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ORDINARY MEETING, JUNE 14, 1880.

H. CADMAN JONES, ESQ., M.A., IN THE CHAIR.

The minutes of the last meeting were read and confirmed, and the following elections were announced :—

LIFE MEMBER :—W. Peek, Esq., London.

MEMBERS :—The Rev. Prebendary W. Anderson, M.A., Bath; Peter Redpath, Esq., Montreal.

ASSOCIATES :—Rev. A. Poole, Masulipatam; Major MacGregor, 29th Regiment, Worcester.

Also the presentation of the following Works for the Library :—

"Proceedings of the Royal Society."	*From the same.*
"Proceedings of the Royal Geographical Society."	*Ditto.*
"Proceedings of the Royal Geological Society."	*Ditto.*
"Proceedings of the Warwick Natural History Field Club."	*Ditto.*
"Proceedings of the American Geographical Society."	*Ditto.*
"Haeckel on Evolution of Man." By Prof. Dawson, F.R S.	*Ditto.*
"The Early Renaissance." By Prof. Hoppin, D.D.	*Ditto.*
A Pamphlet. By the Rev. T. Kirkman, F.R.S.	*Ditto.*

The following paper was then read by the Author :—

SOME CONSIDERATIONS ON THE ACTION OF WILL IN THE FORMATION AND REGULATION OF THE UNIVERSE. BY THE RIGHT HON. THE LORD O'NEILL.

1. TO treat fully of this subject is a task which I have no idea of attempting. My only aim is to examine a few of the arguments lately promulgated by some physicists with a view to upset the doctrine held by Christians, that the Universe was first called into existence, and has ever since been governed, by a personal and conscious Deity. I have little hope of bringing forward anything that is not already familiar to the members of this Institution; but for the sake chiefly of those outside who may read its publications, I feel it to be a great privilege to raise one more voice, however

feeble, in defence of our Faith, and contribute, as far as in me lies, to the refutation of an assertion which is frequently and with great confidence repeated in various quarters, that the scientific, and even the clerical, world is fast drifting into unbelief.

2. It would be my wish to keep aloof as much as possible from the personal, and to deal with arguments rather than with their authors. It will not be possible, however, entirely to avoid the mention of names; but when compelled to do so, I hope to say nothing that could give reasonable offence to any one.

3. Objections to believing that the Will of a Supreme Being is a factor in the changes and mutual interactions which take place among the various parts of the universe are generally founded on "the Reign of Law," this term, "law," being applied metaphorically to the physical world, whereas in its primary signification it is concerned with beings who can choose whether they will obey or disobey it, taking, of course, into account the consequences of obedience or disobedience. The term, as applied to physical results, is sometimes objected to as misleading; but, for my own part, I do not see why it should not be used, if we keep in mind the distinction between inanimate matter and beings endowed with will. When this distinction is overlooked, confusion may doubtless ensue. Now, granting a Creator (and on that subject I hope to say something presently), there is nothing in the prevalence of physical law that is not perfectly consistent with the belief that that Creator originally prescribed the laws, and now governs the world in accordance with them.

4. Dr. Tyndall, in his Address at the Midland Institute in Birmingham, in 1877, observes that while, in a variety of ways, we can distribute the items of a never-varying sum (the sum, namely, of the forces of nature), no creative power is placed in our hands. "The animal body," he says, "distributes, but it cannot create." In a masterly paper by Mr. Porter, the President of Yale College in the United States, read at this Institute on December 2nd, 1878, it is contended that the animal body has more than a distributive power over the forces of nature—that it has a power (of course within limits) of directing as well as distributing—of unlocking at pleasure the potential energy stored up in the nerves, which no mere machine can do. This is a circumstance which indeed appears to be fatal to Dr. Tyndall's doctrine that the animal body is a mere machine, but it need not prevent us from holding, with him, that whatever powers the animal body may possess, creative power at all events does not belong to it. And the

only remark I have to make upon this is, that our belief in the creative power of God is not affected by it in the slightest degree. No one would say that because man has no creative power, therefore God has none.

