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Art. I.—*The Doctrine of Perception, as held by Doctor Arnauld, Doctor Reid, and Sir William Hamilton.*

It is our purpose in this article to offer a monograph upon one of the most limited questions in psychology. But inasmuch as the interest of the discussion must turn very much upon a particular controversy, and even on the opinions of an individual, we think it advisable to place at the beginning all that we have to say of a historical nature, in order that no details of fact may be left to embarrass us in recording the series of philosophical determinations. Working in a somewhat unfrequented field, we hope to be able to show, that in regard to the true doctrine of Immediate Perception, the great Jansenist was not only a successful co-worker, but that he approached singularly near a solution of the problem.

It is not quite ten years since we asked the attention of our readers to a special article on the Family of Arnauld.* Our purpose at that time was not so much philosophical as theological and religious. But the good and ascetic recluses of Port-Royal des Champs also entertained themselves in spare moments with questions of metaphysic; and one of these now concerns us.

Let memory be refreshed by the statement, that Descartes was born in 1596, and died in 1650; that Arnauld was born in

* Princeton Review, 1849, pp. 467—502.

the solution of the great problems of life, moral, religious, social, and political. As such, its subtle movements cannot be too closely watched.

Art. VI.—*Rational Cosmology: or the Eternal Principles, and the Necessary Laws of the Universe.* By Laurens P. Hickok, D. D., Union College. D. Appleton & Co. New York and London.

The work whose title we have thus given in full, exhibits the results of much and earnest thought. Its aim is high; its field of research immense. We respect the author's talent; we honour, in themselves, his energy and industry; and what is more—much more—we have an abiding confidence in his piety. We desire to make this declaration frankly and fully at the outset of our remarks, that we may not afterward be misunderstood, if we shall be found, even conscientiously, and therefore very earnestly, to indicate our utter disagreement with many of Dr. Hickok's positions and conclusions.

The object of the book is to develop all that the title indicates. After an Introduction, the contents of which are "Facts and Principles—Facts determined by Principles—General progress of philosophical investigation—Theology and philosophy possible"—the author presents what he regards as "a concise and independent mode" for the "attainment of a clear idea of an absolute Creator and Governor." Then, much more at large, he discourses of the plan "of the creation itself;" of which he remarks in the general, that "To no finite reason, is it to be anticipated that this plan will ever reveal itself in all the clearness and completeness of the divine Ideal; yet nothing hinders, since such a plan certainly is, that the human reason may not earnestly and reverently apply its powers to the attainment of its grand outlines, and in the teaching of eternal principles find, by a rational insight, what and how creation must have been, and read her great laws, not as mere arbitrary

facts, but as the necessary result of a work rationally begun and wisely accomplished."

"When the cosmos is" thus regarded as "attained in its plan and principle," he then proceeds to take "the facts" as he conceives them to have been "actually given in experience, and study them with the direct design to find their law as plainly determined in the eternal principle." This furnishes "the work" for the concluding portion of the book, but which, as the author states, "might be prolonged indefinitely." (Pp. 56 and 57.)

It will readily be perceived that the subject matter, as thus stated, admits of being viewed under two aspects, which may be designated, respectively, the one as the *physical*—the other as at once the *metaphysical*, *psychological* and *theological*. We shall have regard to these in the order in which they are here named.

In accordance with the plan of the book, as already briefly sketched, as near as may be in the very words of the author, we not only find (Chap. I. 4) "the Absolute as given in the Reason," but also (Chap. II. at p. 101) how God did, or using the present tense, how God does create matter; and that too in a way which would seem to leave very little room for the exercise of his good pleasure. For we are told on p. 15, that "By the insight of the reason, which no animal can exercise, man attains in many facts the principle which was before the fact, and which, wholly unmade itself, controlled and guided the maker of the fact in all its construction." Also (p. 17) that "Universal nature is more than bare fact; it is something made under the determining conditions of unmade principle: and this immutable principle, under which its being and all its ongoings have been determined, has now its counterpart in nature as the perpetual law of its working," &c. Also (p. 256) that "The universe in its eternal principles gives the creation in Idea, and in this we know what is possible." . . . "A universe so may be; yea, if a universe of working central forces be brought into existence, so it must be; but that the universe shall be so in actual fact there is demanded the exertion of creative Omnipotence."

It is the comparison of these and other passages of similar

import or tendency, that has led us to the conclusion already intimated—that the creation which lies at the foundation of the "Rational Cosmology" is one in which very little room would be left for the exercise of the good pleasure of the Omnipotent.

True indeed we learn (p. 20) that "This Creator of the cosmos must" (himself) "be wholly absolved from all the conditions which determine the cosmos"—he is not finite—he is not limited in himself—but then, if the principle which was before the fact *controlled* and guided the maker of the fact in *all its construction*, where is that perfect freedom which must belong to the Ever Blessed One revealed in Scripture—"the *Living God*" and "*Everlasting King*" of the Bible; whose perfection place him as much above all control in the exercise of his "good pleasure," as he is above being "tempted of evil?" Infinite wisdom and goodness unitedly, and always *spontaneously*, fix upon the plans best in themselves, and best adapted to secure the end in view, without the necessity of reference first to any principle, made or unmade, other than such as Infinite Excellence, because it is infinite, will spontaneously and in itself *prescribe*, not *follow*—much less be *controlled by:* and *that* is what we mean, when we say that God's "good pleasure" is gloriously above control. In what the creation of the "Rational Cosmology" consists, it will be easier to describe after an exhibition more or less distinct of those "eternal and unmade principles" to which reference has already been made more than once in the preceding quotations. But with respect to the very question—how God did or does create, we will say here what we desire to say, once for all, in unmistakable terms.

We have not forgotten the sensible shudder which we experienced some three years ago, on hearing it declared by one of the most gifted and pious men of our country, that there were some relations or qualities of things which were out of the region of will, and which, he proceeded to say, "not even the *will of the Almighty* could change." It was, we confess, with somewhat similar feelings, that we read the announcement in the "Rational Cosmology" of how, in accordance with—aye more, controlled by—certain eternal principles, how God, thus *circumstanced*, creates. Our first impulse was to exclaim—witness men, witness *angels*, while a being whose imperfect

knowledge of God's lower works is derived to so large an extent indirectly, through the restricted avenues of his senses, and who has had but "an atom of time" in which to view those works—witness men, witness angels, while a being thus circumstanced *determines* what the angels might well "desire to look into," if they *could*—witness all ye intelligences, while man, with the Bible in his hands to inform him of God's infinite perfections, determines how, within the stringency of eternal and necessary laws, the Almighty exercises the exclusive prerogative of omnipotence in its first great outgoing act—witness *man determining* how *God creates!*

Does not duty, in view of all this, clearly demand, that, feeble as may be the effect of the declaration, we should characterize every such attempt as being, in the very light of revealed truth, presumption of a very high order; though it be even perpetrated by good men—by those whom we verily believe to have a true love and reverence for the Father of Mercies of the Bible? All the rather do we conceive this to be duty in their case; for their goodness lends sanction and gives countenance to what we feel bound to regard as being in very strange association with that goodness itself.

We have endeavoured to express unequivocally what was our first impulse, nor are we prepared to say that we have recovered from it; but our astonishment was the less, when we found that it was such a conception of creation as might be "subjected to" that "insight of the reason" which sits in judgment, as we learn, on the conceptions of other human minds, (p. 92,) that it was such a conception of creation as this, with regard to which we were to be fully informed; a conception of a creation so called: which, being human after all in the *extent* of its horizon, would even thereby prove itself to be human also in its *level.*

The infinite propriety of the first and leading precept of the Second Commandment is ever illustrated by the fact that the idolator *first* himself *forms* an image of the deity which he would worship, and thus brings down his god to his *own level:* to worship afterward what he has thus degraded, seems, in comparison, to be almost a minor offence.

In like manner the exclusive prerogative of Omnipotence, viz.

creation, is here sought to be made intelligible by degrading it in the way already intimated; i. e. to a process within the purview of "the rational insight," which has somehow ascertained that among the foremost of "the eternal principles" of the material "universe" is this, that "matter is force." (P. 90.)

We are well aware that to the force here spoken of are attributed very marked peculiarities; yet the declaration that matter is force, would seem to us to find a very special embodiment in this—an elephant is strength; which sounds to us very much as would the declaration that Homer is the Iliad; Sir Isaac Newton is the theory of gravitation; or—what we rejoice to think is not true—that Dr. Hickok is the "Rational Cosmology." Nay more, might not the philosopher, in full hearing of a very fine echo, after a long and careful scrutiny by the "rational insight" come consistently also to the conclusion, that speaking *itself* was an articulate sound, just such as that which so interested and pleased him—that we do not need the corporeal and mental device of a speaker—and so the fable of Echo was not wholly a fable after all; even with respect to the physical facts of the case.

Yet, if matter be indeed force, it must be important to know exactly how this force is situated. That there may be no misapprehension with regard to this, we quote the author's own description of force, and of how it is situated. Being first concerned with the presentation of his own views, we omit, for the present, his reasoning to show that the ordinary conception of matter is a mere negation. At the conclusion of his remarks upon that, he proceeds to say:

"Simple activity is spiritual activity, and has nothing in it that can awaken the thought of force; and it is only as it meets some opposing action and encounters an antagonist that we come to have the notion of force. In all push and pull there is counteraction, complex action, action and reaction, while simple spiritual agency can never be made a conception of physical existence. It cannot be thought as taking and holding any fixed position; it cannot become a permanent and have a 'where' that it might be conceived to pull from, nor a 'there' that it might be conceived to push to. It could not be determined to any time nor to any place, for it has no constant

from whence the determination might begin nor where it might end. When, however, the conception is that of simple action in counteraction, an activity that works from opposite sides upon itself, we have in it at once the true notion of force. From the difficulty of clearly apprehending counteraction or antagonism in a single activity, as always acting in opposite directions upon or against itself, and which must be the true conception, for the notion is that of one source for the antagonism, it will be more readily taken and equally available in result, if we here, and generally through the work, conceive of two simple activities meeting each other, and reciprocally holding back, or resting against, each other, and thus of the two making a third thing at the limit of meeting which is unlike to either. In neither of the two activities can there be the notion of force, but at the point of antagonism force is generated and one new thing comes from the synthesis of the two activities. To distinguish this from other forces hereafter found we call it *antagonist force*. In this position is taken, and there is more than the idea of *being*, which the simple activities each have; there is being *standing out*, AN EXISTENCE; being *in re*, *reality*, A THING.

"Let, then, an indefinite number of such positions contiguous to each other be conceived as so taken and occupied, and a space will thereby be filled and holden; an aggregate force will maintain itself in a place; and a ground is given on which other things may rest. A substantial reality here exists. This antagonism may be conceived to be of any degree of intensity, and the substantial ground will hold its place with the same amount of persistency, and stand there permanent, impenetrable, and real. Nothing else may come into its place until it has itself been displaced. It is not *inertia*, but a *vis inertiæ;* a force resting against itself, and thus holding itself in place. It *rests*, because it has intrinsically an equilibrating *resistance*." (Pp. 93 and 94.)

But this alone being regarded as insufficient to provide for "combinations and resolutions," "perpetual changes and processes through successive stages," he continues—"Our very primitive idea of matter must comprehend more than the idea of pure antagonist force, even that which may dissolve and

become a combination with pure antagonism. We conceive then of an activity going out in exactly the reverse process of our antagonism, even a beginning in the same limit of the meeting simple activities and working on each side away from the limit; a throwing of simple activities in opposite directions from the limit of contact. Not a counteracting and resisting, but a divellent and disparting activity; not an antagonistic, but hereafter known as distinctively a *diremptive* movement. Such an activity could not be conceived as space-filling of itself. Wherever the limit in which there might be conceived the contact of two simple activities should be, the diremptive movement would be away from the limit on each side, and thus a space-vacating and not a space-filling activity. The diremptive movement alone would be a disparting and going away of the activities from each other, and leaving a void. But if this diremptive movement be conceived as at the very limit and point of contact of the antagonism, the antagonist activity working toward itself in the limit, and the diremptive activity working from itself out of the limit, then must the diremptive movement on each side encounter the antagonist movement, and the simple diremptive activity going out on one side from the limit will meet the simple antagonist activity on the same side coming in to the limit, and these two simples of the opposite kinds of forces must make a new counteraction among themselves. And equally so with the going out and the coming in of the opposite kinds of forces in their simple activities on the other side of the limit, the one must encounter the other, and engender a new counteraction among themselves on this other side. The result thus must be that while the diremptive activity disparts and loosens the antagonism, the antagonist activity on the other hand restrains and binds in the divellency, and thus the diremption can neither go off wholly on either side and leave the limit void, nor the antagonism come up from each side and make the limit full, but both antagonism and diremption meet in the limit and make a third thing, which may be called indifferently an antagonist force loosed, or a diremptive force fixed.

