PHILOSOPHIC SERIES—No. II.

ENERGY

EFFICIENT AND FINAL CAUSE

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INTRODUCTION.

The principle of cause and effect is involved in most of the processes by which we discover truth. True, there are verities which are perceived by intuition, that is, in looking upon the objects, such as that I exist and that material things exist. But it is only a small portion of our knowledge that is obtained by primary and direct inspection. In the case of other and derivative truths causation is implied, if not in the whole, at least in the greater number of them.

The principle has a place in the great body of our convictions as to the past. I do not see that it has any part in memory which is instinctive, but it has in all those which we reach by a process. Thus, we believe that there has been a battle at a certain place, a flood at a particular spot on a river, a fire in a dwelling, because we discover effects, which we argue imply a cause. Thus, we argue that certain strata in the earth's surface are the deposits of an ancient ocean, and that other portions have been thrown up by a volcano. Even in regard to events which we believe on human testimony, we assume that the actors have been swayed by the same motives as men now are.

It will be allowed more readily that our reasonable ex-

pectations as to the future depend so far on this principle. We argue, whether we are conscious of it or not, that the causes now operating in physical nature and in men's minds will act in the future as in the past; that these colleges and schools will continue to produce a high mental cultivation; that these improved modes of agriculture will produce a richer crop, and that the abuses in certain old countries will, in the end, produce a revolution like those of France and America.

The principle is involved in the common arguments for the existence of God. True, those who believe with Schleiermacher that God is perceived by direct intuition do not need this premise. But the proofs commonly urged, for example, that from the adaptation of one thing to another to accomplish a good end, and that from the high ideas in the mind of the infinite the perfect proceed, as has been shown by Kant, on the principle of causation; these collocations and aspirations imply a designing mind to produce them.

Causation is thus one of the bonds which connect the present with the past and the future, and the whole with God as the Great First Cause. If this be so, it is surely desirable, it is indeed of vast importance, to have the nature of cause and our belief in it accurately unfolded, and brought into consistency with modern science. David Hume, in establishing his philosophical scepticism, labored with all his might to loosen the causal connection. In the defence of truth this principle comes next in order to that of the Criteria of Truth.

SECTION I.

PHYSICAL CAUSATION.

The subject will be made clearer by carefully distinguishing Causation Objective and Subjective: that is causation in itself whether we observe it or no (a spark will kindle gunpowder without our taking notice of it), and the principle in the mind which leads us believe in it.

I am not singular in holding that the whole subject of Cause has become confused in the minds of men, especially educated men, and that the time has come for reconsidering it in the light which recent investigation furnishes. In our day two or three doctrines have been propounded and, I believe, demonstrated, which require us to review and revise the doctrine of causation, more especially in its relation to Force, Energy, and Power.

I.

There is a duality or plurality in Causation, that is, there are two or more acting bodies in all physical causes. There were thinkers who had a glimpse of that doctrine from an old date. Aristotle spoke of a *συναίτιον* which Sir W. Hamilton translates Concause.[1] But this truth was first clearly enunciated by Mr. J. S. Mill (*Logic*, Book IV., Chap. 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,

[1] Sextus Empiricus speaks, III. 15, of *συναίτιον*, *συνεργόν*, *συνεκτικὰ*, all pointing to joint action.

and catches cold. We say, perhaps, that the cause of his taking cold was the exposure to the air. It is clear, however, that his having taken mercury may have been a necessary condition of his catching cold; and though 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 the 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.

II.

Secondly, there is a duality or plurality in the effect. This is a further truth which Mr. Mill has not expounded, but which occurred 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 it is 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 toward 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; though 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, though 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 the co-operating 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 along 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, it is said that 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.

III.

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 it is not annihilated. One portion of the matter has gone down in ashes, the other has gone up in smoke, and it is conceivable we might bring the scattered particles together, and they would become the original paper.

Imperious Cesar dead and turned to clay
Might stop a hole to keep the wind away.

It has been proven in our day that the same is true of the energy of matter. This doctrine was anticipated by several philosophic physicists,[1] but was established in our day by Mayer, by Joule, by Grove, and others. According to it, the sum of energy potential and actual capable of being brought into operation or in operation, is always one and the same. It cannot be increased and it cannot be diminished by any human, indeed, any mundane agency. The doctrine is thus stated by Clerk Maxwell: "The total energy of any body or system of bodies can neither be increased nor diminished by any mutual action of these bodies, though it may be transformed into any one of the forms of which energy is susceptible." The amount of energy is constant if unaffected by any agent external to itself. If acted on from without the energy will be increased by what has been communicated. If it acts on bodies without, the energy will be diminished by the work done. When any portion leaves one body it passes into another. If two balls strike each other, they have the same amount of energy before they strike and after they strike, though the energy may be decreased in one and increased to the same extent in the other. When the energy dis-

[1] It has been shown (Thomson and Tait's Natural Philosophy, § 269) that Newton had seized the principle which leads to the doctrine, "Work done on any system of bodies has its equivalent in the form of work done against friction, molecular forces or gravity if there be no acceleration; but if there be acceleration part of the work is expended in overcoming resistance to acceleration, and the additional kinetic energy developed is equivalent to the work so spent." It can be shown, I think, that Leibnitz also approached the doctrine from another side. In his letters to M. L'Hospital he speaks of "l'egalite de la cause et de l'effect," and says, "la force se conserve toujours." This points to the principle. Mayer, who did as much as any other man to establish the doctrine, also speaks of the effect being equal to the cause.

appears in one form, say in mechanical force moving a mass, it appears in another, say in heat, which is molecular motion.

It is an integrant part of this doctrine that the physical forces are all correlated, a truth beautifully expounded by Grove in his "Correlation of the Physical Forces." The energy may take various forms—say the purely mechanical, the chemical, the electric, the magnetic—perhaps also the gravitative, which may be a somewhat weak form of the correlated forces. 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 world to be correlated and capable of being exchanged for one another, the sum of energy remaining the same.

It may not be easy to show 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 world may, as the Pythagoreans supposed, be like a closed globe with an incalculably large but definite number of bodies in it. These act and react upon each other, producing all the activity, all the movement in our world. The bodies act on each other, and form a cause. In doing so they modify each other and the result is the effect. Meanwhile the sum of matter and the sum of energy in the bodies continue one and the same, and both are incapable of increase or diminution. This is at least an intelligible 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.

I am prepared to stand by and defend the statement now made. But when I inquire more particularly into the nature of things involved in causation, I feel that I am treading darkly and have to guard my steps. Important questions are pressed upon me, and I have to speak without dogmatism.

What is the relation of energy to causation? Energy is now the favorite phrase employed to express the activity of matter. Energy produces changes. But the change must be in something. Physical energy is in the system of bodies. By it one body acts on another. There must be energy of some sort in every system of bodies at all times. But the body acts only when another body is present. When two or more bodies act on each other we have cause. Cause is that which will ever produce the same effects.

Energy and cause must be realities quite as much as matter is. Indeed, energy and causation seem to be in the very nature of matter. Energy is the power that acts in matter. Matter, when it acts, acts causally. The energy in the two or more bodies acting as the cause is the power in causation.

Energy is said to be potential and actual or kinetic. When energy is merely potential the bodies are not in evident action of any kind. The energy becomes real or actual when a body comes into a relation of mutual action with another body. There is now causation.

