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ARTICLE III.

THE UNIFORMITY OF NATURE.

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"TRUTHS," says a great thinker of this century, "truths of all others the most awful and interesting, are often considered as so true that they lose all the power of truth." Truths, it may be added, undoubted and most important, are so often entangled in their ordinary forms of enunciation that they become the accepted premises of error and falsehood. Of this the common expression, "the uniformity of nature," affords a striking illustration. In Mr. Hutton's sprightly sketch of the discussion of the Philosophical Society in regard to it, one of its most remarkable features is the apparent unconsciousness of anything doubtful or equivocal in its terms, the absence of effort to come to a specific and commonly accepted definition. Definitions, indeed, are implied and suggested. Evidently Mr. Martineau and Professor Huxley and Mr. Stephen attach to the terms in question a modified, if not a different significance. The phrase itself swarms with ambiguities. As is usual in most cases where it is employed, there are ambiguities in connection with the word "nature." In this particular phrase, moreover, there are different senses with the word "uniformity." And then, again, there are dispute and question as to the grounds upon which any such idea or fact, and whatever its meaning, is known and accepted. Take, for instance, the first of these words in

its varied significations. This idol of the materialistic pantheist is protean, not only in its manifestations, but in its meanings. Its worshippers or opposers find a constant change of meaning as demanding their worship or opposition. When, for instance, it is asserted that nature is uniform, nature with some is equivalent to the universe of being, physical, intellectual, and moral; with others it is the universe physical; with others it is the universe of being so far as is known; with others the physical universe so far as is known, and in its principles scientifically verified. So also with uniformity. The assertion of this, with some, is that of cosmical phenomena; with others it is that of the laws or modes of sequence through which these phenomena take place; with others it is that of the invariability of property, in substance and forces, upon which sequences and phenomena are dependent. With others, again, and perhaps the largest number, it is meant there is uniformity of operation and phenomena in that extent of the universe which science has explored and found to be under the reign of law, the known order of material sequence,—which last is about equal to saying, the known uniformity of certain laws and forces and phenomena is uniform. Each one of these, if controverted, must be dealt with in a different manner from the others. When, therefore, all are treated as meaning the same thing, and the proof or argument passes or repasses from one to the other, without recognition of their difference, the confusion becomes hopeless and irremediable. Definition here is manifestly a matter of prime importance,—the first necessity. Such definition, moreover, will aid to the settlement of another difficulty already alluded to —that which has reference to the ground on which uniformity is asserted. All, in some sense or other, give it acceptance; but the grounds of that acceptance are different. With some, as with Hume, it is the result of unvarying experience,—of an inductive process consciously or unconsciously carried on, by the race, until the conclusion

is placed beyond question. With others, as with Huxley, it is so far a matter of experience, of experimental verification, that it is rationally accepted and used as a working theory in life, as in scientific investigation. While with others its acceptance is intuitive: it is a principle of necessary thought, of which men, if they think rationally, cannot divest themselves. These difficulties of the second class depend largely, for their solution, upon definitions in the first. Some of these may therefore properly receive examination.

First, then, as to the notion and frequent implications of statement which identify the uniformity of nature with the uniformity of material and physical phenomena; and, of course, its reception as a truth inductively certified. If so, it must be manifest. Has it ever been, and is it now thus manifest? The reply often is in the affirmative; and the appeal is to universal experience, as not only inductively demonstrating a certain phenomenal course, but the impossibility or violent improbability of deviation. "It is more probable," says Leslie Stephen, restating Hume's argument, "that men should falsify, than that an event opposed to a complete induction should take place." Without just here raising issue as to what Stephen means in this statement by a complete induction, it has been aptly replied, that there is "a no less complete induction in the science, and from the principles of evidence, that testimony of a certain kind, and given under certain conditions, constitutes moral demonstration. This induction, in the higher sphere of mind and morals, more than offsets that in the domain of physical nature." As illustrations of such phenomenal induction, reference is made to regularity of the seasons, the succession of day and night, the invariable operation of physical, chemical and vital forces. When, however, these are examined closely, it is found that there are, indeed, indications of law, orderly operation, regulating and controlling forces, but not uniformity of phenomena. The uniformities and the inductions of the