"The pure forces in their contact in the simple limit may be known as units under the term of *molecules*, or molecular

forces; the working to the limit constituting an antagonist molecular force, and the working away from the limit constituting a diremptive molecular force. The combination of these forces in their joint interaction making a new compound as a third thing unlike either alone, may be known as also a unit, constituting a material *atom*, and may further on be known as a *chemical* atom or molecule. Our conception of matter must therefore be of this combination of distinguishable forces, though we shall find it convenient for the more clear apprehension of the principles of the universe to follow out the workings of each distinctly and separately." (Pp. 95 and 96.)

We have quoted the author at some length, in order that the "principle" which he advances, and to which he attaches no ordinary value, may be exhibited precisely as he has defined and expounded it, in the use of his own specially adapted terms.

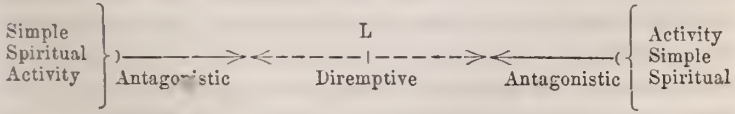
The quotations, even thus far, are also illustrative in another way. They show how much circumlocution becomes requisite, when every thing like symbol or concentrated representation of quantity or of mode of action, is studiously avoided. We say studiously, for although the author informs us in his preface, that "In portions of the intuitive processes here pursued, a help might at the outset have been given to some minds by the interposition of more diagrams," he adds, "and yet in the end the fastest and pleasantest progress will be found to have been secured by casting off all dependence on any such helps, and fixing the mind's eye directly upon the subjective ideal, as the pure ground in which the insight is to attain determinations of the developed principle. In two cases only, from the extent and complication of the intuition, has it seemed best to resort to the interposition of figures; in other cases care has been taken to use precise language, and to give descriptive illustrations and analogies, so that to a careful and clear inspection the process may be followed without much difficulty or discouragement. Nothing can make the journey easy to a mind that refuses to go alone and waits to be carried. The truths sought are not in the sensible phenomenon, nor at the conclusion of a logical process, but must be clear to the rational insight in their own necessity, if apprehended at all.

To the intellect that does not so apprehend them, all forms of expression will be empty; to the mind that does so apprehend them, no interposed figures are needed or would be tolerated." (Pp. 6 and 7.)

Now although all this should even be conceded, yet when the attention of the reader is to be directed to what the "rational insight" of the author so clearly discerns, this cannot be done directly, but only through the medium of some symbols of thought; and it is vastly important that those symbols be not only accurate or even illustrative, but that, withal, they should be presented in a form so far *concentrated* as to make a synopsis or connected view not merely practicable, but easy. There may be more ways than one in which "the words of the wise are as goads;" and more ways than one in which we may be instructed by the proverb, without an irreverent use of it.

The usual adjuncts for the attainment of a concentrated exhibition of truth, and of that *precision* which belongs to true science, cannot be discarded, and no loss ensue. Casting them away on "principle" even, will not free us from the penalty. This is abundantly evident throughout the whole of Dr. Hickok's book, especially in so far as the communication of the author's ideas to others is concerned; and we are constrained to think that such an omission has sometimes led him to conclusions inconsistent with even his own premises: untenable as we must regard them to be.

It is after all conceded that help might have been given to some minds by the interposition of more diagrams; and we will go so far as to confesss that our own ideas have been thus aided. Even before we had reperused the passage here quoted, we had arranged a few simple symbols for ready reference which we will here exhibit and explain:



In this representation it will be observed:

1. The "activities" in question are noted as being "simple" and "spiritual."

2. "The very limit and point of contact of the antagonism" of the "two simple activities meeting each other, and reciprocally holding back, or resting against each other," must be understood to be at L, though the representatives of "the forces in their simple activities" are outspread from these both ways, in order that they may be separately and so distinctly exhibited.

3. "The forces in their simple activities" are represented by arrows; those of the same "kind" which are "*antagonistic*" by arrows turned *inward*, and those of the same "kind" which are "*diremptive*," by *broken* lines, indicating arrows turned *outward;* and thus "the going out and coming in" tendencies "of the opposite kinds of forces in their simple activities" are manifested.

4. The arrows looking inward press against and hold in the arrows represented by the broken lines; so we see that "the diremption" cannot "go off wholly on either side and leave the limit (L) void;" the "diremptive force" is thus visibly "fixed." Neither can the outer arrows "come up from each side and make the limit" (at L) "full;" they being kept asunder by the outward thrust against them of the diremptive arrows; the crowding in of the "antagonist force" is thus seen to be "loosed."

5. The direction of the movement of the diremptive arrows away from L, shows them to be "space-vacating" as respects L, while the others act the other way as "space-filling."

6. Each of the two broken arrows has, moreover, for its own special opposite an arrow of the other sort; and thus we see that "two simples of the opposite kinds of forces must make a new counteraction among themselves;" and that this must take place on both sides of L.

7. Two opposed arrows of the *same* sort, "in their contact in the simple limit," would represent a single "*molecule;*" "the working to the limit," seen in the arrows turned inward, "constituting an antagonistic molecular force," and the working away from the limit, seen in the arrows turned outward, "constituting a diremptive molecular force."

From all that has now been exhibited, it will be seen that the principle that "matter is force" must not be confounded

with the hypothesis which regards atoms as special centres of force. This hypothesis not unfrequently advanced—of which Faraday makes such use—Dr. Hickok does not notice; though he heartily condemns the ordinary one. The hypothesis of centres of force was devised and adopted because the bare necessities of physical investigation did not require anything more than *the laws of action*, as to intensity, &c., of forces. This surely could not be the reason why the author of the "Rational Cosmology" left of matter nothing but force. He certainly intended in that very simplification to seize upon a "principle" behind the law. For he says, distinctly, that "If we have not the unmade principle determining the fact of gravity so to be, and with just such ratios, then we have no rational science of nature, and what we call a law of nature is still a bare fact; an arbitrary making; and no philosophy interpreting the making by its principle" (p. 17.) And again (p. 57) "Facts teach nothing until they are seen in their principles; but when the principle is applied to the fact, and the fact is read and expounded in the principle, then have we and only then, a rational philosophy." Although then the author might strangely seem to be one of a company who throw away every thing material but force, because they have no occasion for anything besides law to work with—however much more they may believe must lie behind it; although this is all so, yet the author of the "Rational Cosmology" is to be acquitted of all sympathy with them, not only because he eschews their deeds, but because his is "a principle" discerned by "a rational insight;" and, "in the teaching of eternal principles" we are to "find by" this "rational insight, what and how creation must have been, and read her great laws not as mere arbitrary facts, &c." (p. 57.) Moreover there are features of the force which he defines, so peculiar, that it requires a special designation, and so it is termed, by way of distinction and emphasis, "*antagonist force.*" This is a force which finds no place among the formulas employed by the dealers in mere laws; except as being the *zero* of forces mutually destructive.

But does the announcement that matter is force, however understood, put us in possession of a principle after all? To us it seems very plain that it is no more than the statement

of a more remote *fact* than that indicated by the other statement, that there is force where matter is; and (if it were becoming in us so to do) we would, therefore, respectfully suggest that the enunciation might have been improved by saying that matter *must be* force. The declaration (it seems to us) would then have been the appropriate expression of "an eternal and necessary principle," which we do not discern in the *fact* that matter *is* force *now*. This we cannot help thinking would have been more consistent; though our own objections to it would still have been as uncompromising as ever. We shall now endeavour to state what those objections are.

And here our difficulty "of clearly apprehending counteraction or antagonism in a single activity" being so great that we fear it will be insuperable, we avail ourselves, as we have heretofore, of the alternative suggested—of what we are informed "will be more readily taken and equally available in result;" viz. "if we here," "conceive of two simple activities meeting each other and reciprocally holding back or resting against each other."

Now, while we disclaim either the right or the wish to advise, we must yet beg to be indulged in one other suggestion. We cannot but think that the hypothesis (or "principle") would be improved, if provision were made for the antagonism all around the point, instead of two opposite directions only; in order that the peculiarities of the "*antagonist force*" might exhibit themselves in all directions around the point, when we attempt to influence that force from without, and thus provide for the phenomena exhibited in the actual world: but our objections are just as real against two such mere simple activities, as they would be if more were introduced at the same place, and we proceed therefore to observe:

1*st.* With respect to all that concerns either activity or counteragency, all physical force however derived, tends to produce similar effects; and these are appropriately described by saying, as physicists do, that force is that which tends to produce, or to modify, or to prevent motion. The elastic force of steam in a boiler may be kept completely in check by the opposing elastic force of a powerful spring, applied to the

safety-valve. Or the same effect may be attained by the application of a sufficient weight, thus counteracting elastic force by the action of gravity. Or, again, for the action of the weight may be substituted that of energetic human muscle, subjected to the continued control of personal effort, of which the man himself is all the while sensible.

Now all these—different it would seem in their origin—all severally serve to hold the *elastic* force of the steam in equilibrio; and however great they may be, if not of a crushing intensity, they will expend their extra energy in pressure on the boiler and its supports. Yet when the same steam is permitted to act upon appropriate machinery, the elastic force, which belongs to the steam, will set the machinery *in motion*, and that with an energy (if the force accumulated be sufficient) such as would overcome and drag away captive more than one thousand horses.

The physical effects or tendencies of force under all these circumstances, are then the same; however they may either be called into action, or else made to hold one another in check; or, under all these relations, force is *force*, however we may get at it, or however apply it; whether we compel rest by the antagonism of opposing forces (i. e. bring about an equilibrium) or, setting force free, let it exhibit its appropriate effect in superinducing the motion of *matter*. Only those who would give force a new place in physics, and require it to do, or tend to do, what it refuses to do at all, only they and no others will find it either "necessary" or *credible* that under the very arrangement of "two countervailing spiritual activities" (p. 139) there should "a new thing" "come from their synthesis;" viz. "*antagonist force.*"

2*d*. Should we be otherwise disposed to adopt the dictum of the "Rational Cosmology" that matter is force, we might well pause in view of the seemingly inevitable consequence of such a step; when we see one who reverentially assents to the fact that God "upholdeth all things by the word of his power," but who yet also maintains that matter is force, express himself thus:—"The antagonism and diremption" are to "be apprehended" "to be the one agency of the Absolute Spirit in one and the same limit of their action" (p. 101.) Now as the anta-

gonism and the diremption are the very phenomena confessed of the matter which is force; insomuch that "at the point of antagonism" of the "two countervailing spiritual activities," "one new thing comes from their" mere "synthesis;" which new thing is represented to be an element of the "substantial reality," matter, the "diremptive" force being also associated with this, "at the very limit and point of the antagonism;" so that "matter is force; distinguishable as antagonist and diremptive" (def. at p. 90)—as all this is expressed in the very terms here exhibited in connection—and withal "the antagonism and diremption" are to "be apprehended" to be "one agency of the Absolute Spirit in one and the same limit of their action;"—are not the phenomena of matter then the veritable phenomena of the Absolute Spirit, and no *thing* else, except in their mere synthesis:—and what is this but the *very verge of pantheism*, if not PANTHEISM ITSELF?

We hesitate to embark in a boat which is so evidently drifting to the edge of such a cataract, and which has cast away its anchor in the rejecting of all matter except that which is force; and Dr. Hickok, as we should think he would, shrinks from any such plunge, though still endeavouring to hold to the boat. Let us hear him:

"The creation of the material is from God; its genesis is in him; its perpetuation and sustentation is from the continual going out of his simple activity; but this material is not God, nor at all competent to rise from its imposed conditions into the place of the Absolute. The Logos, or divine working word, is *in* the world; is the life and light of the world; and yet he was in the beginning with God, and ever is God, while the world is not he but his creature." (P. 102.)