Some would get rid of energy in physics by affirming that the whole phenomenon consists in motion. But there is energy, potential energy, when there is no seen motion. There is energy in that fragment of marble on my table, and this when the body is not moving. Energy is that which produces motion. The energy is measured by the work it does, that is, by the motion it produces.

The ball A, as it moves by its energy, strikes the ball B, loses its energy, and rests. What is the difference between A moving and A at rest? The answer is that it has an energy in the former case, which it has not in the latter. It will not regain its energy and be able to move till it gets it from some other body.

It has to be added that the body without the energy has the capacity (*δύναμις*) of receiving it.[1] "Energy," says Clerk Maxwell, "cannot exist except in connection with matter" (Matter and Motion, p. 165). We have a like statement by the authors of "The Unseen Universe" (p. 106). "Energy is never found separate from matter, so that we might define matter as the seat or vehicle of energy—that which is essential to the existence of the known forms of energy, without which, therefore, there could be no transformation of energy and therefore no *life* such as we now know it." It is commonly said that the energy is in the body. Sometimes the body has more and sometimes less of this energy. The stone taken to the top of a tower has energy which it loses when it falls to the foot. The spring has more energy because of energy expended in bending it. But the body has the capacity all the while to receive energy. Amid all changes the body continues with its capacity.

Let us now look at bodies acting according to the principles laid down. Without attempting to explain their

[1] Physicists have taken their phraseology from Aristotle, but have changed it. I am not sure whether it would not have been better had they adhered to it more closely. He has a *δύναμις*, a capacity, and an *ενέργεια*, or a power in actual exercise. This is very much the modern distinction between potential and actual energy. Between these two he had *εντελέχεια*, or readiness for action, a phrase which his commentators have had a difficulty in comprehending. It might have an appropriate meaning if applied to the two bodies brought into such a relation that they are ready to act.

exact nature or to enumerate them, let us designate the physical agencies operating in our world by the letters of the alphabet, and view them acting. 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 AB.

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^1B^1.

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

Two Causes A^1C and B^1D,

and the

Double effect A^2C^1 and B^2D^1.

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

Complex result, A^3E, C^2F, B^3G, D^2H.

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. Certain important consequences follow.

1. 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^1 and B^1 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 φιλόσοφοι ῥέοντες taught, that everything is becoming.

2. 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 or more bodies, and that a body will not act unless acted on by some other body.

3. 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.

4. It has been disputed whether the cause and its effect are contemporaneous or successive. The difference of

opinion springs from confused notions as to the nature of causation. In all causes there are at least two bodies and mutual action, both action and reaction, and these take place at the same time. When one ball strikes another, when oxygen combines with hydrogen, the action on the part of both bodies is simultaneous. But in causation proper the effect comes after the cause; it is the production of the cause. The gain of energy by the one ball and the loss of it by the other is the consequence of the simultaneous action. The water is the product of the chemical union of the two elements.

5. 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.

6. 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. Three

very important philosophical doctrines seem to be thus established.

7. In physical nature (and I speak at present of no other) the effect consists of the bodies which have combined to form the cause being put in a new state. When the cause is A B, the effect is A^1 B^1. The cause may be more complex, A, B, C, D, E, F, and all the bodies are modified and appear in this modified form in the effect, A^1 B^1 C^1 D^1 E^1 F^1. Thus all action is a kind of evolution or development, a favorite doctrine of the theosophists of the East, who draw all mundane things out of other mundane things, and in the last resort all things from God. This doctrine is commonly apprehended in a mystical way which favors pantheism, but it contains important truth, which can and should be separated from the error with which it has been associated. It is not that the effect emanates or grows out from the cause, but it is that the effect consists in the bodies constituting the cause being put in a new state or form.

8. It is wrong to represent, with Hume, the relation of cause and effect as being mainly or essentially that of invariable antecedence and consequence. Most people have felt this doctrine to be meagre and unsatisfactory, without being able to correct it by supplying the felt deficiency. It is not the invariable sequence which constitutes causation; there must be something in causation which produces the invariable succession, otherwise, why should the sequence be so invariable? The certainty in the succession is produced by the power acting in the causes. Causation is thus seen to be in the very nature of the bodies acting as the causes.

9. We see and can explain what is meant by the continuity of nature which was noticed by observers from an early date, and which has been speculated on by many profound thinkers such as Leibnitz. When we look care-

fully into the operation of the material world we discover that there is no break in its successive actings. True, there is often no causal connection between one state of things and another going immediately before, between, for example, night and day, which do not produce each other while they are invariable antecedents and consequents. But when we go behind the more obvious appearances, we find that each is produced by antecedent causes; the day by the shining of the sun and the night by his withdrawal. If we trace any occurrence backward we find it preceded by a series of antecedents, and if we go on with it we have connected consequents. Causation is a bundle of twisted chains each of which follows its own course, but which are all joined in a connected machine. This it is which at the bottom produces the continuity of nature, which, however, is always gathering adjuncts to enable it to proceed.

10. Among these scattering forces there is need of a regulating power to produce order and beneficence. Without this the powers might work irregularly and injuriously, and bring forth only evil agents, such as flaming meteors and burning worlds, pestiferous creatures devouring one another, as gnats, serpents, wild beasts, arresting all forms of beauty and means of happiness, and yet incapable of annihilation. We find instead millions of agencies combining to accomplish good and benign ends. Take the ear. A sister utters a word, a vibration is started, it reaches our ear, is collected by the outer surface and knocks on the tympanum, is propagated into the middle ear, whence it sets in motion the hammer, 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, and along the auditory nerve into the brain; the silence is broken, and we are cheered by a voice of love.

SECTION II.

PSYCHICAL CAUSATION.

I HAVE spoken of causation in physical nature. I am now to speak of it in psychical action.

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 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 ours, 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 the 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 affect 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 paper.

It is generally believed and acknowledged that there is cause and effect in mind as well as in body. In the one as in the other, we expect the same antecedents to be followed by the same consequents. When we wish to secure in ourselves or others, say in the young, a certain disposition or habit of patience and perseverance, we set agoing a training or discipline fitted to produce the result. When we are anxious to gain the good will of our neighbors, we address the motives most likely to sway them. The orator seeks to convince and move to action by arguments and considerations likely to influence his audience. In knowing a man's propensities, we can at times predict the part he will take in certain circumstances, and so far as we cannot do this fully, or accurately, it is simply because we are not fully acquainted with all the elements in his character; just as in physical nature we often cannot foresee the events that are to occur, because the powers operating are so numerous and complicated. There are some men of whom we are sure that they will not do a mean act. In many cases we can determine what a man's springs of action are by his acts; we are sure he is swayed by passion or malignity, by honor or by charity.

It is clear that there is Power in the mind—I use the word power, leaving the phrase energy to be applied by the physicists to the action of body. All writers who have had occasion to refer to the operations of the mind, have spoken of its powers or faculties, classifying them in various ways, as into the Gnoctic or Gnostic and the Creative with Aristotle, translated into Latin the Cognitive or Motive, or the Understanding and the Will, the Intellect

and the Feelings; and they have spoken severally of the Senses, the Memory, the Imagination, the Reason, the Conscience, the Emotions, and Volitions. They have regarded all of these as having an influence, and capable of producing an effect.

