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

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FINAL CAUSE, M. JANET, AND PROFESSOR NEW-COMB.

I HAVE before me two works on Final Cause. The one is an address at the annual meeting of a scientific association, by a gentleman who is eminent as an astronomer, but who has gone out of his way to take up a topic with which he is not specially acquainted, and who has uttered words of which he does not see the meaning, nor the consequences, nor the use which will be made of them. The other is an elaborate treatise by one who has devoted his life to the study of high philosophic themes, and has now given us a defence of Final Cause, which few will dare to attack and no man will be able to overthrow, so thoroughly does he expound the truth and answer all the objections which have been brought against it.

In former years it was customary for the presidents of scientific associations to open the meetings with an account of the discoveries that had been made in the immediately previous years; and very often at the close there was a reverential acknowledgment of the wisdom and goodness of God as manifested in His works. I remember the brief but earnest testimonies which were given to divine truth by such men as Sir David Brewster, Sir John Herschel, and Faraday. But all this is now changed. Tyndall departed from the custom at the opening of the British Association in Belfast, where he discoursed *de omnibus rebus et quibusdem aliis*, and ended with declaring that he believed that every thing could be explained by

¹ "The Course of Nature." An Address delivered before the American Association for the Advancement of Science, August 22d, 1878.

"Final Causes." By Paul Janet. Translated from the French by William Affleck, B.D. With Preface by Robert Flint, D.D., LL.D.

the potency of matter. We are in danger, unless public opinion speaks out against it, of American scientists following the tempting example set them in Great Britain. Professor Newcomb, in opening the American Association in August last, declines attempting to take up the subject of the advance in scientific research during the year, and gives as his reason that owing to "the immensity of the field of research it has become impossible for any to follow its progress in all its branches." But was it incumbent on the president to take up all the branches? Why should he not have confined himself to his own department, and given us a summary of the great discoveries which have been made of late years in astronomy? No man could have done this more effectively, and no topic could have been more interesting than the glimpses which we have recently had of the chemistry of the stars. But instead he has entered on a subject with which he is not specially acquainted, has written upon it ignorantly and illogically, and uttered statements which will be turned to ends which the professor will not approve.

It is time to lay an arrest on this tendency of scientific men to rush into topics not lying in their own rich domains. Professor Huxley, as President of one of the sections at the last meeting of the British Association, declared that he would stop any speaker who appealed to Scripture for or against scientific hypotheses. But should there not be a counter rule that any member of a scientific society, leaving the rails set for him, in order to attack real or even supposed religious truth, should also be arrested? One of the peculiarities of these assaults on cherished religious convictions is, that they are not made in Sectional meetings where they could be met by members, but by presidents from the chair, which courtesy does not allow any one to attack in return. The consequence is, that the discussions have to be carried beyond the walls of the schools of science, where those who listened to the attacks may never hear the defence. What right had Professor Newcomb to take advantage of his position, where no one had a right to reply to him, to offend the religious convictions of many, and to try to convince young men that design is not evidenced by the physical universe? Most men do believe that the works of God in-

dicare, and as Paul declares, in consonance with the almost universal beliefs of humanity, that "the invisible things of God are clearly seen, being understood by the things that are made, even His eternal power and Godhead." If the professor has any thing to say against this, he has abundant means at hand in the public press and in other societies. There are indications of a rising feeling against scientific men teaching by authority their yet unverified hypotheses in promiscuous assemblies, and in schools and colleges, as if they were established truth. Virchow has led the way in this protest; and Tyndall has been obliged to acknowledge his position to be substantially sound. Dr. Dawson, of Montreal, has uttered a like sound in the University of Harvard, and recorded it in this REVIEW. I believe that the American public are prepared to let scientific men know that, while they will be listened to reverentially when they confine themselves to experimental investigations, they will be met vigorously when they travel beyond their proper territory, and turn their societies to other purposes than those which they profess to serve.

It is a notable circumstance that a number of the eminent scientists of the present day have not been trained at colleges or universities. They have betaken themselves to their favorite pursuits from their love to them, and made valuable discoveries because they have approached them by a new road. But they have not enjoyed the advantage of comprehensive instruction in philosophy and in the science of the human mind, such as is required in our higher universities. The consequence is that they are *specialists*, imagining all the while that they are universalists, and are filled with all knowledge. I do like to see Tyndall and Huxley careering in their respective sciences; but when they pass beyond their magic circle, they are weak and erring as other men. I have had occasion to rebuke religious men when they make bold assertions in science, say in regard to the doctrine of development, of which they are profoundly ignorant. But it is equally needful, at the time to which we have now come, to restrain scientific men when they would make assertions and denials in regard to deep philosophical and religious themes which they have not studied, and which can as little be mastered without study—they will acknowledge—as

their own favorite sciences, which require long training and thought.