3*d*. If the difficulties already specified were removed, then another would (and it actually does) present itself; which (making use of the terms of the "Rational Cosmology") we shall first exemplify, and then state distinctly. We can well conceive of two pugilists, each of whom has contrived, by his antagonism, to hold the one arm of his opponent completely in check; while the other arm of each, being left free, will show itself to be intensely diremptive; insomuch that it might seem as if it would be much more comfortable, if these *mere* activities

might be put in antagonism and show forth their diremption, without the intervention of any brawny muscles at all; but we have yet to learn how it could be done in this world of ours, or (in so far as we can discern) in any material world of which we have cognizance. Indeed we are taught as much in the "Rational Cosmology" itself. For on p. 99 we find that, "man is utterly merged in matter; and can thus put out no act that shall immediately meet another act in counteraction, but his every act of energizing must first encounter the forces," (matter "which is force," we presume) "in which he is incorporated." How then can any *mere* activity, in the sense of the "Rational Cosmology," be brought into antagonism with any other *mere* activity; when the very condition prerequisite to the putting in antagonism of such activities at all, seems to be that of the *interposition* of *matter itself?** The way of escape from this is indicated as follows: "But with the conception of a Supreme Absolute Spirit all these difficulties are excluded. He can begin action in counteragency with no forces intervening," (no matter between) "and whatever positions he may thus take and hold by permanent forces, though subjective to himself, or within his own sphere of agency, they may be objective to all other being, for all being will be subjective to Him in whom all live and move and have their being." (P. 100.)

To escape thus, is to open the door more widely to *Objection 2d;* and, if we unhesitatingly shun that, the demand that we should admit that *mere* activity may be antagonistic to *mere* activity, requires us to admit a state of things the distinct exhibition of which is nowhere found; it requires, thus, that arrangements should first be present to constitute that very matter which is always itself interposed between activities, whenever we either find them or else place them in antagonism. Even gravitation and other kindred exhibitions of force are, none of them, either found or to be placed in *antagonism*, without the intervention of matter in some way. All the postulates, therefore, have about them too much of the character

* Even those who approach nearest to the "Rational Cosmology," in arguing from the "principle" of the *sufficient reason*, even they suppose a *material point*, on which, at the outset, their elementary forces are to act.

of the *petitio principii*. The matter which is force, in these aspects also, of its relations, exhibits so much of the very marked peculiarity of the "antagonist force," that we must respectfully decline its acquaintance: we doubt its credentials.

4*th*. Several of the phenomena of gravitation especially (to mention no other exhibitions of force) are unprovided for, even with the aid of the additional postulates of the "Rational Cosmology;" particularly the action of that force *through* other bodies than those whose attraction may be in question—the veritable increase of the force in the same body or bodies under new circumstances—and that the appropriate changes in the action of gravitation occupy no appreciable time: all of which will be noticed hereafter.

5*th*. On the plan of the "Rational Cosmology," we would seem to need an additional postulate to account for the difference between solidity and fluidity; and how it is to be introduced does not appear, nor does the "Rational Cosmology," in so far as we have discovered, any where discuss just that.

6*th*. We fear that if we adopted the "principle" of the "Rational Cosmology," it would, moreover, be requisite to provide for something like fits of diremptive excess of force and of the contrary, alternately prevalent within very narrow limits, close to the places held by the forces; to provide for the *alternations* of attraction and repulsion, which *are* exhibited when the molecules of bodies are brought nearer and nearer together; all which changes are contemplated in the atomic theory of Boscovich.

7*th*. If all these difficulties were not more than enough in themselves: the continued co-existence, at the same limit of the antagonist and diremptive activities, with nothing else interposed or associated but just what those activities are asserted to produce—all this is itself incompatible with the laws of force and motion, now universally recognized, and which Dr. Hickok would establish as "principles" in his own way.

For that the activities, or else the urgencies with which those activities either press or draw, that these are so many measures of the forces in action, or else kept in equilibrio, is what all the researches of science everywhere justify; insomuch that when

the activities are kept in equilibrio, the forces also are in equilibrio; &c., &c. Now either the activities of both sorts (antagonist and diremptive) would altogether keep one another in equilibrio, and the resultant (the force, in effect) be a *zero* of force; and thus the matter which is force be annihilated—nothing remaining as any effect of force or of activity: or else the efficient result (mechanical resultant), which must be single, would be in the *one direction* of the greater force, or of the more efficient combination of forces, and so two resultants, and their appropriate manifestations, could no longer have place.

To those who are at all familiar with physical science, this must be sufficiently evident, upon the bare statement of these conditions. Others may find an imperfect parallel, by trying to think of something like a cartridge in a cannon holding itself in shape in the direction of its length, while it, at the same time acts explosively, and thus speeds the ball on its errand, and withal produces the recoil of the piece.

8*th.* Apart from *Objection* 7*th*, as it is distinctly stated, we learn withal that we are to take for "'the independent action of force" "the conception of two countervailing spiritual activities." (P. 139.) What the resultant of such activities must be we have distinctly stated before, but we repeat the statement here that the objection which it involves may have its place with the others. Being countervailing, the activities must, in accordance with the laws of force, be equivalent; and in the reasoning which follows the enunciation here quoted they are so regarded, and the symmetrical spherical form of creation is exhibited as a consequence of that condition of the forces.

Now the resultant of two such countervailing activities all nature, everywhere, proclaims to be an activity reduced to *utter helplessness;* and yet it is at the point of antagonism of activities (or of one activity and part of another) situated just so, that the "*antagonist force*" itself is said to be "generated"—in the passages already quoted;—and this is the force, for which it is claimed, that it does so much besides.

It is a very grave fact, that this helplessness—this *zero*-force—does just what might be expected of it in its true character, when the author of the Rational Cosmology employs it

with the expectation of producing such effects as we actually find in nature; as—with a sincere respect for him, but under the uncompromising pressure of a duty to be discharged with respect to his "philosophy" and its tendencies—we shall endeavor to make entirely manifest. Previously to that however some other things remain to be noticed.

We pause for the present in our enumeration of objections, and shall now try to show in what light we are to regard the "principle," that "matter is force;" if (waving everything that has been advanced) we might after all accept of it.

We have already ventured to suggest that, in its present form, it is only expressive of a more remote fact than would be apparent if the laws of force alone were our limit. But whether matter *is*, or whether it *must be* force, what have we gained by knowing that, as long as the "rational insight" even can inform us of nothing more than the *mode* of action or of antagonism of the activities in question; or, if *accurate measure* as well as mode be clearly signified, it is at most with the *law* of action or of antagonism that we have to do? These working "principles" whether we gain them "by an immediate insight into things themselves;" or discover that they are "necessary determinations of the reason in its insight into the grounds of force;" or whether we, "at the best, only creep up from one fact to another on the ground of assumed uniformity in experience" (pp. 139 & 120); and then, withal, call these "principles" by their name when obtained by the "clear insight;" but laws of nature, and so only "bare facts" (p. 17,) when otherwise determined—no matter how we get them, they only inform us, after all, of *how* force, or activity, &c., is efficient or else countervailing, but still leave unanswered the question, *What* is force? To say that it is "generated at the point of antagonism" of "two countervailing *spiritual* activities" only makes that same question the more difficult to answer. We hope this is not beyond the reach of illustration?

As we describe force by stating what it does or tends to do, let the same be attempted in the instance of a piece of machinery: we will take for our example a sewing-machine. A sewing-machine, thus described, is an instrument so contrived as to *do just this*—to penetrate the cloth so as to intro-

duce the thread, and take a suitable stitch; and then to draw the stitch closely together, so as to hold all securely in place. Or, if we may, without offence, apply philosophical terms to such a case, we may say, that every machine of this sort must needs carry out the principle of being diremptive of the cloth, and place-holding in its adjustment of the stitch, just where the diremption was effected. But all this would give us no idea of the actual construction of any such machine itself.

Thus whatever insight we may gain, or however we may gain it, we only learn what force does or tends to do, or, if any more, at most how it is compassed about or situated, but *what* force is we do not know after all. When we know that, we shall perhaps know what matter is;—not force, we are well persuaded. And when we know what force is (if we ever do in *this* world,) we shall very probably be able to deduce from that *principle* what force may do or tend to do, and what, under the existing system of nature, it must do or tend to do (because it is force) everywhere; and then too we may hope to learn how force associated with matter, so that both may do work, (i. e. *power*) can be bottled up, as it were, for centuries in a ton of coal, and then suddenly set free under a steam boiler, developing somehow the efficiency which drives the engine. Until we are better informed with regard to *veritable* principles, which lie concealed here, while we as yet know only the laws which govern the tendencies or the effects of force or of activity, we may make use of the terms *antagonist* and *diremptive*, as being presumed to be more accurately descriptive of *modes* of action; but the question will still remain, "what has been gained except simply removing the mystery and our ignorance one step further back;"* and we would add, in the case before us, placing the matter to be explained more deeply in the shade?

Having obtained the view that matter is itself a combination and resultant of mere activities, the author of the "Rational Cosmology," as might have been anticipated, shows himself vehemently opposed to the old doctrine of *inertia* and all that pertains to it; or at least to what he understands by that doctrine. Thus, among other things, he says—"The sense

* Dr. Hickok's own words with reference to gravitation in comparison with the old notion, "that nature abhors a vacuum." (P. 147.)

conception of matter can by no possibility admit of anything static or dynamic in nature. The supposed matter is wholly dead; mere *inertia;* and can possess nothing by which it may be conceived as holding itself in place whereby it may sustain anything, nor as moving from its place whereby it might push or pull anything, &c., &c." (Pp. 117 and 118.)

Our objections to regarding matter just thus, as *mere* inertia, are quite as intense—though we would rather state them, if need were, in our own way. Indeed we might even be more inclined to believe that "matter is force," than that it is inertia. But while we feel free to say this, we also feel nearly as free to say, that the inertia which Dr. Hickok has thus characterized is an inertia in which nobody believes. The statement involves a mere straining of the term beyond the sense in which it is employed in physics. We must be allowed an illustration again:—

The drones in a bee-hive do nothing toward the making of honey &c., nor toward the housing or preservation of it either —they are so far *inert*—they are veritably *non-workers;* but, alas, they have excellent appetites, and so consume that which they cannot produce. But will any one assert that, when we say, with this distinct explanation, that inertia is a very special characteristic of the drones, and say so truly, that we thereby make the drones to be mere laziness? That could not even be asserted, if it were also true, that it was not unusual for three or four workers at once to seize upon a well-developed drone, and guiding the paws, &c., of the unresisting inert, make good use of them in adjusting the waxen walls of the cells.

A live body (or what is consciously in it) may, moreover, through its activity, oppose any energy which we may put forth, and sometimes even weary us out by such an opposition. But when the same body is dead its derived activity is gone, and can no longer be brought into antagonism with ourselves; the dead body is a non-worker—it is inert: but we should find ourselves most unpleasantly situated if we should stumble over it, or our strength (our *energy*) tried, if we should endeavour to move it. We would find *reaction embodied somehow*, to oppose our energy, and to be, *in effect*, an opposing energy,

and so a *force-waster*, as far as we were concerned, in the sense, and to the same extent, that the activity we thus must *lose* was itself efficient (or might be efficient) in the live body opposing us before. Like the drone, the inert body cannot work, but it makes way with the product of the efforts of others, that can and do exert themselves.

And yet this non-working, this inert matter, may be set in motion by the application of *extraneous* force, and will then be found to be in *a state of power;* i. e. it will somehow have a force accumulated in it, or accompanying it, which is adequate to do work, to break up or even to wholly displace other matter, and to tell powerfully *against* any living energy that may be brought to oppose it;—to produce thus the appropriate effects of *energetic force.* The inertia of matter, its *persistence* in a state of rest, because it could not start itself, has been overcome, and its persistence in a state of motion established; a persistence which matter itself cannot *check*, much less *overcome;* to do *that* would require again the application of *extraneous* force. Even gravitation, that intimate associate of all matter termed ponderable, even gravitation has this characteristic of extraneous force, in its being more or less accumulated in the same body, according to circumstances. The *mutual* action of this sort in the case of the earth and the moon when they are nearest to one another is more intense than when they are farthest asunder, nearly in the ratio of 37 to 29; yet the matter itself of neither has been increased, nor has the size of either been changed thereby; and hence they both continue to turn around their respective axes in the same time as before, and with the same moment of inertia. Matter in a state of power is withal anything but "a mere negation," it is the *substantial* club in the hands of him who wields it, it is the *somewhat with* which he strikes; and if he, or something else, do not check it before it comes down, it may strike with terrible effect. Dr. Hickok would have the club made of something like mere human strength properly antagonized, but diremptive still.