It is not easy to determine precisely the nature of mental effectuation. We are not able to measure psychical as we do physical energy, in foot pounds. It might indeed be argued that, as being immediately conscious of it, we do, in fact, know as much in a general way of mental as we do of bodily production; but we are not able to put it in quantitative form.

This power manifests itself in two ways. There is the power of the Mind over the Body, with the corresponding capacity of the Body to produce an impression on the Mind. For upwards of 2,000 years, philosophers held, generally, by the principle of Empedocles, the Sicilian philosopher, that like can only influence like, and they denied that mind could influence body, or body mind, and this opinion still lingers among metaphysicians. I deny the principle that like can only sway like, and I can see no difficulty in allowing that psychical action may produce physical action, say action of the nerves, and *vice versâ*. It certainly seems to do so. I will to move my arm, and there is action in the gray cellular matter of the periphery of the brain, which proceeds down the transmissive white matter to a basal nerve which moves the muscles and the bones, and the intended effect is produced. There seems to be a causal action throughout this process; an action of the mind on the brain, and of the brain on the nerves. There is a like phenomenon in the feelings producing an effect on the organism, as when a ludicrous idea leads to laughter, and grief bursts out in tears, and a sense of kindness received covers the face with smiles.

Even intellectual exercises seem to have an effect on the brain, as exhaustion is felt when they are prolonged.

There is also an influence of the body on the mind, as when the bodily senses produce a mental perception, say of a form or a color, and a healthy organism raises up pleasant feelings, or a diseased stomach or liver raises up gloomy thoughts. In all these cases there is a power producing certain defined effects. It may be argued that the effects follow not directly, but by some agency commonly supposed to be unknown. There is a constant inquiry into the *how* in the relation between mind and body, usually followed by the acknowledgment that it is a mystery. At this point it may at once be allowed that in the mutual action of mind and body there are processes unknown to us. No one will maintain that the physiologist can as yet specify all the steps involved in the process by which an external object reaches the perceiving mind. But suppose he is able to do so, it does not appear to me that the mystery would thereby be diminished. In tracing back the nervous and the cerebral action, we come at last to a point or line where the body acts on the mind. The only way of avoiding this conclusion is by calling in some sort of *tertium quid* in the shape say of a plastic medium, which communicates between mind and body. The difficulty is not thereby removed, it is not even lessened; for, if it is of the nature of either body or mind, we have still to show how it acts on mind if it is body, and how it acts on body if it is mind. If it is of the nature, neither of body nor mind, it is an unwarranted hypothesis, explaining nothing, and multiplying the difficulties, for we have now to explain how in one case body acts on the medium, and the medium on mind, and how in the other case mind acts on the medium and the medium on body. The simplest, and on the whole the most reasonable supposition, is that mind has a potency

whereby it acts on body, and body a potency whereby it acts on mind. This is far more likely than the Malebranche's hypothesis of occasional cause, or that of pre-established harmony by Leibnitz. Sooner or later, we may be able to determine precisely the nature of the action, that is, in what circumstances it acts, how far it extends, and how it is limited. This is all we can know about any law of nature, and when this is accomplished there is no more mystery than in the law of the mutual attraction of matter, or in that of chemical affinity.

But very nice questions are here started, and to these we can give little more than negative answers, fitted to remove erroneous impressions. Is there any such relation in the mutual action of psychical and physical action as is implied in the conservation of material energy? When the body acts on mind, does the energy in matter go into mind, and appear in a new form? Or when mind acts on body, is there new energy entering matter? I answer unhesitatingly that there is no proof of this whatever. On the contrary, every thing goes on in the body according to the laws or properties of body, and every thing in the mind according to the nature of mind. Our volitions and other mental acts may give a new direction to the forces in the bodies, but they do not add to them or increase them. Our will moves the arm which was before at rest, but it only calls into activity the potential energy already there, and that energy acts according to its nature. The senses make known an object to us, but it does not add any new mental power, and the object being there, or rather being known there, calls forth ideas or feelings according to the mental laws of association. In the body every thing proceeds according to physiological laws; and in the mind according to psychical laws.

In all such causation there is at least a duality in the

cause, both a physiological and a psychical: these together constitute the cause without which the effect would not follow. There is a like duplicity in the effects, both body and mind are changed.

Secondly, there is causation operating in the mind itself. By the will and other psychical acts we can influence not only the body, but the state of the mind. We can detain the present idea, and bring up thereby a succession of associations pleasant or unpleasant: profitable, as when we contemplate a high exemplar, or cherish a good resolution; or noxious, as we cherish revenge or lust. There are certain states of mind which follow necessarily from certain others. The idea of a friend in distress raises grief, of an acceptable gift raises gladness.

I am not sure that we can express accurately the nature of psychical causation, yet we can say much about it. We know so far the limits of the several faculties. We know much of the power of sense perception, as that it reveals objects external to us; that we do not know distance directly by the eye, that we cannot have any idea of a color or odor that has not been made known by a special inlet,—the man born blind has no conception of color. We have ascertained as to memory, that it remembers whatever was vivid in the original impression. The imagination can bring up in new forms and dispositions only what we have previously experienced. We can reason only when we use a middle term to combine the two terms whose relation we do not know. Emotion springs up only when we have an apprehension of something good or evil. Conscience approves of certain acts, and condemns others. We cannot express these powers quantitatively, as we do those of gravity and chemical affinity. We cannot number or measure them as we do the physical forces. Still we can notice their extent and their boundaries. Psychology is doing its proper work

when, with consciousness as its agent of observation, it is finding out the powers of the mind and their functions.

In inquiring more specifically into the nature of psychical causation we find that, while in one sense it is simple, in another sense it is complex. We have seen that there is a duality or plurality in all physical production, both in the cause and in the effect. We have seen that there is duality or plurality in the action of mind on body and body on mind. There is a like complexity or plurality in purely psychical action, both in the cause and in the effect. What is the cause of this reproach of conscience which we feel after committing an evil deed? An essential part of it is no doubt the immediately state, the idea of the deed. But this is not all. Acting with this there is a native moral power, a power of conscience. It is only when there is joint action that the deed is condemned. The mere image or conception of the deed will not call forth the reproach; nor, on the other hand, will the moral power act unless there be an apprehension of the deed: the effect is produced by the union of the two. So it is in all cases. When the mother grieves over the death of her son, there is more than the conception of the event; there is the deep affection which she cherished towards him.

We have seen, that in physical causation, there is always something abiding. Aristotle had a material, as well as an efficient cause. It is the same *mutatis mutandis* in psychical action. In all material action there is a body as a substance, and in all mental action there is mind as a substance; both being permanent. This is a truth never seen or acknowledged by Mr. John S. Mill, who defined mind as "a series of feelings aware of itself," whereas it is an abiding existence with a series of feelings. He defined body as "a permanent possibility of sensations," whereas it is a permanent thing, ever ready to produce sensations within our minds. The present state of the

soul is always the necessary effect of the immediately preceding one. But in that preceding state, and I may add in the present one, there is the mind itself with its capacities abiding. The cause of every given thought and feeling is thus a complex one, made up of some previous thought or feeling, but also of the mind thinking and feeling.