man at the pole, or as near as he can get to it, and those of his remote neighbor at the equator, or of those at points intermediate, are anything but identical. However complete the induction from the phenomena of any one of these points, it will have to be modified by testimony as to those of the others. So, too, confining observations to any of these localities for any considerable period. No one year, nor season, nor month, nor week of a particular year, nor any designated interval, century, or millennium, is, in its phenomena, exactly like that of the same interval prior or subsequent. Drought and famine of one season follow abundance and moisture of that preceding, and *vice versa*. So with storm, and tempest, and seasons of tranquility. So too, again, on a larger scale and for longer intervals, in the mutations of the heavenly bodies, in the successive eras of geological formation. The phenomena of any one of these is not uniformly that of any other preceding or following. If it be said the variations in such cases are within certain limits, through ascertainable forces, and that within these is the uniformity asserted, the question may well be asked, What are these limits? Do they include the variations involved in the successive conditions of our globe, say of the Silurian, Devonian, Carboniferous, etc., or of our planetary system, gaseous at one time, solid at another, and something intermediate in the transition? Limits including such latitude of variation, as a matter of thought, become unmanageable, get away from any intelligible conception of phenomenal uniformity.

Doubtless in all these variations there are found indications of the invariable. It may be seen that we are not in a chaos, but in a cosmos. But it is not that of dead uniformity,—rather that of numberless variety, diversity in unity. There is order, law, controlling force. But there is by no means uniformity of phenomena. "The cloud-wreaths of this evening's sunset," says a tourist, speaking of the ever varying atmospheric conditions of a Venetian sky, "will never be repeated again: the bold and but-

tressed piles of those cloud-mountains will never be built up again just for us; the grain of orange and crimson that stains the water before our prow, we cannot be sure that we shall look upon its like again. The revolutions of the seasons will no doubt repeat certain effects: spring will chill the water to a cold, hard green; summer will spread its breadth of golden light on palace front and waterway; autumn will come with its pearly gray, sirocco days, and sunsets flaming with myriad hues; the stars of a cloudless winter night, the whole of the vast dome of heaven, will be reflected in the mirror of the still lagoon. But, in spite of this general order of the seasons, one day is less like another day in Venice than anywhere else; the lagoon wears a different aspect each morning as you rise; the sky offers a varied composition of cloud each evening as the sun sets. Words cannot describe Venice, nor brush portray her ever fleeting, ever varying charm." After all, however, it is simply a matter of degree. For Venice write Nova Zembla, or Sahara, or any other locality, and the essential features of this description will, to a greater or less degree, find their place. The phenomena are not uniform but multiform, in their repetition myriadfold,—unvarying only in their exhibition of manifold variety.

If, then, the uniformity of nature is not that of phenomena, is it not that of law,—the sequential operation of natural laws in a uniform way and order? The reply to this, in one sense, will be affirmative; in another, negative. "Law," it is to be borne in mind, like "nature" and "uniformity," has, in common usage, a variety of significations. The unconscious transition from one of these meanings to the other, in the same argument, and sometimes in the same sentence, gives a result anything but logically lawful. "Natural Law in the Spiritual World" is the title of a book which has counted its admiring readers by thousands. Does "natural" in this title mean physical or universal? If the former, law means one thing, if the latter, another. If the former in one part of the discussion, and the

latter in another, how then? "Law," says Professor Harris, "is a principle of reason, as that every change or beginning must have a cause," and as such it is immutably controlling. So, again, law is the dictate of a ruling power, whether obeyed or disregarded. Then, again, by many scientific writers, the term is used as the equivalent of force, or resident property, in substances. And then, again, as that of the mode in which such force operates, under certain conditions, and in certain collocations. The last is the sense in which it is here used. Gravity, for instance, is the simple force, the resident property, in matter. Its attraction, as its mass and the square of the distance, is its measure or mode,—its law. So certain chemical elements are forces. That they invariably combine in certain proportions to the production invariably of certain results is their law. Confining the word to the last sense, can it be said there is a uniformity of nature, the result of the operation of these laws? As already intimated, the reply to this question in one sense is, yes, undoubtedly. With the same material, under the same conditions, and in the same collocations, and, however frequently the experiment may be repeated, there will be uniformity both of operation and phenomena. Given two bodies, in certain relations of mass and distance, and the law of gravitation is uniform in its operation as to any others in the same relations: like conditions and forces produce like results. Given one or more chemical elements in certain relations of contact and proximity; and affinity, in all like combinations, will uniformly operate to the production of like results. The uniformity of nature, in this sense of the expression, needs only to be clearly stated to receive universal acceptance. Given the same material, in the same condition, and with the same collocations, and we have the same operations, and the same results,—which is very much the same as saying, $a+b=a+b$. But this is not the result of an inductive process. If equals be added to equals, the wholes are equal. Every schoolboy starts with this in his