The facts involved in the statement that matter is *inert* or non-working in the sense or senses thus illustrated, are these; that matter can neither *originate* its own *transference* through

space, nor yet *control* that *transference* when extraneous force has compelled it. These are facts as incontrovertibly established as are the laws of motion themselves, which indeed involve these very facts.

To explain and reconcile all the several facts in question may not be easy; but, rightly understood, the knowledge of them, and of the laws dependent upon them, is among the most precise and well ascertained that we possess. They are among the well ascertained affections and relations of things; and with instruments such as these of well determined form and measure, science has wrought out her well proportioned and beautiful results.

In accordance with the doctrine of inertia as here exhibited, it is found that the smallest force applied to the greatest mass will produce some motion, whenever the mass is left free to obey the force; i. e. when the mass is not restrained by an obstacle, or any other completely countervailing energy apart from that mass itself; though some considerable *time* may be consumed in superinducing the motion, under ordinary circumstances.

Now, if indeed some fraction of the extraneous force is, withal, consumed in changing the state of the mass from rest to motion, that portion is always in a constant ratio to the force itself; so that, be that force great or small, a similar fraction of the force will be left to transfer the body: and thus the law is maintained that motion produced by even the momentary action of force is proportional to the force impressed—a law confirmed everywhere.

Let it be seen, how the principle of the Rational Cosmology will deal with this: "A static force is that antagonism which holds itself at rest in its balanced counteraction. A dynamic force goes to the overcoming of a static. It may draw or expel, but it goes to the removing another force at rest, or to the retarding or accelerating another force in motion. Should the dynamic not be sufficient to overcome the static, still, in so far as its intensity of antagonism goes toward this, it is thus far dynamic though the static does not yield to it." (P. 118.) "The original intensity of antagonism is its *quantity of matter*." (P. 129.)

"The intensity of antagonism in any point of force is its measure to resist motion. If this intensity be small, a small measure of excess in the energy of one activity over the other will generate motion; and if this intensity be great, a greater excess of energy on one side of the activities must be necessary to generate motion. If then one point of force is to move another point of force," (one molecule to move another molecule, we presume,) "the former must have one of two prerogatives; either a greater intensity, and when just moved its impulse will overcome the latter and displace it, or, a strong excess of energy in one side of its activities that may move to a violent impulse, and then, though of less intensity, the strenuous movement of the former may displace the latter." "The force moved is as its static intensity; the force moving it as its static intensity combined with its excess of energy on one side, and however this be made up so as to exceed the force of the former, or force moved, whether by more static intensity, or more excess of energy in one activity, when thus exceeding it must generate motion.

"And the rate of motion, or velocity, must be proportioned to this excess of dynamic over the static force. The least degree beyond equilibration of intensity must move; and the augmentation of preponderance must so much more move, and thus as nothing but this excess generates motion and all the excess generates its own measure of motion, the degree of motion, or velocity, must be as the moving exceeds the moved intensity of force." (Pp. 127 and 128.)

In accordance with all that is here quoted, it will be seen that the intensity of antagonism or quantity of matter may readily be so great that no small force or excess of energy could move it all; whereas the *facts* as already stated are all the other way, the smallest force moving the greatest mass, &c. The case as presented by the "Rational Cosmology" has only the laws of nature against it, in their working, everywhere; and this is what comes of the "thought-conception of space-filling force as the true substantial matter," which it is stated "involves the full conception of both statics and dynamics:" to which it is added that "counteraction in equilibrium must stand self-fixed." (P. 118.) The "philosophy" which involves

such conclusions is self-convicted as soon as it is applied; for matter, however great its "original intensity of antagonism," refuses to be "self-fixed," but quits its place when the smallest force is applied.

Here again, the counteraction in equilibrium proves itself to be effectually good for nothing or *zero;* viz. in its special self-fixing energy, as respects holding its place in space; and so it will, again and again, in other relations hereafter. Just *how*, after all, it is supposed that it can have any energy apart from its antagonism, will be considered in its appropriate place; but the truth *must* be told: this counteraction in equilibrium, this *zero*-force, (as it is in effect, in this and other operations attributed to it,) is force with all its energy so effectually checked, that it can do, or tend to do, nothing else; it is force with all efficient force for other purposes taken out of it, and finds its parallel in that rare condiment *fresh*-salt; which, if we could but obtain it, might be employed in a well recognized but suppositious experiment.

Nay more, "the intensity of antagonism in any point of force is its measure to resist motion." This we may accept, when we believe that a man who has large debts, with a credit which will exactly balance them—or whom we may regard as having had a large estate, which he has just entirely squandered—has really any greater riches than another who never had much property, but who has just fully expended all that he had. Has either of these (we would ask) any better defence against the attacks of coming want in the balance which he owns, over and above that of his fellow? There may indeed be reasons why the situation of the one is more *deplorable* than that of the other; but each has an equal "landed estate somewhere in Terra Incognita," and each has an equal amount deposited in the Utopian Bank.

We are withal told that "In this third principle of motion there is involved the conception of *momentum*, which on account of its wide application to physical science, it is important should be made clear and exact," (p. 129.) With this we entirely agree; and now append the explanation.

"In the body moving, its power of impulse or capacity to act on other bodies is an aggregate of force from two sources. It

has received the excess of intensity over its own in the body moving it, and this now becomes one part of its force to strike and move another body. This is measured by its own velocity, for it is this excess that has made the whole movement, and we may thus represent the force acquired by the *velocity* imparted. But its measure of intensity that it originally had, and which had neutralized just an equal amount of intensity in the body which impinged upon it, has not all been annihilated. It neutralized its own measure in the other body to produce motion, and left only the excess to pass over into the moved body, but itself remained in, and goes along with, and is indeed the very essence of, the moved body, and this original intensity it now has also, wherewith to strike and move other bodies. This original intensity of its antagonism is its *quantity of matter*. The aggregate of force in the excess imparted from the moving body, and which is represented by the acquired velocity together with its own original intensity of antagonism, and which is its quantity of matter, now constitute the capability the body possesses to generate motion in some third body; and this whole aggregate of motion generating force is what we comprehend under the term *momentum*. It is commonly said to be compounded of the velocity and quantity of matter, but it should not thereby be understood that mere motion has itself any moving force, or capacity to generate motion, but only that the motion is the index of the moving force which generated it, and which has been transferred to it from the force moving it."

"The principle involved in *virtual velocities*, when the less quantity of matter balances the greater, or more generally in all cases of equilibrium, refers at once to the conception of momentum. The less force balances the greater, because the motion of the less would be more rapid in the inverse ratio of its comparative weight." (Pp. 129 and 130.)

By the moving body spoken of in the beginning of this explanation, is evidently to be understood the body put in motion—the body moved. And "the measure of intensity that it originally had," "has neutralized its own measure in the other body," &c.; "but itself remained in, and goes along with, and indeed is the very essence of the moved body, and

this original intensity it now has also, wherewith to strike and move other bodies."

How do such intensities appear when brought into antagonism, &c., in actual experience? The two pugilists referred to in one of our former illustrations, had each "neutralized" his "own measure in the other" body's arm, by holding that arm fast, "and left only the excess" of strength, if any, which his opponent might possess, "to pass over" and overthrow or otherwise maltreat his adversary. But the strength of the *restrained* arm of the weaker man, "itself remained in, and goes along with and indeed" (matter being force) "is the very essence" of the arm itself, and "this original intensity," this strength of the restrained arm, (this "very essence" of the arm itself,) "it now has also wherewith to strike and move other bodies;" though the opponent of the weaker man, all the while holds the same arm fast. The strength is there—that is conceded, but the man *now* has it not with which to strike and move other bodies: he *will* have, when the strong man sets him free.

We desire not to comment on the other steps of the reasoning, but must leave them, as we have quoted them in full, to speak for themselves. That the intention has been to bring out the doctrine of momentum *right*, is evinced by what is afterwards said of virtual velocities: the exposition will be entitled to be called a demonstration, when it is admitted that 8 times 10 *zeros*, or 80 *zeros*, will amount to just 4 times as much as 5 times 4 *zeros*, i. e. 20 *zeros*.

"The first principle of motion is *that it must be rectilineal and uniform.*" P. 120. The motion is represented as being produced by an excess of energy of one of two activities; and it is stated that "the excess of energy" in the stronger, "having nothing to balance it, will forbid that it should be holden in any one point; and yet, as the weaker activity continues its antagonism to the amount of its energy, there is a perpetual space-filling force, which cannot be holden in any one point of space. The result must be a constant force which cannot abide in any one position, and it is thus the idea of the generation of motion." (P. 121.) The deductions from this are, 1. That the motion must be *incessant.* 2. That it must be *rectilineal.* 3. That it must be *uniform.*

The first of these cannot be disputed, as the force is all the while acting; but the effect must even therefore be *cumulative*. When unobstructed force continues to act in the same direction, it continues to produce its appropriate effect in that direction; it inevitably *accelerates*. The motion will go on, faster and faster. The case becomes that of falling bodies. The veritable case contemplated here, but not reached, is that of the *momentary* action of force. Very remarkable it is, that *that* should superinduce a *uniform* and rectilineal motion. The conclusion of the "rational insight," apart from all experience, would, as it seems to us, be (as is usual in this connexion) the other way; viz. that the effect of a *momentary* action must, after a time, be worn out; but it is not so; it remains, and will remain (if unobstructed) ever, *in all its intensity*. How the "principle" of the "Rational Cosmology" would provide for *that* does not appear; unless it might be on the impracticable plan exhibited in the explanation of momentum. That the direction of the motion should also be *rectilineal* is the most simple arrangement supposable. It appears to us the most natural withal, because we have always been accustomed to its working. That such an arrangement is necessary, even in a subordinate sense, we had rather not assert, before we know what force is, at the very least. The fact, that a momentary force is ever afterward efficient, is itself specially emblematical of what must ensue from the application of a *wrong* "principle."

What will be the resultant of two forces acting at an angle, is also discussed. We are not disposed to analyze the reasoning, nor have we room for such an analysis: the conclusion is quite sufficient to condemn the whole as a demonstration of truth. It is, that if forces which act at an angle are "of unequal excess of energies, their composition must give the line dividing their angle in the inverse ratio of the excess of energy, viz. the greater excess to have proportionately the less space, and the less excess to have proportionately the greater space, on their respective sides of the divided angle between them." (Pp. 125 and 126.) The ratio is *not* that of the partial *angles* in question, but that of their respective *sines*. The contrary would introduce confusion everywhere, in ways to be specified hereafter. What is here stated of course vitiates also the conclusion with regard to the *inclined plane*.

The results being thus contradictory to fact, the inquiry may well arise, what were the phenomena in which the author of the "Rational Cosmology" supposed that he most distinctly discerned the working of his principles; and also in what precise way the "antagonist force" acts? He has not left us in the dark in either of these respects. He seems to have derived his idea of *place-holding* force from those complex phenomena of elasticity which are always due to a molecular *displacement* of *matter*. For on pp. 119 and 120 we have:

"It is also obvious that a static is nothing in nature without a dynamic, for were there no push nor pull there could be no holding place by an equal antagonism; and so also that there can be no dynamic in nature that has not also its static, for no push nor pull could be without a stand-point. In nature there is complete sophism of the ὕστερον πρότερον; and were there no way of attaining to the supernatural, both the perpetuation of rest and the beginning of motion would be absurdities; for you must first have your motion in the very act of *holding* at rest, and you must first have your rest as the hold-point or spring-board of your *moving* some other body. The only way out of such an antinomy, between nature in the understanding and nature in the sense, is the apprehension of a supernatural in the reason. An absolute spirit has the spring to an originating act in himself, in that he is ethical law in his spiritual excellency to govern himself. He may originate action, directly from the claims as known to be due from himself to himself. He has an *ethical* stand-point and spring-board, and can thus put forth his spiritual act in counteraction and make a beginning. Spiritual activity put in counteragency makes a *physical* stand-point; takes a position and holds it; and in that a static force already is, from which all physical mechanics may go out in operation."