The portrait suggests the original. Is the portrait, or the perception of it, the cause of the thought of the person painted? I do not regard this as a full account of the cause. The portrait may be seen by one who never saw the original, and to him there is no such suggestion. The true cause embraces the sight of the portrait, but there is also involved in it the mind with its knowledge of the person painted, and also the principle that like suggests like. When two premises are before the mind, they necessitate a conclusion, as when we have it allowed that "all men have a conscience," and that "the Indian is a man," we conclude that "he has a conscience." Are the two premises the cause of the conclusion? I believe they are not to be so regarded. The act taken by itself is to be regarded as one of judgment, and not causation. In the cause there are not only the premises, but the laws of the mind, or rather the mind with its laws, that is, the laws of reasoning, especially the dictum of Aristotle, that whatever is true of a class is true of all the members of the class. Every thought, every feeling, I may add every resolution, is thus the result of the state of the mind with its properties, and of the immediately preceding thought or feeling, which might be called the occasion. It thus appears that the web of causation is quite as complicated in psychical as in physical nature.

I am unwilling, in this paper, to enter into the conflict of ages as to whether there is causation in acts of the will. I am prepared to argue that there is. On the other hand, I hold resolutely that there is a sense in which the

will is free. Holding by both these truths, as I reckon them, I am obliged to add that I cannot remove all the difficulties in which I am thus involved. It is asked, how can there be free will, which I resolutely hold, if our volitions are after determined by something out of themselves, and above themselves? I do not profess to be able thoroughly to clear up this subject; but the view of causation which has been set forth in this treatise is fitted, I reckon, to lessen, if not to remove, some of the difficulties. We have seen that there may be different kinds of causation. The causes that act on the will are certainly not mechanical or physical, like those which compel a body to move in a particular way. A man's volitions are not swayed altogether, or even mainly, by the same circumstances; for two men will act differently in like circumstances, and this evidently owing to the difference of their character. We have seen that there are causes operating within the mind itself. Those that finally sway and determine the will lie within. If we properly understand the language, I believe we may admit that in every particular act the mind is swayed by motives, but the motives are to be found, not out of the mind, but in the mind, nay, largely in the will itself. The causes which sway the will are mainly in our nature and character, in our dispositions and habits which our own wills have been forming. It is certain that this man will yield to the temptation, and be guilty of excessive drinking in a particular company, but it is because of habits which he has indulged in for years. It is certain that this other man will act honorably in a certain trying position, but then it is because he is guided by right principles, and by an upright character. I do not say that this doctrine delivers us from all difficulties, but it helps to relieve us from the oppression which we feel when we are told that our whole acts are under a law of stern necessity which allows no liberty.

SECTION III.

CAUSATION SUBJECTIVE.

The above is all I am able to say as to the nature of cause. I do not claim to have removed all difficulties. I am satisfied if I have corrected some erroneous notions and shed some light on important points. I am now to turn to the other side of my subject, to the mental process involved in our conviction as to the relation between cause and effect. Even as causation objective pervades all nature, so causation subjective runs as a binding power through the great body of our mental exercises.

We may allow physicists to use the word energy for the activities of matter. But there is activity in mind as well as matter and it is needful to have a word to express both. The word Power may be used for this purpose.

There are two special ways in which we come to know power. The one is by the muscular sense. We move a muscle, and we find it resisted by the objects it meets with. We experience this in the first exercise of our muscular activity and in every succeeding one. There is resistance offered not only by that table, but by the air as the arm passes through it. Science finds it necessary to maintain that the very ether has been offering resistance to the passage through it of the comet of Encke. The other is by the exercise of our voluntary power. Our volitions produce changes directly or indirectly over our bodies of which we are sensible. We will to move the arm, and it moves. Our will also produces changes on the states of our mind.

We will to detain a present thought, and it keeps with us as long as we will, thereby resisting the ordinary flow of association.

I believe that both these potencies have a wider extension than is commonly supposed. I have at times thought that there may be power discerned, as it is certainly involved, in the exercise of all the senses. In the vibrations which enter the ear, in the rays of light that fall upon the eye, in the odors that reach the nostrils, in the liquid which affect the palate, there is a mutual action dully felt of the touching bodies and of the organism. It might be argued, I think, that in all these ways we get an apprehension of bodies as having power, just as it is now generally acknowledged we have a knowledge by all the senses of bodies as having extension. We know our nostrils and palate as having a certain direction which must be in space, so we seem to know these same nostrils as affected, which implies power.

I am farther sure that volitions are constantly mingling with our mental operations. A sensation is agreeable and we detain it, or it is disagreeable and we banish it or escape from it, and in all such processes we use causation. There is an exercise of will implied in the regulation of our thoughts, otherwise they would run wild as in our dreams. In making ourselves acquainted with any subject we have to attend to it, and attention is an act of the will. In reading a book and in listening to a discourse we have to keep our thoughts from wandering, which they would be sure to do if they were allowed to follow merely the laws of involuntary association. We have to order our thoughts when we are conversing with our fellow men, and when we are writing intelligently. The orator has to give his thoughts a direction all toward a point, when he is seeking to arouse and persuade. The mathematician, and indeed,

every one who reasons closely, has to restrain and guide his ideas and his judgments. Some have supposed that one difference between our waking thoughts and our dreams lies in the will having lost its control in the latter, mainly owing, it may be, to the weariness of the organism, indisposing us to farther exertion till the pool which had run out is again filled. Causation has thus a place in the greater number of our thinking operations. We exercise power in every volition, but volition is constantly interposing to direct our thoughts.

Causation has a place in the very steps by which we obtain our knowledge of things. It is involved in the very means by which we acquire our knowledge of external objects. We know them as affecting us, that is, having power over us. It is much the same with all the knowledge acquired by us. The things have been made known by their having power over us, or some other thing, by which they are made known to us.[1] It is a common saying that we know things by their properties, but what are properties but powers? It is not by induction, that is, a gathered experience, that we know things as having power; we know this in our primary experience, and in all subsequent experiences. Power is thus involved in things as known to us. We cannot think of them except as having powers.

It will now be seen how I would settle the question which has been the leading philosophic one since the days of David Hume, as to whether our conviction as to cause and effect is *a priori* or *a posteriori*, to use the phraseology of Kant, or, to employ more unexceptionable terms, arises at once from our looking at things, or is the reasoned result of a gathered observation. It is certainly experiential, as all

[1] "We are obliged," says Herbert Spencer in his First Principles, "to regard every phenomenon as a manifestation of some Power by which we are acted upon." Let him follow out this.

our knowledges and beliefs are in the consciousness of the mind, but it is not experiential in the sense of needing induction and reasoning. It is intuitive in that we perceive it to be in the very nature of the thing. It can stand the tests of intuition, as these have been enunciated in the paper on the *Criteria of Truth.* We perceive objects directly as having power and acting causally. It comes in consequence to be necessary; we cannot believe it to be otherwise. We cannot be made to believe that there is an event without a cause, or a causal relation without a definite action being ready to follow. It is, thirdly, universal in that all men have the conviction.

Not that this is done without the competent and appropriate mental capacity, but this is neither less nor more than the faculty to perceive the thing, and what is in the thing. These perceptions may take several forms, such as primitive cognitions, faiths, and judgments: cognitions when we look directly on things, faiths when they are absent and yet we believe in them, and judgments when we compare the things known and believed in. Our perception of self and body having power is of the nature of a primitive cognition. Our conviction as to cause is more of the relation of a judgment in which we discover a relation. Except that I am not partial to the formidable nomenclature, I am willing to allow it to be called, with Kant, a synthetic judgment *à priori.* But the two, cause and effect, are connected, not by a category or a form of any kind in the mind, as Kant held, but in the very nature of the things, in the action of things according to their nature, that is, the properties or powers by which they are endowed.