geometry. It is one of those laws or principles of reason, under Professor Harris' definition, from which there can be no variation. Or, as it has been expressed by President Hopkins, "uniformity of causation is productive of uniformity of effect."

But suppose new materials and forces, or that those already existing are put in new and different relations. Then the uniformity of nature, in the sense described, no longer has existence. This very uniformity of natural forces and operations necessitates variation in the result. It is like a mathematical process based upon an astronomical observation: its conclusion, as correct or incorrect, depends not only upon the mathematical process, but upon the correctness or incorrectness of the observation, the material included or excluded. So here. In the largest scale of which we can form conception, there has been the bringing in of new material, or the arrangement of the old under new relations; and the result has been not uniformity, but multiplicity, not only of phenomena, but of operation. In the geological, the ante-geological epochs, as in the present conditions of our system, such differences are to be recognized. The laws of the physical world now operating to the production of certain results in their phenomena, operated then, upon different material or under different conditions, to the production, of course, of results very different. Whether we go upon the assumption that the same material, in some form or other, as to amount or intrinsic energy, has eternally existed, or was thus simultaneously called into existence,—neither of which can be scientifically verified,—we only have, under such supposition, the material and its forces chaotically existing. These become protean, and yet orderly, in their manifestation as conditioned by collocation, at different periods, and from different centres of operation. The only uniformity to be asserted in such case is that already pointed out,—not that of phenomena, not that of operation, but of either one or both as similarly conditioned. A power, we will

say, above that of physical, or additional to physical force coming into physical force, under this law of uniformity, necessitates a new result,—not contrary to physical force, or nature, but above or additional to it, and working through it, to results of which nature without such power is not capable. The power of will controls the nature or law of muscle, and the power of muscle, thus called into motion, controls the nature or law of gravity,—does not destroy it, but modifies the result of its action. The first of these, will, is a power in relation to the physical, but not subject to its limitations,—not within the range of its uniformities. It may seem useless to elaborate such truisms upon this point, as upon the preceding one of the uniformity of phenomena. And yet our literature, scientific and unscientific, is full of statements implying their opposite. "Nature's seeming anomalies," says Dr. Chalmers, "can be traced to a law that is inflexible, so that what appear to be the caprices of her waywardness, are, in fact, the evolution of a mechanism that never changes. The more thoroughly she is sifted and put to the the test by the interrogations of the curious, the more certainly they will find that she walks by a rule that knows of no abatement, and pursues with obedient footsteps in that even course from which the eye of scrutiny has never yet detected one hair's-breadth of deviation." The term used by Dr. Chalmer, "constancy of nature," that is of natural operation, is evidently that of the unvarying operation of the same forces under the same conditions and circumstances. The seeming anomalies are the result of new collocations, it may be of mind and will arranging these collocations. If, as his figure seems incautiously to imply, nature is a machine, then it is modified by the mind and will, not only of the machinist, but of numberless subordinate workers. If it is a scheme marked out, then apparent anomalies are part of the scheme. The "inflexible law," "the undeviating course," after all, is only that which we have insisted upon; given the same forces, operating in the same mate-

rial, and under the same conditions and you have the same results,—a=a, a law not of physics, but of reason, not of induction, but of rational intuition. Under this, and with superphysical elements of intelligence and will, there is multiformity both of the phenomena and of operation, uniformity of forces and of their modes of operation.