The author's idea of the precise mode of action of the antagonist forces is first discerned in the complex phenomena which would be presented if "two rigid metallic rods" were pressed "together at their ends," and then one "should procure a complete fusion of the metal in the two rods at the point of contact." The result is stated to be "an accumulation of the metal from both in a rude globe of molten matter about the point of contact." (Pp. 134 and 135.)

From this result, in which ten thousand oblique molecular

actions are concerned, it is actually inferred that the resultant of two antagonistic activities of this sort is not *zero*, but "a growth, a new-birth of forces from the original point of counterworking," (p. 140,) and that this veritable resultant is *at right angles* to the line of antagonism of the two activities; i. e. in a direction, or in directions, of the greatest accumulation of matter in the globe about the point of contact. We cannot be mistaken in this respect; for the idea is carried out in full, through ten entire pages, under the head of "The Material Creation a Sphere:" as well as abundantly elsewhere.

This supposed action is also exemplified by the effect produced by dropping a stone into a lake; also by the progress of sound.

We observe, in passing, that the waves of sound are compared to the waves on the disturbed surface of the lake; thus—"The percussion of solid bodies, or the force of the human voice, make their similar circular, or, as entirely surrounded, their spherical waves in the atmosphere," &c. (p. 138.) The waves in the water rise and fall in directions at *right angles* to their *respective lines* of outward progress: the waves of sound are those of alternate condensation and rarefaction *in the respective directions* of their lines of progress.

Two of the conclusions which have now been distinctly exhibited and on which we have already commented, would, if true, be so important in their consequences, that they deserve to be restated, together with a declaration and description of what those consequences would be. The first of these conclusions is—that two countervailing forces (or activities) have a veritable resultant, or resultants, at right angles to their line of antagonism; the second, that when forces of "unequal excess of energies" act at an angle, their composition "must give the line dividing their angle in the inverse ratio of the excess of energy:" which would imply that in the two triangles into which the parallelogram of forces is divided, the *sides* should be as their opposite *angles*, instead of being as the *sines* of those angles. Now the prevalence of only these two as laws in the world actual, would lead to the following results:

It would derange the motions of all the heavenly bodies, at once—would render utterly unsuccessful all astronomical prediction—would make nugatory every computation of the

architect—it would change the rate of all our clocks—it would do much more:—it would urge the ocean to career over the land; and thus go far to even falsify the promise held forth in the rainbow: for the effects would be cumulative. It would modify all the analogous actions of the imponderable substances; rendering twilight different in extent and duration from what it really is—make every telescope a happy accident—and change all the climates of the earth more or less. It would (unless some unforeseen compensation should arise) introduce discord into every stringed instrument of music ever made—it would toss the atmosphere into storms such as the world has never seen. All these effects, and more than we can think of, would take place;—and of all that is here asserted *we fearlessly challenge the contradiction* by any one who knows enough of the physical forces, to know how the Great, the Almighty Sovereign of All is really pleased to order them.

It is truly gratifying to turn from the paralogisms of the Rational Cosmology, and behold their author in a very different light. The introduction to his description of what he regards as the creation of matter, contains a paragraph which we regard as one of the very finest in his book; and there are many which indicate his ability. He says of "a Supreme Absolute Spirit:" "But in the knowledge he has of his own supreme excellency of being, there is an end in his own dignity and glory ever before him. He knows what is due to himself, and nothing can intervene that he should not be true to himself. 'He remaineth faithful, he cannot deny himself.' He sees that it behooves him, as a right consciously due to himself, to manifest himself in creation. Under such ethical behest, and not at all before the impulse of any constitutional craving, God arises to the work of creation, and becomes a beginner and Author of an existence which before was not." (P. 100.)

This is no appropriate part of the "Rational Cosmology"—it seems almost out of place in it. It is Dr. Hickok himself, when he has, with humble reverence, looked into the mirror of divine truth; and, having been cheered and reanimated by its reflected beams, he then skilfully holds up the mirror to others.

But "he straightway" forgets "what manner of man he was" —philosophically we mean, not otherwise—for, on the very

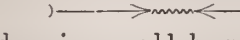
next page, the author of the "Rational Cosmology" begins his description of "creation, as an origination of matter," thus:—

"Solely from the reason (*this* reason?), and not from any want as if he too had a nature, God puts his simple activity in counteragency. He makes act meet and hold act, and in this originates an antagonism which constitutes force; a new thing; a something standing out for objective manifestation, and holding itself in position as a reality distinct from his own subjective simplicity. This force fixes itself in position; holds itself at rest; and so far from being inert, its very existence is a *vis inertiæ*, or a force actively holding itself still. Combined with this antagonist activity, in the same limit of counteraction, is the diremptive activity;" as described in the passages heretofore quoted. We have already expressed ourselves with regard to any such exposition. What is intended by it, the views already commented on will sufficiently indicate.

After this we are informed as to how the material creation progressed; how it became a sphere.

"Taking then the independent action of force, as the conception of two countervailing spiritual activities, and following out the action directly according to the necessary laws of motion, we come to the knowledge that matter must accumulate itself about the point of counteragency in the form of a sphere, and must take on all the properties of a solid globe, which has the whole space filled from the centre to the circumference with successive forces, in their contiguous positions, sent off from the central action of the original simple antagonism." (P. 139.)

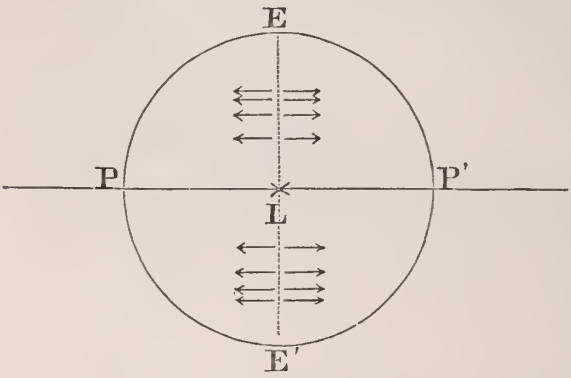
As we have heretofore indicated and shown by quotation, the conception of the mode of action of the two activities is discerned in the reaction of an elastic spring-board. Thus, "you must first have your rest as the hold-point or spring-board of your *moving* some other body." Also it is said of "an absolute spirit" that "he has an *ethical* stand-point and spring-board." (P. 119.) The author, therefore, must suppose a reaction of the activities backward, "each agency turning its opposite back upon itself," (p. 140); a recoil, such as spiral springs crowded up between two arrows would have



Only *one* pressed spring would be needed; hence we presume

the idea of "counteraction or antagonism in a single activity," (p. 94,) heretofore spoken of; and the "conception of matter" as being a "combination of distinguishable forces," (p. 96); both the crowding in, and the reacting outward being where the spring is.

This arrangement might be practicable in the case of a pressed spring, a spring of a veritable elastic *material;* but the reaction would be the resultant of ten thousand molecular forces, instead of only two. But whether this be all so or not, the subsequent processes described are all in accordance with the impracticable laws of force already condemned; because found to be either inadequate, or else wrong, everywhere. The



processes are these: The simple reacting forces go out from the limit L, in the two directions backward from the arrow-points, toward P and P'.* Then it is asserted that, "while the simple reacting force would go out in right lines directly back each way from the point of contact, the compounded forces will rise, as it were in a ring, at the point of contact directly transverse of the original line of action." This ring E E' is here seen edgewise, and so appears like a straight line; it is afterward styled "the equatorial ring." Then the accumulation begins at right angles to the ring itself, as represented by the short arrows, and so two other rings are formed parallel to the ring E E'; and this "will be, in fact, the turning of the whole ring on each side from itself, and making it to flow in newly engendered streams of forces on both sides backward toward

* The figure is, of course, our own.

the polar points" P and P′. These polar points are represented as keeping "the continued activity" "from going back any further in a right line" (P P′) "as an axis;" and so those activities "must perpetuate this flowing back, on each side of the equator, in new generations of forces, till they meet in their respective polar points, and a proper globe is thus formed by a spherical layer all about the central point. This primitive globe is now self-balanced in all its points, but as the central action goes on, it must again push each way in the axis and generate two other polar points beyond, thereby elongating the axis," (as is represented in the figure) "and in this elongation there comes as before a static rest in the axial direction, and the central working must rise again in a new transverse ring, and repeat a new flow of forces in their rings from the equator each way to the poles, and augment the globe by another ensphering layer," &c. &c.;—"and so on indefinitely, till the reactions in the accumulating forces of the globe balance the energy of the central working, and the globe ceases to grow." (Pp. 140–142.) Moreover "the continual working at the centre continually generates new balls within the old, expanding the old as the new are generated within them," . . . . "and the whole globe is held in one as it were by a perpetuated agency that runs through and connects every position. No portion of the material force is isolate from the rest, but the whole ball is concrete from the centre through its entire sphere." It is stated, moreover, that "By no way can the created matter be lost except through a dissolution of the central force," and, that gone, "the outlying forces in the globe would have nothing to rest upon, and they must all dissolve, and literally,"

> 'Like the baseless fabric of a vision,
> Leave not a wreck behind.'—(Pp. 143, 144.)

What shall we say then, when we remember that this very "central force" is the activity reduced to helplessness, the *zero*-force, which we have heretofore described and characterized? Why truly that what we have here quoted, accurately describes what the whole globe is, and what its fate must be.

Even if this were not so, we see, withal, that it is not nature in general, but the central force that *abhors a vacuum;* and, as

it used to be said, there is *a limit* to the abhorrence, so here: for though "an infinite energy at the centre may generate new layers infinitely," yet we are also told, that when the power that created "ceases to augment the central action against the ensphered reactions, the globe will have attained its determined magnitude." (P. 142.) The question then recurs as to "what has been gained, except simply removing the mystery and our ignorance one step further back," (p. 147;) but it is visibly applicable to the "philosophy" of the "Rational Cosmology," instead of the Newtonian theory of gravitation.

Another illustration of the actual state of things here supposed, seems to us to be precisely in point; but we forbear to employ it, lest our object should seem to be mere ridicule. But unfortunately for the "Rational Cosmology" there is a point beyond the ridiculous; and that the "philosophy" here in question has attained to it may readily be shown, for, in this connexion, that philosophy has ventured again into the region of exact science; the region of ascertained fact and well-determined law.

For "the insight of the reason" is next "turned" "to the eternally necessary and immutable law of gravity." (P. 148.) The ensphering action is reviewed, and farther exhibited, and it is stated, that "the central point expels the outlying points on all sides;" while the other points are so situated, that "each point" "must on the side towards the centre act upon it, and only on the side from the centre act upon the layer exterior to it," &c. (P. 150.) Then, besides, that "It is a necessary determination that a globe so generated should have in every molecular force a centrifugal and a centripetal tendency just balancing each other, and thus holding the molecule at rest. The centrifugal force, it is said, "is properly *expulsion*," and the centripetal "*repulsion;*" though the terms attraction and repulsion are retained under protest. (P. 151.)* Under the

* There have been several attempts to account for gravitation; among others the elastic fluid supposed by Newton himself. Playfair found, by rigid investigation, that for this purpose, there is only required an elastic fluid, of which the density is as the distance from the central body, and the elasticity as a certain given magnitude diminished by the reciprocal of that distance. Here repulsion comes in at least appropriately.

head of "the principle of falling bodies" we have, what would seem to be an additional postulate, of "one simple activity of a greater energy working toward the centre, and one activity of a less energy working from the centre." (P. 155.)* Be that as it may, it is with the laws of repulsion and attraction here deduced from the consideration of the forces that we are principally concerned. On page 153 we have "the necessary law for repulsion," expressed thus: "*directly as quantity of matter, and inversely as the cube of the distance.*"

Now as the cube of the distance is *zero* at the centre, the law will of course require an *infinite* repulsion at *the centre*, as the resultant of the *finite* "working" originally begun *absolutely there.* But an infinite repulsion once seated there, what is to prevent *it* from acting in the manner before described; and then "an infinite energy at the centre may generate new layers infinitely," (p. 142); and the globe must very soon be beyond all bounds.