SECTION IV.

VARIOUS SORTS OF CAUSES.

From the nature of causation, as I have endeavored to unfold it, there is a vast complexity in the activities of our world. There are two, or commonly more, agents in every cause, two or more in every effect. What a variety of powers at work in the great natural occurrences, say in the seasons, in the production of spring with its increased heat, its buds and blossoms and leaves. 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 of religion, in the English, the American, and French revolutions. There are innumerable agencies concurring and crossing in all the important events of our personal and family life.

In this complexity a number of very marked operations, well worthy of consideration, come under our view. One of these is Development or Evolution. All physical causation is in a sense evolution; it is a body, or rather a combination of bodies in one state produced by a body or bodies in another state. The development as such may or may not be beneficent. It is conceivable that it might move on ruthlessly, working only confusion and misery to sentient beings. When it proceeds in an orderly manner, with beneficent laws, and means of promoting the comfort of animate beings, there is evidence of good arrangement. The subject of Development is so important as to require

a separate paper, when it will be shown that it is an organized causation.

It will be necessary here to take up a subject on which I fear little light can be thrown at present. It is the nature of energy and causation in chemical action. Oxygen and hydrogen combine to form water; what is the relation of the two elements? Is it simply mechanical? Or does it imply the existence and operation of a separate power which we may provisionally call the chemical? To these questions no very satisfactory reply can be given at present. There are some presumptions in favor of its being shown in the end that the union is merely mechanical. On the other hand, there are phenomena which cannot be thus explained at the stage which science has now reached. The most remarkable peculiarity of this chemical combination is that the compound exhibits properties of which no trace can be found in the separate elements. Water shows qualities which neither oxygen nor hydrogen seem to possess. In consequence many questions arise which cannot at this present time be definitely and certainly answered. Were the powers now shown by the compound in the elements in a potential, but not in a real state? Have we in the union merely an example or the duality or plurality in all causation, the elements taking a new form or shape in the compound? It is certain the bodies constituting the elements have not lost their identity. The water can be decomposed, by some other body acting on it, into the oxygen and hydrogen of which it is composed.

The above are questions which we may expect to have settled sooner or later, as we come to know more of the constitution of matter.

In the complexity of causal action we may notice the combination of a number of agencies necessary in order to the production of results which have an important place

in the economy of nature. These, in a loose sense, may be called causes. From the very commencement of reflective inquiry men had to refer to causes. But for ages the views taken and the nomenclature used were vague and confused, though containing important elements of truth which have been unfortunately omitted in the more precise systems of modern times. In the theosophies of the East causation was represented as an emanation of one thing out of another, and of all things out of God. The tendency in this conception was toward pantheism. The Pythagoreans made numbers the cause of things, meaning that which makes things what they are. Aristotle blames Plato for neglecting efficient and final causes and giving exclusive attention to the matter out of which things are formed, and the form they are made to take.

Aristotle was the first to draw distinction between the different kinds of cause. This he did in his Physics, ii. 3, and recapitulated in his Metaphysics, i. 3, with a farther reference in Post Anal., ii. 11. In these passages he uses the word (cause) in a wider, and it may be allowed in a looser, sense than we now do. The grand object of the First Philosophy is to discover causes. By cause he meant all that is necessary to account for or explain a thing, all that is necessary in order to its *being as it is*, and therefore to our comprehending it and explaining it. In later times the word cause is commonly restricted to efficient cause, to productive cause, or as Hume analyzed it, invariable antecedent. Aristotle included this, but also included other things *necessary*, as he thought, *to make a thing what it is;* which is his definition of cause. He had four kinds of causes. He had first a matter and a subject (*τὴν ὕλην και τὸ ὑποκείμενον*). He had secondly a cause, whence the beginning of motion (*ὅθεν ἡ ἀρχη τῆς κίνησεως*). Thirdly, he had a cause which was the substance—that in

which a thing consisted (*τὴν οὐσίαν καὶ τό τι ἦν εἶναι*). Fourthly, he had that on account of which a thing is (*τὸ οὗ ἕνεκα*). More briefly, he had a *ὑλή*, an *ἀρχὴ κινήσεως*, an *εἶδος*, and a *τέλος*, which we translate a material, an efficient, a formal, and a final cause. He sought in every object for each of these. He did not regard the one as inconsistent with the other. He often found several of them in one and the same object (De Anim., ii. 8). In regard to the material cause, he represents the Ionians as seeking for it and finding it in water, air, or fire. As to the efficient cause, he regarded it as that which produces motion or change. The formal cause corresponded to the Idea of Plato, only he represents it as being not above things, but in things. He does not use final cause to prove the divine existence; he supposes the thing to have in itself (as immanent) an end after which it is striving—a view very much the same as that taken by Hegel. He blames Plato for neglecting the efficient and the final, and confining his attention to the material and the formal.

These distinctions were not drawn by the thinkers who preceded Aristotle. Socrates, without giving final cause a separate place, used the argument from final cause—the argument from intention or design, as seen for instance in the eyelids to protect the eyes. Plato argued more from the models or patterns in nature. Epicurus simply ignored final causes. The Stoics identified efficient and final, representing every thing as done in conformity with the decree (fatum) of God; and so ordered that one thing is a prognostic of another thing. Cicero (De Nat. Deor. 115) and Augustine (Civ. Dei, xi. 4, 21) appeal, like Plato, to the order of the universe. The schoolmen did not use Aristotle's division of causes so frequently as they did his logical distinctions, but occasionally they proceeded upon it.

Coming to modern times, Bacon adopted Aristotle's four-

fold division of causes. He gives material and formal causes to Physics, and formal and final to Metaphysics, which he regards as occupying a higher sphere than physics. It is often said, by men who have never read Bacon's works and take his opinions at second-hand, that Bacon sets aside final cause. This is an entire mistake. He would exclude it from physics, but it is only to give it a higher place in metaphysics. He compares it to the vestal virgins, not productive indeed, but dedicated to God. He erred, I think, in excluding final cause altogether from physics, where it may be used, if properly restricted, in the study of organisms, where the means are ends and the ends means. While he was living, Harvey discovered the circulation of the blood by the principle of teleology, arguing that the valves which he saw opening in one direction and not in the opposite must be intended to let a fluid pass through—thus discovering the grand doctrine of the circulation of the blood. But Bacon was right in insisting so strongly that the discovery of final cause should not keep men from seeking the efficient cause. Bacon attached great importance to the discovery of forms, which he represented as the supreme end of all science. The form of a thing is that which makes it what it is—thus, anticipating our latest science, he regards motion as the form of heat. Without fully seeing it, he came very near to Plato; the aim of all science, according to both, being to discover ideas, forms, or patterns; only, according to Plato, the ideas are to be discovered by calling forth the inward idea, while according to Bacon they are to be found by a careful induction of facts. Bacon showed profound wisdom in making the discovery of forms the supreme end of all science; and in placing the forms of nature at the very top of the pyramid and next unto God.