It will thus be seen that one of the difficulties with this expression "uniformity of nature," "constancy and course of nature," is that which comes out in the language above quoted: the conception of it thus suggested as a mechanical arrangement, and, of course, its unvarying repetitive movements within the limits of such arrangement. The crank is turned, or the motive is applied, and the machine goes on in an unvarying round of similar successive revolutions. Anything from outside stops this machine or disarranges it. It works perfectly, within the range of its working. But that range is limited, and within its allotted interval repeats itself, both in the action of its forces and the phenomena. What a cast-iron conception this is, as compared with the revelations of physical nature upon our globe and in our system, will at once be seen, when the character of those revelations, in the great epochs of the past, are recognized, and borne in mind. The uniformity or identity of forces all through the past, in their mode of working as in the evolution of new results through that working, are a prophecy of the same thing in the future. Nor does the fact of their convertibility and correlation at all affect the validity of this anticipation. Revelation speaks of a "new heavens and a new earth" following those of the present. The time was when the heavens and the earth that now are could have been prophetically spoken of in the same language. And times and times over again the same terms would have been applicable to coming new epochs, of sidereal, planetary, and telluric existence. The course of nature, like a heavenly body in its orbit, goes around and at the same time goes on: it goes around in the uniformity of its forces and modes and opera-

tions; it goes on in its evolution of new and wonderful results of such operation, under new collocations, and in different conditions. Nor is this conclusion in any manner affected, whether it be regarded as accomplished through the operation of these forces and laws, all along existing the same both in quantity and quality, or through, at times, the evolution of new material.

Nor are these conclusions at all affected, if by laws of nature are meant not the process or mode of sequence, but the simple process as existing in different substances or elements, in their peculiar proportions of atom or molecule, the uniformity of substances. Here, also, whether in the force which unlocks the properties of these elements and combines them with others, or in the sequential process to results following, new arrangements and conditions give variation, as would new material. The principle already insisted upon holds good: the uniformities are as are material and conditions. That, as a matter of fact, there is not unvarying uniformity of physical phenomena shows there is variation either in quality or condition of material.

This brings up the other question to some degree anticipated, but which it will be well to look at more distinctly and fully: Why is it that we rely upon the identity of existing energies and forces, and their modes of sequence under the same conditions? In other words, what is the underlying ground upon which the uniformity (identity is really the word) of nature, whether that of force or operation, is accepted? Is it the result of experience? Why do we feel assured that in chemical elements we shall always find the same properties? that by subjecting any one of them to certain conditions, or placing in it in the same collocations, we shall have the same results? So, on a large scale, in other calculations and spheres of investigation. The biologist, the physiologist, and even the historian, all calculate with reference to uniformity, either in their material or its mode of combination. Why is this

done? Is it the conclusion of experience, or does it go back to that which precedes experience? "We assume that, under heat, the vapor of water will expand one day as it expanded the previous day"—the savage who boils his kettle for the first time, as the child who sees it for the first time, as well as the old man of fourscore who has been seeing it all his life. As the majority of seeds put in the ground in previous seasons, sprang up and reproduced similar seed, so we assume they will in seasons to come. In cases where the same antecedents are apparently not followed by the same consequents, we take for granted that we have been mistaken; that there are differences in the antecedents which explain those of the consequents, e. g. the kettle does not boil, and it is found that the fire is low or has gone out; the seeds fail to come up because the soil is exhausted or improperly prepared for their reception. This last illustration affords a striking one additionally of an apparent uniformity going out, and of its restoration through intelligence under similar powers and forces. The ignorant cultivator sows in the same soil eight or ten years in succession. Just as he has inductively certified himself, upon the experiences of these years, of the uniformity of harvest phenomena, there is a change of those phenomena, and the seeds fail to come up, or give any crop if they do. Then comes in intelligence, and by a restoration of chemical conditions, that is, by the application of the uniformity of forces, in the shape of a fertilizer, restores that of the phenomena. But here is something which stands above both of these phenomena, and controls them within certain limits to its own purposes. In other words, we assume identity of substance or material in the things, and identity of operation in their laws, as they are in similar conditions. What is the rational ground for such assumption?

Of course if rational it will be justified by general experience,—will in many cases, as to particular anticipations, by such experience be modified; just as the spontaneous

belief of the child is justified, yet modified, by the discriminating examination of the man, as to the reliability of human testimony. We believe such testimony, prior to experience either of human truthfulness or falsehood; rationally so, that testimony itself being a reason against which there is nothing opposing. We assume prior to experience the identity of substance and of its modes of operation. What in so doing is our rationally justifying principle?