The key-note of his discourse, Professor Newcomb tells us, is the proposition "that science concerns itself only with phenomena and the relations which connect them, and does not take account of any questions which do not in some way admit of being brought to the test of observation. The only universe it knows is that made known by the telescope, the microscope, and other appliances of observation." He tells us expressly that science "refers only to things which admit of being perceived by the senses, or at least of being conceivable as thus perceptible;" and he adds that "there is no scientific knowledge beyond this visible frame." Surely this is a narrow view of science. It seems to exclude a department with which the professor is well acquainted; that is, mathematics. No doubt mathematical truths admit, in a sense, of being brought to the test of observation; but they are true prior to observation, and it may be long before they can be verified by this test. Some of the late discoveries in the higher mathematics, such as quaternions and quantics, have not been so tested. He speaks everywhere of the forces of nature being mechanical, whereas he must know that chemical affinities have not been shown to be mechanical, and there is no evidence that vital action such as assimilation and absorption are of this character. As a more serious oversight, he takes no notice of mental action, such as perception, memory, imagination, reason, emotion, conscience, will. He will no doubt reply that he was not required, in addressing an association which deals with physics, to mention these; and in this he is so far right. He acknowledges that physics do not constitute the whole of the universe. But then he asserts that science refers only to things which admit of being perceived by the senses, and that there is no scientific knowledge beyond this visible frame. In this way he shuts out from the domain of science mental action, which I hold admits of scientific treatment quite as much as material action, though it is not visible, and is not made known by the telescope, the microscope, or any like appliances. I do believe that the professor honestly meant to keep physics within its proper bounds, and if he had said that physics as physics had to do with nothing but me-

chanical cause, he might have done good service both to science and religion. But without intending it (for I admit the goodness of his intention), he leaves the impression that there is no science except that which deals with mechanical forces, and that these give no evidence of an end or purpose in nature, or of the existence of God.

He once and again refers to a higher sphere than that which he has swept with his telescope. His language is reverential, and there is every reason to believe that it is sincere and earnest. But he does not give us any indication as to what that sphere is, as to where it is, or how we may reach it. Doubtless he has in some way reached a belief that there is such a region; but he has kicked down the ladder by which many have risen to it, and he has not provided us with any other. Meanwhile, and without any special application whatever to Prof. Newcomb, we must protest against the conspiracy which certain men have intentionally or unintentionally entered into, to deprive us of one stronghold of religion after another, telling us all the while that they do not mean to deprive us of religion itself,—thus following the policy of the Saxons when they drove out the ancient Britons, always on the pretext of aiding them. I suppose that these men conceive that we should be grateful to them for their generous admissions as to religion. But some of us are shrewd enough to see that they are treating us very much as the Epicureans did their gods, whom they placed in a high serene region, where they had nothing to do and took no interest whatever in the welfare of man. Tyndall tells us that religion cannot be rooted out of the hearts of men; but he does not show us what kind of religion can remain when he has derived all things from matter and bound them in an iron chain of necessity. Huxley deprives us of immortality, but leaves to any one who wishes to engage in it a worship chiefly of "the silent sort," while he does not and cannot tell to whom it is to be paid, or who there is to hear it. Herbert Spencer allows a wide enough sphere to religion; it is the unknown, darker than any heathen grove. Professor Newcomb has undoubtedly somewhere a temple where he pays sincere worship; but this is not in the works of God, in which he discovers nothing but clanking mechanism. We cannot allow

ourselves to be thus bowed out of one apartment after another of our goodly temple. We do insist that God works in His works. We do love to behold Him in the beautiful forms of plants and animals. We can confidently commit ourselves to His providence, which is so admirably adapted to our state and character. We refuse to yield to that wretched sophistry which would convince us that God has so excluded Himself from His works that He cannot hear the cry of distress or answer the prayer for light.

Professor Newcomb claims that he can account for the course of nature by Mechanical Causes, and argues that therefore it is not necessary or scientific to call in Final Cause. Now we may admit to him that efficient causes are found everywhere in nature, and that all events are brought about by them. I choose the phrase *efficient causes*, because I am not sure that all the forces of nature are mechanical; there seem also to be chemical and vital forces, and these have not yet been resolved into mechanism. Admitting the universal action of forces or efficient causes, I am not thereby precluded from discovering final causes. It can be shown that the enlightened defenders of final causes never believed them to be inconsistent with efficient causes. To establish this point and to clear up the prevalent confusion of thought, I propose to give a brief historical account of the views that have been entertained, and the discussions that have taken place in regard to the various kinds of causes.