5. Again, Dr. Tyndall says, in the same address, that the principle of conservation of energy in nature "leaves no nook or crevice for spontaneity to mingle with the necessary play of natural force." Holding, as he does, that man can *distribute* force—that any one (to take his own example) can raise his arm whenever he chooses—he cannot but admit that *man's* will, at all events, is, or may be, concerned in the distribution of force. Does he mean, then, to deny to God a power which he concedes to man? Very possibly he does. For in so far as he has explained himself on the subject of the Deity, he appears to deny to Him personality, and therefore will. But we must take leave to differ with Dr. Tyndall in this matter until he offers some better proof than I, for one, have been able to find in his writings. Perhaps, however, there is a more recondite meaning in his assertion that there is no room for spontaneity in the play of natural force. He asserts that the animal body, including that of man, is a mere machine, and that the actions which seem to us spontaneous are really the result of movements in the brain produced by a physical necessity. This view has been satisfactorily disproved by many, and among them by the President of Yale College, in his paper already alluded to. But the only thing that need be said about it now is, that the arguments by which Dr. Tyndall supports it are altogether founded on material considerations, and lie in a field that is quite apart from the world of pure spirit, nor can they affect our views with regard to it one way or the other. It is true that Dr. Tyndall rejects the idea that there can be such a thing as pure spirit. "Divorced from matter," he says, in his Belfast Address, "where is life to be found? Whatever our *faith* may say, our *knowledge* shows them to be indissolubly joined." (*Belfast Address*, page 54, 1st ed.) But what is this "knowledge" which he says shows life to be indissolubly joined to matter? It is simply *ignorance*. All that can be said is that our senses do not give evidence of life not joined to matter. And this is ignorance, not knowledge. Believers in Revelation, however, have evidence of it in abundance, but of another kind. And whatever Dr. Tyndall may think, there may be more things in heaven at least, if not on earth, which are not dreamed of even in his philosophy. Christians, who hold that God is a spirit, can see nothing in "the play of natural force" to militate against the hypothesis of divine

spontaneity mingling with it, whether as creating or directing it. They who assume, with "the foolish body" mentioned in the Psalms, that there is no God—*i.e.*, no such God as Christians believe in—can, of course, allow to Him neither spontaneity nor any other attribute. But it is easier to make such an assumption than to prove it.

6. The law of conservation of energy, as recently established, is but a further instance of the reign of law to which the physical universe has been long known to be subject. Under the name of conservation of *vis viva*, it has been known, in a more restricted form, since the time of Newton; only it was supposed that in cases of collision *vis viva* was irrecoverably lost. Now it is believed that it survives in the form of heat. But how does this make it more difficult to believe in the action of spontaneity on the part of the Divine Being than it was before? We believed in the uniformity of the course of nature before this additional instance of it was brought under our notice; and the general uniformity of nature is that which is supposed by some to militate against the supposition that a Deity intervenes. "Has this uniformity ever been broken?" asks Dr. Tyndall, in his Birmingham Address. And he answers, "Not to the knowledge of science." This is, of course, a sufficient answer in Dr. Tyndall's mind, inasmuch as he acknowledges no other teacher than science. But even if science were our only teacher, its ignorance on this point would be no argument. That science does not know of any breach in the uniformity of nature, is a circumstance which surely does not prove that there has never been such. Science, at best, can reach no further than to the *existing* universe. It can tell us nothing about its commencement. It cannot even tell us whether it had a commencement or no. It will probably be admitted that the chief indications to be found on this subject are from geology, and these point to a commencement, at all events, of terrestrial life, in that the farther we go back in time the lower and fewer are the organisations found in a fossil state. And what greater break in the uniformity of Nature can be well imagined than the commencement of life? If terrestrial life had a commencement, there can be no great difficulty in believing that the whole universe had a commencement also.

7. It has been well observed by Mr. Eliot Howard, in a paper read before this Society on December 3, 1877, that science and faith part company at the first verse of the first chapter of Genesis, inasmuch as science knows nothing of a "beginning." Here another teacher than science enters upon the scene, and vouchsafes to us instruction in matters with

respect to which science is mute. It is the fashion with some scientists of our day to entirely ignore Scripture—to treat it as if it were so completely beaten out of the field as not to be worth even a thought. I fearlessly say that the Scriptures come to us with a strength of evidence and an authority so great, that no man has any right to ignore them, or to view them otherwise than as an important factor in forming his opinion on these subjects. The facts cannot be got rid of, that their teaching has civilized and elevated a great portion of mankind; that, taking in the whole time since Christianity was first introduced, the great majority in the most civilized countries of the world have received it as of divine origin; and that in that majority are to be found a Newton, a Leibnitz, a Euler, and a Descartes. With respect to Newton, Dr. Tyndall, in his Belfast Address, says, "that the very devotion of his powers, through all the best years of his life, to a totally different class of ideas, not to speak of any natural disqualification, tended to render him less instead of more competent to deal with theological and historic questions." I think we may fairly ask, if this remark be justly applicable to Newton, what guarantee can Dr. Tyndall give that it is not also applicable to himself? It is a remark which is capable of being retorted. And I believe it will generally be thought that Newton was at least as good a theologian as Dr. Tyndall.