Descartes perceived God in every mechanical action, and

could not believe that God was to be seen in one act more than in another; and insists that we ought to beware lest, "in our presumption, we imagine that the ends which God proposed to Himself in the creation of the world are understood by us" (Princip. Philos., iii. 2). There is a misapprehension here of the kind of ends supposed to be discovered by final cause, and it is curious that his error is pointed out by Gassendi, an adherent of the Epicurean philosophy. "You say," he replies to Descartes, "that it does not seem to you that you could investigate and undertake to discover without rashness the ends of God. But although that may be true if you mean to speak of ends that God has willed to be hidden, still it cannot be the case with those which He has, as it were, exposed to the view of the world, and which are discovered without much labor." The celebrated natural philosopher Robert Boyle also answered Descartes. Referring to a gnomonic instrument, "It would no doubt be great presumption on the part of a peasant, ignorant alike of mathematical science and the intentions of the artist, to believe himself capable of discovering all the ends in view of which this machine so curiously wrought has been constructed; but when he remarks that it is furnished with an index with lines and horary numbers—in short, with all that constitutes a sun-dial, and sees successively the shadow of the index mark in succession the hour of the day, there would on his part be as little presumption as error in concluding that this instrument, whatever may be its other uses, is certainly a dial made to show the hours." Leibnitz, with his usual comprehensiveness of mind, would unite final and physical causes. "It is good," he says, "to conciliate those who hope to explain mechanically the formation of the first texture of an animal, and of the entire mechanism of the parts with those who give

an account of the same structure by final causes. Both are good, and the authors who follow these different ways ought not to abuse each other."[1]

From this survey we gather that some of the profoundest thinkers that have appeared in our world have seen more than mechanical cause in the course of nature, and that they have discovered no inconsistency between efficient and final cause. We are now to illustrate these two points.

There is a foundation in nature for Aristotle's fourfold division of explanatory causes, though we may have to amend it somewhat to suit it to modern science.

Material Cause.—Here we inquire into the nature of the substances, be they inanimate body, or living body or mind. It is the end pursued in chemistry, and in all the sciences dependent on it, and so far also in psychology. No doubt the inquiries into the matter, and the forces in matter, may be mixed up with each other; but they may be distinguished, and it is often desirable to separate them.

We may or may not approve of calling the matter out of which a thing is formed a cause, but it certainly has a place, and this a deep one, in the economy of nature, and as such it should be acknowledged. It is allowed that there is never energy without body, and the body should be taken into account as well as the energy, in explaining what things are and how they act.

Efficient Cause.—This is the kind of cause whose nature I have been seeking to determine in the earlier part of this paper. It is the power element in what makes a thing to be what it is. This sort of cause is not inconsistent with the others. It is necessary in order to make the matter take a form and fulfil an end.

[1] The quotations from Gassendi, Boyle, and Leibnitz may be found in M. Janet's work on "Final Cause," translated by W. Affleck, pp. 184, 185, 119.

Formal Cause—the idea of Plato, the ἔιδος of Aristotle, the law of modern science, and the type of naturalists. We have here mechanical causes, but co-ordinated so as to produce orderly results, as we see in what are called the laws of nature. The properties of bodies, such as attraction, chemical affinity, etc., may be simple; but they require conditions, that is, co-operating agents, in order to their working. But the general laws of nature are always complex; that is, imply the action of two or more agents operating and co-operating. We see this in the law of the succession of day and night, of the revolution of the seasons, spring, summer, autumn, and winter; in the motion of the planets in their orbits. What a number and variety of agents conspiring in the reproduction of plants and animals; in the seed, the blade, the fruit, the decay of the vegetable; in the germ, the growth, the death of the animal! What a complexity in order to the production of the mathematically exact forms and harmonious colors of the shell, the stalk and the flower of plants, and the bones of animals! What a combination to produce those types according to which we classify the animate kingdoms, and which make every living thing to grow after its kind! What a complex complexity in that assortment of forces which produce development and heredity—processes of which we now talk so glibly and familiarly, but of the elements of which we know so little! All these may be called the ideas or forms of nature.

Much the same may be said of Formal as I have said of Material cause: we may or may not approve of the term cause being applied to it. But it is quite as clear that things are made to take a form as that they have a matter, and are produced out of that matter. It is one end aimed at in all science to discover what the form, or, as it is now more commonly called, the law is. Our view of nature is

narrow and partial if we see only its composition and the mechanical powers acting in it. In that rich web we should notice not only the silk threads and the shuttle carrying them along, but also the pattern after which the whole is formed.

Final Cause.—Here there is a concurrence of mechanical or efficient causes to produce an evident result. It is not an antecedent followed by an effect; it is the consequent or issue of a number of conspiring antecedents. From the number of agents combining to effect an end we argue that there are intentions and purposes. I suppose a hundred agents so far independent must combine before I can see. I infer that there must have been a designed arrangement in order to their coming together to produce the obvious end.

We discover these four causes in the works of man. That statue of Hercules had a material cause in the marble in the quarry; an efficient cause in the chisel of the sculptor; a formal cause in the shape given it; and a final cause in its being set up in a temple. We can discover the same four causes in nature. In shells we have the matter, be it carbonate of lime, or whatever else; the chemical forces operating; the mathematical form taken—possibly a spiral; and an end the protection of the animal. In the plant, say the apple-tree, we have the chemical elements; we have the vital forces, whatever they be; we have the shape taken by the tree and by its flower; and a final cause in the fruit provided for the sustenance of living creatures. In the cereals there is matter in the composition of the plants, an efficient (not necessarily a mechanical) cause in the vital forces, a formal cause in the form taken, and a final cause in the food provided for the nourishment of man and living creatures. Take the two colors, blue-purple and orange-yellow, found in the flower of the forget-me-

not: they must have a composition produced in some way by the dividing of the beam; they are found in all the plants of the species; and they are suited to the eye, which delights to look on complementary colors—that is, the colors that make up the beam.

I believe that these four principles can be discovered in all animated objects. In dead matter it may be more difficult to detect all of them in every individual object. Yet in the higher forms we can discover several of them. Thus in crystals, the crystalline forms, which all bodily substances are capable of assuming, we have the matter, the forces, and also the forms; but it might be difficult to discover a special final cause. Plato, in seeking to find his idea everywhere, was asked whether he could find it in the dust or sand of the ground, and acknowledged that he was in difficulties. Modern science could help him here, and show him by the microscope beautiful forms in the rudest matter. It might be impossible in such cases to detect a final cause; but just as we argue that there is efficient cause everywhere, though we may not be able to discover it in every occurrence, we may, on a like principle, infer that as we discover a purpose in so many parts of nature so there is purpose everywhere, if only we can discover it; and thus reach the conclusion of Socrates, Plato, and Leibnitz, that nature consists of physical causes working for ends.

SECTION V.

FINAL CAUSE.

I AM sure that the course of nature cannot be comprehended or explained except by taking into account more than efficient cause, except indeed by all of the principles we have been considering. The chemist will insist on knowing what is the elemental composition of the crystal, the rose, or the crustacean. The naturalist will seek for the type that he may be able to arrange it. The merchant will wish to know its economical use that he may buy or sell it.