The inconsistencies do not even end here. For "the attractive force," withal, "must be *directly as the quantity of matter and inversely as the square of the distance.*" (P. 154.) Now as in approaching the centre the repulsive force increases by a more rapid law than the attractive; if then, in the instance of any molecule, we have "a centrifugal and centripetal tendency just balancing each other, and thus holding the molecule at rest," then repulsion must prevail for points nearer the centre; and so, if matter under these circumstances could exist at all, it would be driven away from the centre, to the limit of the just balancing forces, and the sphere be hollow; while beyond the limit it must at first increase in density, &c., &c. Nay more, the attractive force, separately considered, is itself all false to nature. For it is "*in* all globes" (p. 154) that the law "must" prevail. Now the attractive force of the earth (its

* Physical astronomy has demonstrated that gravitation is not modified by the interposition of the bodies which transmit it. How will "*place-holding*" force and the "principles of motion" dispose of this?

Gravitation withal exhibits itself not as an *emanation*, requiring (like light) *time* for its transmission. Its velocity, if not infinite, must be at least *fifty million* of times greater than the velocity of light, (Méc. Céleste.) How can so much *more, or so much less* force be there, without loss of time, when circumstances require it, if matter *be itself force*, definitely arranged already?

intensity we mean) has been determined in at last four different ways; and all involve the doctrine, abundantly confirmed otherwise, that every molecule attracts every other directly as its mass indeed, and inversely as the square of the distance between them. But just in accordance with that, the attractive force at the centre of a symmetrically arranged globe must be *zero* instead of the *infinity* due to the law of the "Rational Cosmology;" for the forces all around the centre hold one another in equilibrio there: it is the case of millions of countervailing forces, all reduced to *zero*, of course. With respect to other points *within* the globe, the well digested investigations of physics with respect to central forces show that in a sphere of a uniform density, the force varies *directly as the distance from the centre*; but when the globe is more dense toward the centre, the attractive force would not vary quite so rapidly with the increase of distance: the former is the case in question. The law as expressed in the "Rational Cosmology" is that of attraction on a particle *outside* of the sphere, instead of *within*.

Thus, with respect to both the attractive and the repulsive force, the solution of the "Rational Cosmology" has surpassed the point *beyond* the ridiculous to an extent that cannot well be exceeded; and this with its central force veritably *zero*. The despised inductive method would seem here not out of place, in leading as it does to the generalization;—That all false philosophies have this feature in common; the attempt to veritably make something out of nothing.

Afterward it is said, with respect to the law of attraction, that it "is true again, not only of all globes in respect to each one's own portions of matter among themselves, but of all globes relatively to each other." The law indeed prevails with respect to the action of a sphere on a molecule without it, and hence controls the action of one sphere on another; but the mode of illustration in the "Rational Cosmology" is peculiar. For, we learn that, "when any two globes come within each other's range of attraction so that the peripheries of their spheres cut each other, the point of contact is at once a point of antagonism, and their acting central forces must so work this commencing antagonism as to push each one back upon itself and begin an ensphering anew, with the central point at

the first point of contact, and the forces of each globe must be successively turned back in a hemisphere within itself, and both together must form a new globe around the central point, and like 'kindred drops both ultimately mingle into one.'"

We find, withal, that "Any masses of matter less or more, must stand to each other as two such globes when they have their gravitating forces brought in contact, and their common centre of gravity must work after this eternal principle." (Pp. 154 and 155.)

We *must* leave this illustration (as such) to speak for itself. In no other way scarcely, could all we have before said about precision and other matters connected with it, be so well justified.

The author's remarks on p. 268 convey an idea to which we would earnestly demur; viz. a central point of revolution for all the visible creation, as being the last conclusion to which the doctrine of gravitation must tend. The author of the "Rational Cosmology" however, or any one else, will find it difficult to make it even probable that absolute rest exists anywhere in all this wide domain. That there may be absolute rest, is derived by an *induction:* we do not find it realized.

We have no room for a criticism of the explanation of capillary attraction (p. 262, &c.) It leaves out we may say several of the facts; and those omitted will be found to condemn it; especially the *depression* of mercury in a glass tube of a fine bore, below the level of the mercury in the basin in which the tube is plunged; the very decidedly *convex* surface of the top of the column even then; &c.

We have already spoken incidentally of the principle of falling bodies, we can only speak here of results; having already occupied a greater space than we had intended.

On pages 157 and 158, the spaces traversed in successive and equal times seem to be correctly stated, after the *principal* fact has been *assumed;* and the reasoning, after the veritable quantities are introduced, goes on consistently, though involving errors already commented on before that. But then the law, when summed up, is on pages 158 and 159 applied to the *velocities last acquired* instead of the *spaces variably traversed.* Now the action of gravitation near the surface of the earth

being in effect constant, the velocity acquired during each successive moment is the same; and thus the *velocity* is twice as great at the end of two moments from the beginning of the fall as at the end of only one, &c., &c.: the velocities acquired being directly as *the times*, instead of the *squares* of the times. A different result established as a law would derange the action of gravitation everywhere.

At the top of page 160 we have the old error of angle for sine. Farther down the page we have the ratio of the height of an inclined plane to its length, which gives the sine and not the angle; and so contradicts the other statement.

The *principle of heat* finds the "diremptive force" in place, (pp. 179, &c.;) the diremptive force being, in some of its relations, another name for the repulsive force of heat. Every thing else in connection with heat is marred by the presence of the old helpless antagonist force.

When the water in a canal is disturbed by the motion of a boat on the surface, the ripples are propagated faster than the motion of the boat on the surface, and so, far outrun the actual forward thrust in the water of the boat itself; and thus predict the boat's approach. So when a carpet is held at one end, so that it cannot travel along the ground, but then is violently shaken, we see waves, like those in the canal, rapidly exhibited in the successive folds of the carpet. When a stone is dropped into a lake, the waves superinduced are circular, but it is the wave that is propagated, the water is scarcely more moved onward than was the shaken carpet, as we may see by observing the light substances which float on the surface.

In his exposition of the *principle of magnetism*, (pp. 163, &c.,) Dr. Hickok supposes waves similar to these; but instead of attributing the motion to them after the manner here described, he supposes two such circular disturbances of the substance, or matter, or force, in question, themselves to be moved until their *centres coincide*, and they coalesce and give one circular arrangement, after an impracticable fashion; very much as in the instance of gravitation. We need not pursue the reasoning after this. It gives to a globe two poles situated at the extremities of the same axis, &c.

It will be quite enough here to add several questions, to

which any theory or explanation of magnetism is bound to reply. Why is the development of magnetism at or near the surface of the magnet much greater than it is in the region within? How is it that the earth has very possibly *four* magnetic poles; and that these are so far from the astronomical poles? Why do not the positions of greatest intensity coincide with those respectively at which the dip is 90°? What is the connection between the isothermal lines, and the lines of equal magnetic intensity? What shall we do with thermo-magnetism? Scarcely one of these does the "Rational Cosmology" consider at all; nor could it solve them without ruinous postulates.

Electricity (p. 171, &c.) is derived from the interrupted action of magnetism; which is the case after a special fashion with magneto-electricity. The careful inductions of science point all the other way with respect to electricity under other circumstances; and the ingenious and beautiful, though highly artificial, theory of Ampère, derives magnetism from currents of electricity; and explains the phenomena with unsurpassed success.

We seem to see a man of great intellect standing beside that special exhibition of science and art conjoined, a railway train with the locomotive attached. The philosopher having well considered what is before him, comes to a distinct persuasion, which is to him a clear insight, of how the whole ought to move. He then seizes upon the magnificent quartos of Tredgold on the Steam Engine, and without looking into them, exclaims they have their use, and forthwith converts them into a footstool, by means of which he mounts into the engineer's seat. He then announces the conclusion, that it is reasonable that the passenger-cars should have the precedence, because of the great value of the freight which they carry. He therefore "backs" the engine, and puts all in motion in conformity to that reasonable arrangement; and so in the end arrives at the place from which the train had started some time before, instead of that which they had been destined to reach.

On page 210 the vibrations of *Light* are represented as being spheroidal or rather ellipsoidal, involving a change of shape in spherical layers of masses; instead of those molecular

changes which the undulatory theory so imperatively requires; which theory withal has received such ample confirmations. The interference of light (p. 217) is attributed to cross-vibrations. Their direction is almost anything but that. Also (p. 297) we are told that "the angle of refraction is the same in all cases for the same substance." That the vibrations of the atmosphere which give sound were incorrectly stated, we have heretofore noticed.

On page 214 we find it stated of the sun, that "its light and heat are as determinate principles as its gravity, yea, they are eternally determined in its gravity." The late Professor Hassler had we believe some such idea. But if this be so, how is it that the same principle does not illuminate the dark bodies in space; such as the companion to Sirius which must yet be many times heavier than our sun; to say nothing withal of the relative light of red, yellow, blue, white, and green stars?

On page 219 we are informed that "the first geological formations must be plutonic, the crystallized and partially crystallized will underlie the composite, and the inner heat will at length be so confined and softened, that an atmosphere shall form, and the combination of water commence, &c."

On page 203 and elsewhere the tangential force is naturally enough put for the centrifugal force. This would accord better with the doctrines of force as laid down in the "Rational Cosmology;" but the substitution is just as incorrect as it is natural. The relations of central forces are among the things well-ascertained. They cannot now be overturned.

On page 204 we find, in effect, that the course of one of two fixed lines which meet a tangent, *at the point of contact*, will "evince a curve to be a hyperbola, or a parabola," &c. We cannot but think that this will be new to mathematicians. An embodiment of the idea may be found in this. If a target be placed so as exactly to touch the more remote bank of a river, and then a ball be fired from a *given station*, so as to strike the target at any angle, and then be reflected at an equal angle; then the *precise course* of *the ball in its rebound*, will "evince" the *special form* of *the turns and bends* of *the river*, both above and below the target.

Besides other errors of tangential force, &c., we find (p. 207)

that the radius-vector of a planet varies inversely as the velocity. When the velocity is variable at all, it varies inversely as the *perpendicular* from the centre of force on the tangent, and not as the radius-vector.

"The *squares of the times of revolution*" (of the planets) "*must be as the cubes of the mean distances.*" In the proof of this we find (p. 208) "a less or greater force, in carrying the planet through the same orbit," &c. A less or greater force could *not carry* the planet through the *same* orbit, the central force remaining constant. When *impossible quantities* are introduced into calculation, they must be represented as in *impossible relations;* in order that what is *not* to be found among the *impossibles* may appear among the *possibles.*

On the same page, and the next the relations of distances and times, are made to depend on the form of body from which a planet is thrown off. They depend essentially on the law of central force, its intensity, and the velocity of projection.

On page 209 we read, moreover, this comparison between a planet thrown off from "the circumference of a circular plane," and that "expelled from the equatorial surface of a sphere:"

"But when a planet has been expelled from the equatorial surface of a sphere, although revolving at the same time within the same orbit, yet must its force have been far greater. Every radius of the sphere has thrown off its own portion, and here the principle must be as the cube of the distance" (instead of the square, when thrown from the circle,) "and we shall have the determined formula that the squares of the periodic times will be as the cubes of the distances." Here we have the former difficulty of revolving in the same orbit with a far greater force which (if provided for) may possibly be compensated by a greater central force. But then we have every radius of the revolving sphere throwing off its own portion; though all revolve about the axis in the same time. The force could not be gravitation which admitted of that. Then, lastly, we have squares of distances for the planetary fragment of a circle, and cubes of distances for that of the sphere; because, it would seem, circles are as the squares of their radii, and spheres as the cubes of the same. We have heard of a conjecture that the days were longer in summer, because heat

expanded all bodies. The cases certainly are not quite parallel; but the connexion is no less unreal.