8. While on this subject, I would take the liberty of making a short quotation from Dean Mansel's *Limits of Religious Thought*, in which are enumerated the topics which require to be well considered and weighed before any man can have a right to ignore the Scriptures. These are:—"The genuineness and authenticity of the documents; the judgment and good faith of the writers; the testimony to the actual occurrence of the prophecies and miracles, and their relation to the religious teaching with which they are connected; the character of the Teacher Himself, that one portrait which, in its perfect purity and holiness and beauty, stands alone and unapproached in human history or human fiction; those rites and ceremonies of the Elder Law, so significant as typical of Christ, so strange and meaningless without Him; those predictions of the promised Messiah, whose obvious meaning is rendered still more manifest by the futile ingenuity which strives to pervert them; the history of the rise and progress of Christianity, and its comparison with that of other religions; the ability or inability of human means to bring about the results which it actually accomplished; its antagonism to the current ideas of the age and country of its origin; its effects as a system on the moral and social condition of subsequent

generations of mankind; its fitness to satisfy the wants and console the sufferings of human nature; the character of those by whom it was first promulgated and received; the sufferings which attested the sincerity of their convictions; the comparative trustworthiness of ancient testimony and modern conjecture; the mutual contradictions of conflicting theories of unbelief, and the inadequacy of all of them to explain the facts for which they are bound to account." (*Limits of Religious Thought*, p. 173.)

9. It would be interesting to know how many of those who ignore Revelation, or who undertake to pronounce Christianity a mere fable, have carefully, patiently, and candidly weighed all the matters here enumerated by Dean Mansel, before coming to the conclusion that Christ's teaching, and the teaching of the Bible about Him, is certainly untrue. I say "*certainly* untrue," because nothing short of absolute certainty could exempt from guilt the men who are persistently endeavouring to persuade mankind that the God in whom Christians believe does not exist. On the other hand, to look upon this as absolutely certain is to look upon themselves as infinitely better judges than the many equally renowned men who believe and have believed in a God that has vouchsafed to reveal Himself to man—an estimate of their intellectual powers and superior knowledge which will scarcely be endorsed beyond their own circle, however great those powers and that knowledge may be admitted to be.

10. But to return to our immediate subject. The argument against an intelligent personal Creator of the universe which seemed to be supplied by the extension of the principle of conservation of *vis viva* to the more general one of conservation of energy, may be supposed to assume some such shape as this,—*vis viva*, considered as mechanical, that is to say, as belonging to molar motion, may be lost. Two bodies devoid of elasticity, coming together by virtue of their mutual attractions, are both deprived of sensible motion provided their masses are equal. Until comparatively lately it was supposed that in such a case the motion was entirely lost, and therefore a force banished from the universe. And if a force can cease to exist, there is no reason why a new force might not be originated, as was formerly supposed to be the case when a limb was put in motion by an exercise of the will. But it is now found that the motion extinguished in the collision of two equal non-elastic masses survives in the heat which immediately pervades them, and which is caused by, or rather consists in, a rapid motion of their molecules. And the connection of this molecular motion with the previous molar motion is brought

into the strongest light by the quantitative relation existing between them, which is expressed by saying that *a weight of one pound, falling through a height of* 772 *feet, generates an amount of heat sufficient to warm a pound of water one degree Fahrenheit, and that in lifting the weight so much heat exactly disappears.*

11. My main object being to make it appear that the new doctrine of conservation of energy does not conflict with the belief that a personal Deity is the Creator and Director of the universe, it would be out of place, as well as beyond the limits of my knowledge, to call in question that doctrine itself. It may be as well, however, to mention that the quantitative relation between molar and molecular motion is not yet looked upon by all scientific men as indubitably proved. Mr. Porter, President of Yale College, to whose paper I have already more than once alluded, says in p. 85 of that paper:—"We question very much, indeed, whether the experiments have been conducted with mathematical exactness, or whether the laws have been formulated with scientific precision, or, as Tyndall phrases it, whether 'the inter-dependence' between the several factors has 'become quantitative—expressible by numbers.'" We may let this pass, however, as having little or no bearing upon religion, if the view I would advocate be correct. What I would at present observe is, that the argument derived from the principle of conservation of energy, as extended to molecular motion, will be found, when duly examined, to leave the belief in a Creator and Director of the universe altogether untouched. That principle, granting it to be established, shows that in the universe, *as constituted*, energy is neither lost nor gained. *Kinetic* energy may be, and constantly is, either diminished or increased. But when it is diminished, the quantity deducted is stored up as *potential* energy, while its increase is accompanied by a corresponding deduction of potential energy, so that the sum of the two, *i.e.* the total of the energy existing, remains unaltered. This, under the name of conservation of *vis viva*, has been known, so far as molar motion is concerned, since the days of Newton, as already observed. But I am not aware that it was ever looked upon as strengthening the arguments of unbelievers derived from the general uniformity of nature. Why, then, should the extension of the same principle to molecular motion be so looked upon? It is only another instance of that general uniformity of inanimate nature which was already fully acknowledged. If it was thought previously that man could originate force ("*creation* of force" is, I believe, rather a new expression), I am not aware that this was ever looked

