mind; that mechanical action can gender mental action; that chemical action can manufacture consciousness; that electric action can reason, or organic structure rise to the idea of the good and the holy. I argue according to reason and experience that we must call in a power above the original physical forces to produce such phenomena. I may admit that a body may come out of another body by the powers with which the bodies are endowed; but I say that a sensitive, intelligent, moral discerning soul cannot proceed from the elements of matter. New powers have undoubtedly come in when consciousness and understanding and will begin to act. They may come according to laws not yet discovered, but they are the laws of the Supreme Lawgiver.

I can find no more satisfactory account of this process than that in the opening of Genesis, where new manifestations appear

in successive days or epochs, the whole culminating in man in the image of God. "Howbeit that was not first which is spiritual [*πνευματικόν*], but that which is natural [*ψυχικόν*]; and afterward that which is spiritual." "And so it is written, the first man was made a living soul; the second Adam was made a quickening spirit" (1 Cor. xv. 44-46)—where we may mark the advancement from the merely living soul (*ψυχὴν ζῶσαν*) to the quickening spirit (*πνευμα ξωποιοῦν*).

Secondly. There are mental and spiritual powers working in our world. Of the operations of the mental powers we are conscious. I am quite as certain that I have thoughts and wishes as that I have hands and feet. But not only are there psychical acts, there may be spiritual powers. I am aware that some of our savans will turn away from such an idea not only with unbelief, but with scorn, declaring it to be inconsistent with the uniformity of nature, with all history, and with all science. But this arises not from the comprehension of their views, but from fixing their eyes so exclusively on their own favorite subjects that they do not see others lying alongside of them possibly higher and more important.

Earnest men in all ages have been seeking after intercourse with God. They have prayed in the belief that there may be One to hear them, and they have expected an answer. They do not allow to you that God has so shut himself out from his own world that he cannot act on it. They deny that there is any proof that our petitions are so bound to the earth by gravity that they cannot mount upward and reach the ear of their heavenly Father, who is felt as pitying them. They believe that their spirits can hold communion with God, who is a Spirit, quite as certainly as our earth can act on the sun and the sun on the earth. They have faith that there are wider and more intimate unions than those produced by the attraction which all matter has for other matter. They are sure that all holy intelligences throughout the universe are in union with the Holy God.

Christians believe that they live under the dispensation of the Spirit. We have seen that there have been in the history of our world times or seasons in which new powers, apparently always advanced powers, appeared. There was a time in which life appeared, in which consciousness appeared, in which intelli-

gence appeared and will appeared, and a conscience discerning between good and evil appeared, and the full man in the image of God appeared. There has been a like introduction of new powers, and a like advance in the revelation which God has been pleased to make of his will, first in the shadow going before, then in the grand Personage appearing in the fulness of time. The Jewish dispensation comes out of the patriarchal, and the Christian out of the Jewish, in each case something new being added. Under the old economy there were promises of the coming dispensation, and there were anticipations of it in persons moved by the Holy Ghost. It was thus in the geological ages; as Agassiz delighted to show, in lower creatures stretching up towards higher and towards man himself. But the full dispensation of the Spirit was introduced when the Mediator, having finished his work on earth, went up to heaven: "If I go away, I will send him unto you."

Christians believe that in this dispensation they have access to God. They maintain that science has nothing to say even in appearance contradictory. Some of the profoundest investigators of science have believed all this and avowed their convictions, such as Newton and Leibnitz, Brewster and Herschel, Faraday, Meyer, and our own Henry. They have been quite as sure of this as of their own great discoveries as to the laws of the universe.

No doubt these spiritual operations are not without law of some kind. But that law is not the same with the physical laws operating around us. It may be such that we cannot by searching find it out. The arc visible to us is too small to enable us to calculate the full circle or sphere. So we piously ascribe it all to the sovereignty of God. "The wind bloweth where it listeth, and thou hearest the sound thereof, but canst not tell whence it cometh, and whither it goeth: so is every one that is bórned of the Spirit."

JAMES MCCOSH.