On page 330 we have a reproduction of the error exploded some two years ago at the meeting of the British Association for the Advancement of Science, viz. "The satellites revolve but *do not rotate.*" If one person should take his seat in the middle of a room and another walk around him looking always north; the traveller would turn his back to the other when he was on the north side of the apartment; his face when he was on the south side; be turned sidewise when he was on the east and west sides respectively, &c., &c. He would revolve around the central body but would not rotate; and therefore would so present himself to the central body as to exhibit himself on all sides. So does *not* the moon; she shows nearly the same face always. Therefore it cannot be true that she does *not* rotate. But a body going round another and fastened to it by a rod so as to turn its face always inward, must *face around on all sides once* in doing so. *That* is what a body always facing another must do whether the connecting rod be there or no. This is the case with the moon and perhaps some other satellites.

On p. 331 we have—"The same conformity with the principle is found in the facts of the very *slight excentricity* of the moon's orbit, and the *absence of all flattening at the poles.* If the moon had been ejected from its primary with sufficient force to rotate, it must have been considerably elliptical in its orbit; and if it had rotated on its axis it must have been oblate proportioned to the rapidity of rotation. The facts all correspond to the determinations of the rational principle."

The stubborn facts are all the other way. The excentricity of the moon's orbit is very nearly the same with that of most of the larger planets, and it is more than three times as great as that of the earth's orbit. The moon does rotate, as has been shown already: and the form of the moon is that of an approximation to an ellipsoid; the shortest equatorial diameter being longer than the polar, and the longest of all, the equatorial diameter pointing to the earth.

On the same page the result of M. Hansen's profound analysis as regards the shape of the moon is thus gotten rid of—

"This general law of the satellites, that they constantly turn one face to the primary, has been sometimes accounted for by supposing that one hemisphere of the satellite is protruded towards the planet and is thus held in place, by an excess of gravity in the protruding part; but no fact of such protuberance appears, and the true principle determines the facts as they are given, without any gratuitous hypothesis." There is the usual fatality here as regards all the facts. The gratuitous hypothesis is a careful deduction. The part of the moon formed of more dense material, but not really heavier, is that turned away from us, and not toward us. Being more dense it *is* less protuberant. The lunar irregularities (and not the regular turning of the same face toward us,) led to this conclusion.

In regions such as these, which the most profound analysts enter with a wholesome dread, and within which they step with caution, the "Rational Cosmology" moves along with a step which it evidently regards as being well-assured, and specially becoming to itself. It here also displays its *triumphs;* as we have just now seen. Witness, moreover, its prediction that such retrograde comets as Halley's must become direct in their movements; which *means*, as we see, that "the line of ascending node" shall "revolve" "till the point is reached in the particular orbital plane of the comet, that equilibrates the right and left hand attractions through the whole revolution, and must then remain with slight oscillations to and fro that incidental disturbances will occasion." (Pp. 356 and 357.)

We add but one other exemplification, which may serve, withal, specially to illustrate what here immediately precedes.

On p. 337, "Because the axis of the earth is more than 90° turned from the axis of Uranus, the moons of Uranus must from the earth appear to move in a westerly direction."

Passing by minor criticisms on this, we observe that the sun, the moon, and very commonly the planets, *appear* to turn around their axes in a direction from east to west, while they really are turning from west to east—all because we must look upon them from the outside. Such motions may then in one part of their circuit appear the reverse of what they really are; but any method of measuring the angle between the axis of Uranus (or rather its parallel) and the axis of the earth,

which would make that angle *greater* than 90°, must itself succeed in putting *south* for *north*, and of course, also, *west* for *east*.

Are not exemplifications such as these among the *triumphs* of the "Rational Cosmology?" Let us hear what it says:

"That the moons of Uranus are retrograde has been a surprising anomaly from its first discovery, but that this exceptional fact is found to leap within the necessary determinations of the eternal principle, and is found anomalous only in appearance, the principle itself expounding why it must so appear, is a most conclusive example of that accordance of fact and principle, which is alone true science." (P. 338.)

The concluding remark rightly understood is indeed true; and therefore it must be abundantly manifest by this time, that the "Rational Cosmology" is *not* true; or if true, that it must be true in other worlds than those of which astronomy has any knowledge. It stands condemned by a just criterion of its own selecting. Its author has failed, conspicuously failed; but he has failed where no *man* can hope to succeed. The philosophy, or rather science, at which he aims may be that of angels; it has not in this world yet been attained by unaided men. There is another path for them—"Nay, it is a point fit and necessary in the front, and beginning of the work, without hesitation or reservation to be professed, that it is no less true in this human kingdom of knowledge, than in God's kingdom of heaven, that no man shall enter into it, 'except he become first as a little child.'"*

In obedience to this noble aphorism (though not always in view of it) all veritable progress in physical science has been made. The science thus built up may be decried. It may be misrepresented as having "its full mission" "accomplished" "in complete and final positivism." That will be true when Mormonism is the perfection of civil liberty. It may be told "that it can vindicate its possession logically to no fact that it assumes beyond actual experiment." That may be true when it is shut out from the use of certain of its mental powers, or agrees to make use of only a portion of them: but it cannot invalidate its

* Bacon's Valerius Terminus Of the Interpretation of Nature, Montague's Edition, Vol. I. p. 267.

mode of gathering its own facts. It may be told by those who would shut it up to less than this, that it "is in the end atheistic or" (*mirabile dictu*) "Pantheistic." It were sad indeed if that were true, for its method is evidently the humble child-like one of first carefully studying what God has permitted to be, without a previous determination of what it must be. This is the only way in which the book of nature can be successfully studied. That some of its students have wrongly read, and wilfully misinterpreted it, may be an argument against the only proper use of the book itself, when the abuse of a doctrine makes it untrue.

But this method has no philosophy; it terminates in mere facts. Its investigations can indeed go no farther, in themselves, than general facts, and those *great pervading relations* of facts, *the laws of nature.* But in the knowledge of these *precise* relations lies its strength, of their *precision*, not merely of their generality.

But has it no principles—no philosophy? Yes! But both are heaven-born, and not of man's devising; and therefore they will be *eternal.* For there is one science which *can* begin where the "Rational Cosmology" would put itself; it is heaven-descended theology, which finds its perfection in Christianity; and derives its knowledge from Him who "was in the beginning with God," and "who hath declared him."

With the Bible before him the *Christian philosopher* accepts as his great hypothesis the God of the Bible; and attributes creation to his "good pleasure;" and having learned the resources of that good pleasure, the Christian philosopher considers it *philosophical* to conclude that Infinite Wisdom might have devised a plan different, even very different, from that which we find; nay, that it would be very *unphilosophical* to think otherwise. This philosophy accepts withal the Bible's account of creation, which (in the words of the author of the Rational Cosmology,) "makes God a beginner and Author of an existence which before was not;" but *that* a veritable *substance*, infinitely beneath the blessed Creator himself. This the Christian philosophy receives in the simple faith of the little child, believing as it does that it cannot comprehend God's first great formative act. Other principles there may be, inferior to these; but the

humble student of the book of nature, is every day more perfectly convinced that the knowledge of them is still lodged where the Bible came from.

The unexpected length to which our remarks on the physical aspect of Dr. Hickok's book have run, constrains us to the most brief and general comments upon its psychological, metaphysical, and theological views. The points to which, in closing, we call attention are the following.

1. We encounter on the very first page, and repeatedly elsewhere, a characteristic infirmity of this class of writers—the attempt to give a decisive turn to the discussion of fundamental questions, by arguments drawn from the etymology of words. This is done by the author, in establishing his doctrine of principles as uncreated in contrast with facts as things made: his theory of the functions of understanding as distinguished from reason; his contrast between existence and being; his objection to the Scottish philosophy of common sense; his distinction between nature and the supernatural. Of this last we give a single specimen, because we shall have cause to refer to the passage for another purpose. On the fallacy of this kind of argument, it is needless here to expatiate.

Dr. Hickok tells us: "Nature, *natura*, (*a nascor*,) is a birth, an outspringing, a growth. . . . It is applied properly to every created individual thing, inasmuch as each separate thing has its own peculiarly constituted forces which make it to be what it is, and gives to it its own essential identity, and which secure that it must develop itself after the conditions of its original constitution. . . . That which was not created, or constituted of such conditioned forces, has not a nature, but must be wholly supernatural. Of all created existence we may say in general, it is Nature." Pp. 131–2. We need not repeat here the criticisms we have offered in another article, in regard to this view of nature and the supernatural, as it is given by Coleridge.

2. Dr. Hickok pronounces man's "free personality," "the rational in humanity," to be "wholly supernatural," "wholly above nature." Pp. 80, 81. Much more might be cited to the same effect. But, as we have just seen, he pronounces "all

created existence" to be nature. Where then are we? Are the free personality and the rational faculty in man uncreated? What else does all this mean? If uncreated, are they simply an effluence of the Uncreated One, consubstantial with Him? If any clew to a different meaning can be shown, we shall be thankful. We shall need a keener "insight of reason" than we yet dare profess, to detect it. This "unmade" part of our being, what is it? Is it, or can it be anything which God made, when he created man in his own image? We do not see how it differs from the "impersonal" reason of Cousin, which can only be a one divine essence permeating humanity, or from that of Coleridge which he pronounces "identical with its own objects, *God*, the soul, immortality." The prerogatives which Dr. Hickok ascribes to the reason are commensurate with its supreme dignity. "Reason," says he, "is not a *fact;* a somewhat that has been *made;* but from its own necessity of being, can be conceived no otherwise than a verity which fills eternity and immensity." P. 85. No wonder then that "the created facts being given, the reason may in them detect the laws by which they are governed, and *when the insight of reason also determines that these very laws in the facts are such as the eternal principles made necessary*, we have then a true and valid science of the universe, and may safely call the result of our work a Rational Cosmology." (P. 256.) "This immutable principle, which determines how the fact *may*, and, if the fact be at all, how it *must* be, is given in pure thought alone, and is no appearance in the sense." P. 18. "If the creator *must* make and guide the universal cosmos after the determination of immutable principles," &c. p. 56.

According to this, if God puts forth any creative act, he can do so only in conformity with certain eternal laws, which necessitate the production of the results actually accomplished, and no other. The only election left to the Creator respects the degrees and times of the forth-putting of his creative energy, but not the quality or manner of the working thereof. These latter are determined by immutable necessary laws. It is the province of reason to detect these laws, and their eternal necessity; how a creation *must* be if it be at all. Such insight and nothing else is true science. Dr. Hickok then proceeds to

unfold these laws, as seen by the insight of reason; to show how force, i. e. the antagonisms and diremptions of activities, and the necessary laws seen by the reason to govern its working, *must* develop all the forms and properties of matter, mechanical, chemical, organic, and inorganic, physiological, vegetable, animal; gravity, cohesion, repulsion, heat, light, electricity. magnetism, &c.! Such is the prerogative of reason, according to Dr. Hickok; not to see what creation is, and that being such, it must have had a creator, but to see how it must be, and the eternal laws which necessitate that the creative act produce what is produced, if it be exerted at all! That faculty which can do this, he may well assert "fills eternity and immensity." We hardly know how to speak of the stupendous daring, the heroic audacity of such an attempt on the part of a mortal. The utter failure of the attempt, already made too apparent in the examination of the physical part of his book, is no discredit to Dr. Hickok's powers. His only discredit lies in not knowing better than to essay an insight into what is beyond mortal ken. We will just here, before discussing another point that arises in this connection, note another prerogative which he awards to reason, in which its divine dignity culminates. "The being is bound to be his own end." P. 84. "It (the rational) can make its own conscious worth and dignity its end of action." We think so too, if Dr. Hickok's account of it be correct. With the exception of its being incarnate, and, according to the author, susceptible of some kind of subordination to the Supreme Reason, (we can hardly see what,) wherein does it differ from Him, of whom, and through whom, and *to* whom are all things, to whom be glory for ever?

But who hath known the mind of the Lord, or who hath been his counsellor? Who by searching can find out God? Who can fathom the great deep of his counsels? We see enough indeed of the outbeamings of his infinite excellence and uncreated glory, to know that he is entitled to our absolute homage and devotion. But the light which reveals this, also discloses an infinitude beyond, utterly unsearchable by us. The beams which disclose also veil him. He *covereth* himself with light as a garment. What we know, are only parts of his ways, and how little a portion is heard of him? But, as Dr.

Hickok portrays *man* and his Maker, is God the being who dwelleth in light which no man can approach unto, whom no man hath seen or can see? Dr. Hickok says that he is. But we see not why he should say so without renouncing his system.