From the very beginning of inquiry, men referred to causes; but Aristotle was the first to distinguish between the different sorts of causes. 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 analysed it, invariable antecedent. Aristotle included this, but also included other things

necessary, as he thought, to make a thing what it is. He had four kinds of causes. He had first a matter and a subject (*τὴν ὕλην καὶ τὸ ὑποκείμενον*). He had secondly a cause, whence the beginning of motion (*ὅθεν ἢ ἀρχὴ 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 ὅν ἔγενεα*). More briefly, he had a *ὑλή*, an *ἀρχὴ κίνησεως*, 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

¹ The quotations from Gassendi, Boyle, and Leibnitz may be found in M. Janet's work, pp. 184, 185, 119.

up with each other ; but they may be distinguished, and it is often desirable to separate them.

Efficient Cause.—It appears to me that since the discovery of the doctrine of the conservation of energy, or of the persistence of force, as Spencer calls it, the whole subject of causation (objective) needs to be carefully reviewed by some one combining scientific knowledge with philosophic comprehension. Mr. J. S. Mill seems to me to have clearly shown that all causation is dual or plural, as implying two or more agents acting on each other. We say that a certain plant was killed by frost : but when we spread out the full phenomenon we find that the true cause was not the mere frost or cold, but the state of the plant and the state of the temperature combined, for it is only when these unite that the plant is killed ; with a stronger plant, or with less cold, there might have been no such result. I have carried out this doctrine a step farther, and shown that there is a duality or plurality not only in the cause, but in the effect, which consists of a change both in the plant and in the temperature. A picture falls from a wall, and breaks a table below ; the cause, the productive cause, the invariable antecedent, consists both of the picture and table ; but the effect also consists both of the picture and table in a new state, the picture having lost momentum and the table being broken. Taking this view of physical causation, we see that the course of nature consists of agents affecting each other, changing other things, and being themselves changed. Nature is not, as Newcomb seems to view it, a chain going on in one line : it is a network going out in all possible lines, stretching out from every given point to the circumference of the cosmos. The forces acting are quite as ready to produce disorder as order, to produce evil as good. We see the need of an ordering power to produce order and beneficence, and so we have—

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, the bones of plants and 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.

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 intention 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 (Professor Newcomb will acknowledge this), 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.

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 mate-

rial 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. It is said that Professor Lockyer thinks he has evidence 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 variety 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 on 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.

Professor Newcomb evidently labors under several very erroneous impressions in regard to final cause. "From the very earliest at which men 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 physical 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. Now 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 that 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 clenchi*, 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. 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

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.

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 any thing 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 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.

I feel that I ought to refer here to a statement of Dr. Draper in the January number of this REVIEW. I am not sure what is the drift of that article. He pictures in dark colors the low state of faith in this age, and seems—and we are bound to give him credit for sincerity—to deplore it. I am not sure that religious belief in America is at so low an ebb as he imagines. He seems to account for the prevailing infidelity by alleging that it is a revulsion against the superstition of bygone ages. I do not see that superstition in past time or in certain continental countries can justify scepticism in our day or country. He seems to regard this defect of faith as an evil. But what is he doing to remove it? He sees that the politician cannot effectually contend with it. Who then is to contend with it? He does not tell us what is the true faith which is to oppose superstition on the one hand and infidelity on the other. His historical sketches are one-sided, as giving only the unbelieving side. To be impartial, he should narrate the atrocities of infidels, as seen for instance in the first French revolution, which drove so many back to superstition. His theories are not philosophical. What can be more weak and ridiculous than his theory of the origin of the belief in one God at the opening of

the Christian era? "The acknowledgment of one emperor was followed by an acknowledgment of one God!" He tells us that in the present day "there is a risk that with the fraudulent, much that is true may be swept away." I fear that the tendency of his own writings is to sweep away much that is true. He speaks of there still "lingering in some of our noble old rituals forms of supplication for dry weather and rain—useless but not unpleasing reminiscences of the past." I fear there will be still less of faith than there is at this moment if men, women, and children are kept from expressing their desires in prayer, as they will certainly be, if they are made by our savans to believe that God does not hear, and that He cannot answer prayer.

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.¹ 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

¹ Thus in the December number of the *American Naturalist*, after stating a theory of Haeckel called "Perigenesis of the Plastitude," a young naturalist complacently tells us that "this relegates teleological doctrines to the category of extinct ideas." Without being a prophet, I venture to predict that final cause may outlive some of the theories of Haeckel. The author of the paper says "the vibrations of the plastitudes are adaptive in their character—that is, they are the resultant of outward circumstances." I discover in these adaptations some traces of teleology.

be comprehended by the human mind by a kind of pre-existence 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 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 towards 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 pro-

duce 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."

JAMES MCCOSH.