"There is," says the author of "The Analogy," "that kind of presumption or probability expressed in the very word 'continuance' which seems our only rational reason for believing that the course of the world will continue tomorrow as it has done so far as our experience and knowledge of history can carry us back. Nay, it seems our only reason for believing that any one substance will continue to exist a moment longer, the Self-Existent Substance only excepted." What is this only reason, in view of which the continuance of these substances, and their energies, and conditional operations, and any orderly results of them, are anticipated? Is it not in the principle of necessary law of reason, adequate causation? That which is, is,—actually exists. That which is as it is, is actually existent as it is. That which manifests itself in its powers and their modes of operation, in their connections of interdependence and diversified unity, actually exists in such manifestation. This fact of actual existence, whether of substances, properties, sequential operations, or orderly results, implies a sufficient cause or reason. In the presence of this sufficient reason for them as they are, and in the absence of any reasons for their discontinuance, there is the rational inference of their continuance in the future. Let such reasons for change or stoppage be given, and those reasons may then be investigated. But prior to this, the inference and the rational anticipation is as has been exhibited,—this, too, prior to any extended experience, spontaneously assumed, action basing itself on such assumption. Experi-

ence or testimony, as to the experiences of the past, comes in, and shows that uniformities of the past verify such assumption. Things, and their properties, and their modes of operation, in all the changes of the past, are thus perpetuated, "nature forever shattered, yet the same forever," under this law of sufficient reason. It is the assumption alike of the child, of the untutored savage, of the veteran scientist. Until, under that same law of sufficient reason, there comes in a new force to terminate existences, or change their properties, or place them in new relations, we rationally calculate and act in view of their continuance. It is not so much experience as it is the initiative to experience,—not an induction, but the basis of all induction. What is usually meant by uniformity of nature, as we have seen, is not uniformity of phenomena, but of substances, energies, and modes of operation, and even this would be better expressed by the word "identity." The scientific or unscientific experimenter upon the assumption of such identity anticipates their results. With a new force thrown in, or an existing one taken away, or with re-arrangement, under this principle of identity or uniformity, these results will be modified.[1]

But this law of sufficient reasons, in the presence of existing facts, involves two inferences: one as to the past, another as to the future. Uniformities, whether of substance, of properties, or of law, in the fact of their existence, imply a sufficient reason or cause. As it is the rational ground of anticipation for their continuance, so it

[1] "We might even assert that though the forces of the physical universe have never changed from the beginning, and even while not a particle of matter has been destroyed, the effect of these forces in their combined action has never been in any two instants precisely the same. Forces and laws may continually repeat themselves, and the phenomena which constitute these effects may never be alike. The fixedness of the agencies employed by God in the conduct of the universe commands the confidence of man. The variety of the results and the wisdom manifested in their production compel his admiration."—PRESIDENT PORTER.

is the necessary ground of their present and past existence. Here are the atoms and molecules. There is so much energy in each one, so much more in their combined aggregation, millions of energies and potencies of operation, in so many uncombined and independent centres, so many more as combined and interdependent. How did they get there? Just so, of themselves, and causeless? Is there any principle of reason dictating or justifying such a reply? Are there any inductions of experience by which it is suggested? An unreasoning animal, if capable of asking the question, might answer in such fashion; but not so any child of ordinary intelligence, and certainly no man of experience and observation. But finding such material, and whatever the account of its origination, what further is it that has originated and accounts for its power of aggregation, attraction, repulsion, affinity, and proportionate combination? Still further, these materials, under certain conditions, and in certain relations, in the epochs of the past, as in the present, have operated, and are operating as an orderly system, so that regularity of movement may be recognized in the past, and calculations made for it in the present and the future. Can matter irrespective of its potencies, or contemplated in these as millions upon millions of independent atomic centres, be rationally contemplated as an adequately originative, constructive, and unifying agency to the result of the world as actually existing? Manifestly there is not only evidence of mind in these properties and operations, but necessity of mind to account for them. Nor can that mind or intelligence be either divided or finite. The unity of the world finds its only sufficient explanation in the unity of its author. And that author, even if finite, if in his finiteness capable of originating and impressing the world with its existing properties, finds, and can only find, the sufficient reason of his own being in that of the Infinite One, the mystery of mysteries, and yet the only satisfactory solution of any of the mysteries of finite existence, of the finite as existent.