3. As to these necessary laws or truths, which the reason sees to be such, and which govern uncontrollably the whole construction of the material universe, and by which the human mind can develop the necessary forms of matter, animate and inanimate, as it develops the science of geometry from its axioms; we say, 1. There is no evidence of their existence; 2. There is evidence that, whether they exist or not, we cannot know them. The question is not, whether, or in what sense, there are any necessary truths or relations. On this we may presently say something. But it is whether there are necessary unmade principles, which necessitate that, if the Creator puts forth creative energy at all, it must issue in the precise laws and products which we find in the material universe. We say there is no proof of them. If they have being, we are incapable of ascertaining them. By laborious experimentation, observation, and induction, we are constantly learning that certain laws do exist, some governing all matter, others particular kinds of matter. But by no human "insight of reason" can it be proved that these laws could not be otherwise, if such were the good pleasure of God. Dr. Hickok, in attempting to prove it, as has already been shown, has undertaken to prove not a few things to be *necessarily* true, which are *actually* false. Is it not too much to deserve serious refutation for any man to claim, that if God exerts his energy at all, it must be in such a way as to produce light, heat, and electricity, and the precise laws which now shape their action? that "matter *must* impress itself upon the senses?" (p. 110;) that, "with the complicated and nicely adapted organism of the eye given in conception, it may be a clear insight of the reason that matter, as a space-filling force, must give all the conditions requisite for vision?" (P. 116.)

Can any knowledge be more purely empirical than all that we know or can know in regard to the susceptibility of the

senses, or any of them, to impressions from material objects? Is it possible to know the first fact in regard to the capacity of any bodily sense, or the power of other objects upon it, except by experience and consciousness? Is it possible to demonstrate before-hand that vision will result from the structure of the eye, or that it will be destroyed by lesion of the optic nerve or brain? Would it not be quite as easy to prove that the brain must be intensely sensitive, while, in fact, as Sir Charles Bell has observed, "that part of the brain which if disturbed or diseased takes away consciousness, is as insensible as the leather of our shoe?"

The same writer observes, "When the bones, joints, and all the membranes and ligaments which cover them, are exposed, they may be cut, pricked, or even burned, without the patient or the animal suffering the slightest pain." If *a priori* reasoning has place in regard to the existence, kind, and degree of animal sensibility, would it not quite as easily prove the contrary of all this, as that a "space-filling force" must furnish the conditions requisite for vision, or that matter must impress the senses?

With regard to necessary truths, in the strictest sense, they are those, the contradictories of which to the human mind are neither supposable nor conceivable. These, however, are, with slight exceptions, truths of relation rather than of actual existence, and chiefly pertain to the formal sciences of Logic and Mathematics. A close analysis will show the necessary judgments in these sciences, to be chiefly reducible to the simple principles of identity and contradiction: viz. that we must think a thing to be what it is, and not what it is not. Space and time are necessary in our thought, as the illimitable void receptivities in which all bodies and all events must have place. The metaphysical ideas of causality and substance have this conditional necessity; that, if events are given, they must have a cause, if qualities are given, they must have a substance. The mind is unable to judge otherwise. The idea of the good is necessary on the supposition of the existence of moral beings; of the beautiful, on the supposition of esthetic faculties; of the true, on the supposition of intellectual and rational faculties. While, however, we cannot conceive of a perfect God as desti-

tute of either of these ideas and attributes in absolute perfection, it is conceivable that man, had it been the will of God, might have been made a sentient, but not a rational being, or an intelligent being, to a certain extent, and yet not an esthetic or moral being. But within the realms of actual existence, the range of necessary principles, ascertainable by us as such, is exceedingly narrow. As to all created substances, or events, what can we pronounce to be necessary regarding them even in our conception, that is not implied in saying, that bodies must be in space, events in time, and that they must have a cause? But this in no appreciable degree limits the divine activity, or the possibilities open to creative energy. It determines not how, nor where anything must be brought to pass. It limits not the Holy One, and leaves all things possible with God, to be executed according to the good pleasure of his will. The laws of nature are uniform, not by any compulsory necessity that they should be so, as that the sum of the angles of a triangle must be equal to two right angles; not because God could not, for cause, wholly change their working, as he has been pleased to do in the case of miracles; but because, for wise and holy reasons, it has pleased him that they should abide, and that seed-time and harvest should not fail during the present dispensation. But how long this system of physical nature shall last, we know not. The scoffers of old and of late, who reluctate against the reign of a personal God in nature, providence, and grace, have asked "Where is the promise of his coming? Do not all things continue as they were from the beginning of creation?" But the answer of the Supreme Reason to this is, that as he destroyed the wicked of old by a deluge of water, and a rain of fire, so "the heavens and the earth which are now, by the same word are kept in store, reserved unto judgment and perdition of ungodly men." See 2 Peter ii.

On Dr. Hickok's theory, nothing, so far as matter is concerned, is left to the free disposal of God, except the bare supply of the "force" requisite to the creation and sustentation of created things. All else is remanded to the domination of "immutable principles," as relentless in their necessity as fate. He may exert more or less of the *vis creativa*. But that is all.

The manner and measure of its working, and the results to which it comes, are determined by an overbearing necessity, which is beyond the reach of Omnipotence. Where then is Providence? What rules us and the universe? A free personal God, or a fatalistic necessity?

4. The fundamental doctrine out of which Dr. Hickok evolves his whole system of "Rational Cosmology" is that "matter is force," purely and simply force. What then does he mean by force? Recurring to what we have already frequently referred to, he tells us, "When, however, the conception is that of simple action in counteraction, an activity that works from opposite sides upon itself, we have in it at once the true notion of force." (Pp. 93, 4.) This subject has been sufficiently discussed in its relations to natural philosophy. We wish now to consider it as related to metaphysics and theology. It appears then that force is the resultant of counter activities. Whose activity, whose action in counteraction? Certainly that of some agent or substance. Certainly we may insist on this with one who postulates necessary truths on so liberal a scale. If there be any truth, which the "insight of reason" cannot avoid discerning as a first truth, it is that all qualities belong to some substance, all attributes to a subject, all actions to an agent. Whose action and counteraction then is it that thus develops itself as force, i. e. as matter? Surely it can be no other than God's. What else then is matter than the activity of God, God in act? Says Dr. Hickok, "Solely from the reason, and not from any want as if he too had a nature, God puts *his simple activity* in counter-agency. He makes act meet and hold act, and in this originates an antagonism which constitutes force; a new thing; a something standing out for objective manifestation, and holding itself in position as a reality distinct from his own subjective simplicity." (P. 101.) "This material is not God, nor at all competent to rise from its imposed conditions into the region of the absolute." (P. 102.) We are glad that Dr. Hickok disclaims and tries to escape monism. But whether he can do it logically, without renouncing the fundamental principle of his Cosmology, is another question, which fealty to God and truth requires us to put and answer. After all disclaimers, he teaches that God's "act

mecting and holding his act," gives the "antagonism which constitutes force," or matter. If this is any "new thing" beyond God's activity in antagonism "standing out for objective manifestation," or in any other sense "distinct from his own subjective simplicity," we do not see it. Indeed Dr. Hickok explicitly declares, "the antagonism and the diremption to be the one agency of the Absolute Spirit." (P. 101.) "All being will be alike subjective to Him." (P. 100.) At all events, most pantheists will be satisfied with such a *που στω*, and will readily found their systems upon it. Dr. Hickok says truly, "there is a dualism; the world is not without its Maker, and the maker is not in and of the world." (P. 21.) But we confess that this dualism does not "exist or stand out" on his theory, any further than the dualism between the agent and his activity. The most common pantheistic formula is, that the Absolute being comes to *exist* or *stand out in objective manifestation*, by becoming an object to himself in Nature and Humanity. Some say that He does this in coming into self-consciousness. Self-consciousness implies distinction; distinction limitation: thus the Infinite evolves itself and becomes objective to itself in the finite. Still these men would say "there is a dualism," in the monism. The finite is not the infinite, although of it, as the flower is of the plant, the wave of the ocean. The main thing is that the finite is not a created substance distinct from the Infinite Creator, but an act or evolution of him. When we consider the divine prerogatives ascribed by Dr. Hickok to the reason in man, along with his definition of matter as force or the antagonism of divine activities, we feel ourselves nearing that awful vortex of modern German philosophy, from which all but the most dauntless speculatists must recoil with horror. Says Chalybäus, in his historical survey of Schelling's philosophy: "If in all this, we never forget the main point, namely, that apart from this living impulse, movement, and activity, there is nothing material or real whereupon or wherein these indications of power occur, *but that the very real and material itself consists intrinsically of the play of these mutually determining activities, we may then be enabled to grasp at once intelligibly and intuitively the principle of the whole system; that all is in its essence one and*

the same."* Coleridge, whose dissertation on this subject has been stigmatized by some as a plagiarism upon Schelling, and by himself acknowledged to evince a "coincidence" with him, dicourses in a similar tone. "There is strictly speaking," says he, "no proper opposition but between the *two polar forces of one and the same power.* Every power in nature and in spirit, *must evolve an opposite, as the sole means and condition of its manifestation.*" *Aids to Reflection*, *p.* 287. "The transcendental philosophy demands, first, that two forces should be conceived which counteract each other by their essential nature; secondly, that these forces should be assumed to be both alike infinite, both alike indestructible." *Biographia Lit. p.* 169. "The *identity* of Thesis and Antithesis is the substance of all *Being;* their opposition the condition of all existence, or Being manifested." *Aids*, p. 287. All this seems to us so very like Dr. Hickok's divine activities in antagonism, constituting matter, as to show very clearly, their substantial identity. And when once the antagonism is posited, his process of world-building, or evolution, seems to us little more than a modified reflection from that given by Schelling, and the Pantheistic Transcendentalists. Notwithstanding his analysis and rejection of the schemes of Fichte, Schelling, Hegel, and Cousin, the germinal elements of that monism which is common to them all, seem to us to lie in his radical principles. The variations are such as enforce themselves upon a Christian man. But as to their real character, and logical consequences, they are circumstantial rather than fundamental.

The simple doctrine of Scripture and reason we take to be this: that the physical universe and its constituent parts are not mere acts of God in mutual antagonism; but that they are entities, substances, created from nothing by his omnipotence, distinct and separate from him, yet dependent upon his sustaining, and subject to his governing power; that these substances or entities are also made the subjects or media of certain physical forces, acting according to uniform laws, which forces and their laws exhibit the distinct and invariable modes of the the divine control over matter; that he governs and disposes and acts in and through them, by his all-controlling provi-

* We quote from Tulk's Translation, p. 222.

dence; that it is his prerogative to make or unmake, or modify this whole material frame or any part thereof, according to his good pleasure, not being necessitated otherwise than by that moral necessity which forbids him to deny himself, and ensures that he doeth all things well. We do not believe, that, to any extent of the least moment, in such a discussion, he is constrained by any eternal necessity, so that he can produce nothing but his own activity in antagonism and diremption; or that he is unable to impart to matter, if he be pleased to create it, any properties, he may please, not mutually self-contradictory. If he cannot create material substances other than his own "act holding his own act," much less can he create immaterial or spiritual essences or substances. Indeed Dr. Hickok tells us, p. 84, that spirit as being "self-activity and self-law," is "essence which is not substance." Still if it is activity, it must be the activity of some person or thing;—of what, or whom? Whose activity is the free, responsible, rational "essence" within us? Whose, ours or God's? Does the trans cendentalism of Schelling develop a more "insoluble ego?" There is no escape from these difficulties but in the simple recognition not only of the absolute substance and absolute cause, but of derivative, dependent substances, and second causes, distinct from God's mere act, yet created and sustained by his act. Otherwise the distinction between God and the creature, holiness and sin, freedom and fatalism, is a sublime fiction. Is it demanded that we explain how this is possible? How God by his Almighty working can create and uphold that which is not his mere activity? We freely confess ourselves unequal to such a demand. We have no "rational insight" which can fathom the measureless profound of divine possibilities. These are things too high for us to meddle with. We rest in the Apostle's solution, in which our faith and philosophy begin and end, "O the depth of the riches both of the wisdom and knowledge of God! how unsearchable are his judgments and his ways past finding out!"