We know not what is the number of elements in the material universe. The ancient Greeks supposed them to be four: air, water, fire, and earth. Modern chemistry has found sixty-four, which it cannot analyze into any thing simpler. Many chemists think that some of these can be resolved into others. It is certain that there is in nature a certain number of elements, be it four or sixty-four, with their properties. We may conclude that these are adapted to each other. Were they not, they would not act upon each other, molecule on molecule, atom on atom, mass on mass, as they evidently do. The orderly results point to an instituted order. Being so adapted, if these elements were cast into a capacious vessel, they would produce regular results such as we see in a kaleidoscope, where we have a number of beads thrown into a constructed receptacle, and reflected by glass, and producing regular figures. Here we have in the figures a material

cause in the instrument, with its wood and glass and beads; an efficient cause in the movements of the beads; and a formal cause in the regular shapes and dispositions. It can scarcely be said that in the figures themselves there is a final cause, for no end is served by them, except indeed to give pleasure to the beholder. But there is certainly a formal cause. And I would have it noticed that this form is a result of arrangements made, and of mutual adaptations, arguing a purpose and design. So it is with the laws, as they are called, and types of nature. They are the result of a vast number of agents or efficient causes combining and co-operating. We thus see that the very order of nature is a manifestation and evidence, as Plato, Cicero, and Augustine argued, of plan and purpose, and therefore of intelligence.

But Final Cause furnishes another and a more special argument. It may be noticed of the figures of the kaleidoscope that they never show final cause, properly so called. They never show amidst their great varieties such utility as a lichen, a polype, a finger or a toe, much less a hand or an ear. Mathematicians tell us how many millions of chances there are against a handful of molecules ever producing an ear, and how many millions of millions against their producing in the same frame an eye, a nose, a tongue, skin, and muscle, and nerve, and brain. How many milliards of milliards of chances against the formation of all the senses and organs of all the creatures on the face of the earth. The meeting of these efficient causes in the frame of man and animal makes it as certain as mathematics can make it of their being an end contemplated and designed.

The force of this argument is not to be avoided by saying that what we represent as final causes are merely conditions of existence. True they are conditions of existence;

but the proofs of design lie in the conditions of existence all meeting in the hundreds or thousands of coincidences all coming together to form the rose, or the deer. The strings of a harp are the conditions of its existence, and we argue that the harp has been made for a purpose, because the strings are all there and yield music.

At this place I think it proper to refer to the *Course of Nature*, an address delivered by Professor Newcomb, as President of the American Association for the Promotion of Science. I do so because there is presented there, by a gentleman whom I profoundly respect, the views entertained by a great many scientific men in the present day. The Professor evidently labors under several very erroneous impressions in regard to final cause. "From the very earliest at which man began to think two modes of explaining the operations of nature have presented themselves to his attention. These modes are sometimes designated as the teleological and mechanical." He thinks that final cause is meant to give the same sort of explanation of a phenomenon as efficient cause. But all enlightened defenders of final cause have asserted that the two principles or causes do not accomplish the same ends. Final causes or ends were never meant to account for the production of an event; this is done by efficient cause. On the other hand, an efficient cause does not show how efficient causes or forces should combine to produce an obviously intended beneficent result—the good, as Aristotle calls the final cause. The fact that the ear was meant to hear did not make the ear, though there are passages in Lamarck which seem to indicate that the wish of the fish to fly actually gave it wings. We bring in efficient cause to explain one thing, namely, production; and final cause to explain another thing, a combination to produce a useful end. Again, he argues that we are entitled to call in final cause only when physi-

cal cause fails, thereby falling into the error of Kant and Laplace, both far-sighted but one-eyed men. But surely he sees both efficient and final cause in the telescope by which he scans the heavens so profitably: efficient cause in the formation of it by Clark, and final cause in the use to which he is able to turn it. Nor will it do to say that he uses the instrument because it is there; it is there because he or some other was meant to employ it. It is conceivable that there should be a like union of the two principles in the eye and in the works of nature generally.

He is evidently under a farther impression that the two are inconsistent. He thus makes them rivals, and supposes that the one strives with and overcomes the other. But final cause, so far from being inconsistent with efficient cause, implies a combination of physical causes, which are blind in themselves, but which are led by a prearranging power to combine to accomplish an end. He insinuates that as mechanical cause comes to be seen everywhere final cause will have to hide itself. But viewed by a mind capable of seeing two truths alongside of each other, the belief in and the evidence of ends in nature are not vanishing, as the Professor expects. We have as clear and certain proof that the eye was meant to see and the ear to hear as the first man had, and can now discover more fully the wonderful machinery by which the ends are effected.

The Professor's argument against final cause is the most glaring example of the fallacy of irrelevant conclusion or of *ignoratio elenchi*, which I have seen for many a day. He would disprove the existence of final cause, and he merely attempts to prove the universal presence of mechanical cause. With proper explanations we may admit all he claims as to mechanism and not feel thereby that teleology is weakened. Let us look at the principles at work when our astronomer gazes at a binary star with his telescope.

Rays go out from the star, proceed in vibrations, first through millions of miles of ether, then through thousands of miles of air; then into the telescope, where they are turned in a variety of ways; then into the eye, into the cornea, which is transparent; into convergent media, which unite the luminous rays, the three refracting media—the aqueous humor, crystalline lens, and vitreous humor—till they fall on the retina, where, according to the theory of Young, carried out by Helmholtz, there are twelve thousand or even twenty thousand cones, sensitive to various kinds of light, and they form there the image of two stars with perhaps complementary colors. The process is not ended till an action goes up through the optic nerve into the brain, and not till then does the astronomer see his star. The want or the failure of any one of these processes, thousands in number, would prevent vision or make it imperfect.[1] In this long and complicated process there has been mechanical cause throughout. Professor Newcomb will not deny that there is final cause, in the part of it which goes on in the telescope; but if there be an end manifested in the passage of the rays through the one instrument, the telescope, there is like, but far stronger evidence of a purpose in the other instrument, the eye.

In all such discussions a distinction of some kind is drawn as to the actual operations of the forces or laws of nature.

[1] M. Janet has shown that Helmholtz has answered his own objection derived from the imperfections in the eye. The great German physicist says: "The appropriateness of the eye to its end exists in the most perfect manner, and is revealed even in the limits given to its defects. *A reasonable man will not take a razor to cleave blocks;* in like manner every useful refinement in the optical use of the eye would have rendered that organ more delicate and slower in its application." This is sufficient to defend final cause. But a full explanation may have to take into account the existence—the great mystery of our world—of disease and pain.

Paley in his "Natural Theology" indicates a distinction between the laws of nature and their construction, and speaks of an adjustment being necessary, and of "the laws being fixed" and "the construction being adapted to them" ("Nat. Theol.," iii.). Dr. Chalmers drew elaborately and illustrated at great length the distinction between the Laws of Matter and the Collocations or Dispositions of Matter. "We can imagine all the present and existing laws of matter to be in full operation, and yet, just for the want of a right local disposition of parts, the universe might be that wild undigested medley of things in which no one trace or character of a designing architect was at all discernible" ("Nat. Theol.," ii. 1). Mr. Mill has adopted this distinction, and sees that "collocations as well as laws are necessary to the operation of nature" ("Log.," iii. 12, 16). I have taken up the subject at this point and endeavored to give the distinction greater precision. I have shown that it is between, not the laws of matter and collocations, but between the properties of matter and adjustments necessary to their operation. I have shown that the laws of matter are not simple, but complex, and imply adjustments; this is the case with the seasons, the typical forms of plants and animals; all imply a number of agents or properties combined to produce a uniform result. Such laws are not mechanical forces, but the results of mechanical forces adjusted ("Meth. Div. Gov.," ii. 1) and implying a purpose. Professor Newcomb seems to feel a difficulty in understanding how there should be anything else than mechanism necessary to explain the course of nature. And yet he has been obliged to draw this very distinction without seeing its meaning: "In this work we have to be concerned with two things—the general laws of nature, as they are familiarly called, and the facts or circumstances which determine the operation of these laws."