So too, as to the inference for the future. The Infinite Sufficient Cause of what has been, and is, of powers, and of properties, and modes of operation, is not, in any finite actuality, exhausted. The sum of such actuality, in the broadest possible sense of that word, is the natural. Before it as its source, and in and under it as its sustainer, is the supernatural. Who will say that any such finite actual cannot be added to it as its material,—that, without such addition, it cannot be modified, in its action and result, by higher spiritual agency? "Providence," it has been said, "is a wider and more complicated nature." This takes in moral and spiritual agencies, not contravening or opposing, but traversing physical agencies, and modifying their action. Man on a small scale often exercises such spiritually modifying prerogative. In one element of his being,—physical or natural, in another, moral and spiritual, in this latter above nature,—he has it, as his task, to subdue the earth, to control and transform nature, to subdue the elements of nature, by modifying them for his purposes. This in many important respects he actually does. He does it, moreover, in view of his knowledge of natural uniformities, of the forces and operations of nature in their ordinary course. He strips mountains and plains of their forests, and changes their climate, produces drought and sterility. He replants and covers them with forest, again, and there come back refreshing showers and fertility. He drains, and ploughs, and sows, and malaria disappears. He enforces sanitary regulations, and the "pestilence walking in darkness and the sickness destroying in the noonday" by their hundreds and thousands, in some communities, are arrested, and not allowed to touch others. He brings to bear moral and social influences, and with them come moral and social health, diminution of crime and of vice, of disease and of suffering, more positive enjoyment and comfort, higher average of human life. Just as mind and will agency thus come in, as something additional, controlling and modifying

those that are physical, chemical, and vital in the sphere of nature and of providence, so may it to the production of results of a still higher character. Under the law of adequate cause or reason, the Originator of nature is competent to surpass nature, or to modify its powers and agencies to results previously non-existent. "Why should it be thought a thing incredible that God,"—not man nor angel, nor previously operating forces and uniformities, but "that God"—through these, or without these, "should raise the dead?" that the power which gave life should restore? that he should be able to convince man that he has done so? Consistent theism has but one answer to such question. No rational principle, no fundamental belief, in such case is sacrificed. The same forces, acting under the same conditions, and in the same way, uniformly produce the same results. But these same forces, with a new or modifying element acting under different conditions, produce a different result. In the former, it may be, we know all the forces and their law of action, and we call it natural. In the other, we know only a part of them. —beyond and above is the supernatural. We may not indeed in all cases mark exactly the line of distinction—in our ignorance of the natural, we may call it supernatural. But that does not disprove, in its own place and with its own proper evidence, the reality of its existence and operation. "No man," says Edmund Burke, "can draw a stroke between the confines of day and night, yet light and darkness are, upon the whole, tolerably distinguishable."

Nor does the last, the supernatural, take us beyond and outside of the range of law, the domain of identified energies and their identified modes of operation. Nature, as so much of the universe as we can see, is made up of these. The universe is what is above, and around, and beyond. The energies and operations that we know, we assume are identical in the domain of the universe unknown with what they are in that which is known, and which we call nature. But in this universal region of the beyond and

around, not only unrevealed by the spectrum or by any scientific agency, but unrevealable to human capacity, there may be additional energies and higher agencies, traversing those that are natural, and bringing results of which nature is not capable. In all these, however, there is the reign of law, of the Infinite Lawgiver. And higher and broader than these, is the will of his spiritual perfection. To him this universe of powers and operations, as of their ultimate reason, is fully comprehensible. "Known unto him are all his works." To him the distinction of nature and universe, of natural and supernatural, has no place. To him the universe is nature, the powers and agencies and results in that universe which he called into existence and sustains in all their operations. In them all, controlling all, sustaining all, and yet above and beyond all, he is in his own spiritual and personal perfection, ever in nature, and yet the Infinitely Supernatural.