The Professor imagines that final cause implies "interference" and "miracles," and says: "We are not to call in a supernatural cause to account for a result which could have been produced by the action of the known laws of nature." But according to the view of the great body of the supporters of final cause, and according to the view now presented, we do not need to call in a "supernatural cause," for all may be performed by the known laws of nature. Nor do we need an interference to bring about the special designs of God, say to send blessings, when God so intends it, to reward the good; or judgments when He means to arrest the evil, or to give an answer to prayer for things agreeable to His will. There is no interference with the machine in a factory when it lets off its cotton, or its linen thread, or its paper; it was planned and adjusted for this very purpose. The grain-reaper is all mechanical, and it has no conscious design; but it throws off and binds its sheaves for an evident purpose. So in the far grander machinery of nature it is arranged that good is encouraged and evil so far restrained and punished. True, the mechanical forces work blindly: they know not and do not care for the consequences; but these were all foreseen by One who appointed them and arranged them for the accomplishment of grand purposes, and small ones —as we reckon them; for the progress of the world in knowledge and civilization, to adorn that lily, to feed that raven, to secure that the sparrow cannot fall to the ground, and protect, in answer to prayer, the widow and the fatherless.

I could show, if the time allowed or the subject required, that there is a wonderful correspondence between the scientific doctrine of the uniformity of nature and the Scripture doctrine of foreordination. They are the same truths; the one seen from below and from the earth, the

other seen from above and from heaven. Both imply that every thing is fixed; but both also imply that every thing is arranged to accomplish special, and these beneficent, ends. Nature is uniform, and as we perceive it to be so, we proceed to use that very uniformity. Every thing is ordained, and believing that prayer is one of the ordained means, we use prayer to secure our ends—these ends being agreeable to His will. Because nature is uniform, we do not, therefore, on account of speculative difficulties, refuse to toil for our food. Just as little does the Christian, because of infidel objections, refuse to pray for blessings such as God is ready to give; and he finds that the blessing has been ordained and comes at the proper time, and in answer to the prayer which has also been ordained, and this to secure its end.

Professor Newcomb quotes, without naming me, my defence of Providence in my work on "The Method of the Divine Government," and objects to my statement that a rock may fall at a prearranged moment and kill a person beneath it. He says "the moment is fixed entirely by antecedent circumstances, such as the solubility of the rock and the amount of water which percolates over it. At that very moment the rock begins to fall." Now I agree with all this. But he himself has admitted that there are "facts or circumstances which determine the operation of these laws." The question arises who arranged these "facts or circumstances," which are needed, however far we go back beyond the nature of the rock and the water, and which imply an arrangement from the beginning? He acknowledges that if we had sufficient capacity we could from a knowledge of the causes (including always their adaptations) predict all that would follow. But if this be so, may we not conceive of a Being who not only foresees but has arranged all that follows? That Being might so

arrange them that special ends are accomplished, and these such that they are obvious to every thinking mind.

Nor are we, in discovering these ends, going into the region of speculation, to which the Professor allots every thing but mechanical cause. He talks of science, meaning mechanical, concerning itself "with phenomena and the relations which connect them." I am sure that the same intelligence which can discover the connections and relations in mechanical cause is all that is needed to discover the combination of causes which constitutes final cause. As M. Janet puts it, "The error of the scientists is in believing that they have eliminated final causes from nature, when they have shown how certain effects result from certain given causes." "We must not say 'that the bird has wings in order to fly; but that it flies because it has wings.' But wherein, I ask you, are these two propositions contradictory? In assuming that a bird has wings in order to fly, must not its flight result from the structure of these wings? Consequently, because the flight is a result, is it right to conclude that it is not at the same time an end? Would it then be necessary, in order to recognize final causes, that you should see in nature effects without a cause or effects disproportioned to these causes?"

We are in danger at this present time of a whole swarm of young naturalists, following one or two leaders, attacking final cause without knowing what it means. We are happy, in these circumstances, to have a work by a French philosopher which rests the doctrine on the proper footing, and corrects the misapprehensions of objectors. It is not necessary to give an epitome of M. Janet's "Final Causes." Those interested in the subject will go directly to the work now so accessible. Any one perplexed may here have his thoughts cleared up. Those who would oppose final cause must attempt to answer it, and as they do so they may find

every objection to the doctrine effectively disposed of. He shows first as a matter of fact, and this independent of any theological bearing, that there is finality or teleology in nature. He founds "the existence of the final cause on this principle, that when a complex combination of heterogeneous phenomena is found to agree with the possibility of a future act which was not contained beforehand in any of these phenomena in particular, this agreement can only be comprehended by the human mind by a kind of preexistence in an ideal form of the future act itself, which transforms from a result into an end—that is to say, into a final cause." He shows, secondly, that this teleology implies an intelligent cause.

He is particularly successful in showing that development, so far from superseding final cause, implies it throughout. Hugh Miller had said, in criticising the "Vestiges of Creation," that development does not affect the argument for the Divine existence. Professor Huxley allows this fully. Professor Asa Gray discovers an order and design in development. But M. Janet has discussed the subject more fully. No one will maintain that development is a simple mechanical law. It is the law of a most complicated correlation of forces, most of which are as yet unknown. When these are detected, by some Newton of physiology yet to appear, it will be seen that development, always kept within its proper sphere, more perhaps than any other process of nature involves a complexity of adjustments all tending toward a point, the preservation, and I believe the gradual elevation, of plants and animals.

Professor Newcomb's discourse is on the Course of Nature. But there is vastly more in that organized course than he and other scientists are noticing. I have endeavored to spread out that rich web, of which the forces which he has looked at are the mere threads. I have proceeded on

the fourfold explanation of nature by Aristotle, only modifying it somewhat to adapt it to modern science. All that I insist on is that nature cannot be understood, except by such principles as those I have been unfolding. I discover not only force which hurries on like a railway train, but rails to restrain it and intelligence guiding it. I find not only mechanism, but machines constructed for ends. The mechanical doctrine, if carried out exclusively, would strip nature of all that endears it to us — of all its sunshine, of all its beauty and beneficence, and leave nothing to call forth our admiration, our gratitude, our love. A skeleton is an interesting object to an anatomist, but I love to see it clothed with form and color and expression. I am interested in the restless activity of nature, capable of working such effects for evil or for good; but I do not feel assurance, and my soul is not elevated to adoration till I see the powers harmoniously joining to produce regular laws, and types after their kind, and intelligible species, and special ends of support and benignity. Pythagoras uttered a profound truth, and had doubtless glimpses of its meaning, when he said that if men's perceptions were sufficiently acute they would hear the music of the spheres, being, I may add, the voice of One boldly represented by an old prophet as "joying over His works with singing."

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