upon as an encroachment on the province of the Deity as Creator of the world. Still less could the extinction of force be so looked upon. But however this may be, the true inference from the application of the principle to molecular motion is, that *man*, and *à fortiori* other animals, cannot originate or extinguish force, or (if the expression be better liked), cannot create or annihilate it; but not that *God* has no such power. Before the latter inference could be drawn, it must be assumed that there is no Creator, which is the actual question in dispute. And this is, in fact, the assumption which underlies all the arguments against belief in a personal Creator that are founded upon the uniformity of nature.

12. Dr. Tyndall, in his Belfast Address, calls the will of a Deity, *caprice;* which, with those who do not exercise much thought, might pass for an argument. In this meeting it is unnecessary to say that Christians do not ascribe caprice to the God in whom they believe. They hold that "the Judge of all the earth will do right"—will act on principles of right and justice. They believe, with St. Paul, that in justifying repentant sinners, He does not act on a mere impulse of mercy, but that He is both "just, and the justifier of him which believeth in Jesus" (Rom. iii. 26). And St. Paul says again: "Is God unrighteous, who taketh vengeance? . . . . God forbid; for then how shall God judge the world?" (Rom. iii. 5, 6). That is to say, He punishes, not for the mere gratification of His anger—in other words, not from caprice—but on principle, and with a regard to justice. The assertion, therefore, of Dr. Tyndall, that "science demands the radical extirpation of caprice," may be assented to. But it is a glaring fallacy as applied to the God of the Christian. Dr. Tyndall asserts throughout—asserts, but, so far as I can see, never proves—that science leaves no room for will. Nature, he says, is uniform, therefore will is excluded. Here we have a major premise and a conclusion; but where is the minor premise? By his own admission, the will of man can interfere in the distribution of the forces of nature. This he can do by the power which, within limits, he has over matter: and his power over matter external to himself is exerted through his bodily movements, and these movements are effected by the efforts of his will. Thus, in the last resort, material forces are distributed through the power of mind over matter. And if the mind of man has power over matter, much more may the Divine mind have such power. This *à fortiori* argument can only be met by denying that there *is* a Divine mind—the *petitio principii* already referred to. Thus it is, I think, fairly made out that there is no reason to ques-

tion the power of God to interfere in the *distribution*, at least, of natural force. To question this would be to question either His existence or His superiority to man, who, it is admitted, can do the same. And if God can exert a power thus far over matter, who shall undertake to say it must stop there? who shall deny to Him a creative, as well as a distributive, power over it? They only who assert that creation is in itself impossible—an assertion which we have to consider presently.

13. In the mean time I venture to quote the words of the Bishop of Edinburgh (Bishop Cotterill) in a paper read before this Institute on February 4, 1878, in which he endeavours to show that Will *must* have played a part in bringing about the present state of the universe. Referring to Mr. Herbert Spencer's account of the doctrine of evolution, which sets out from the hypothesis that all matter was once homogeneous, the Bishop observes:—"Something must have determined the variety of forces; it cannot have arisen from the mutual action of the parts, for the structure is by supposition homogeneous. If the universe should be supposed infinite and homogeneous, and, for example, the forces acting on it the mutual attraction of each particle, every particle would then be acted on by equal and opposite forces, and no change whatever could take place. If it were finite, the only effect could be the concentration, and, so to speak, the crystallization of the whole mass. The variety of nature necessarily implies the introduction of some other element besides that of uniform law. One arrangement may by its heterogeneity of structure and its different forces be developed into another yet more varied, with nothing but law to direct it; but that which is homogeneous can never become varied by law alone. Variety itself thus points to a higher origin than law."

14. If we assume that the shape of the homogeneous mass was spherical, which seems the most natural supposition, this reasoning seems quite conclusive. A homogeneous structure, whether infinite or finite, could, on that supposition, never become differentiated by any inherent power of its own. If infinite, it must be *in equilibrio*, and there would be nothing to disturb its equilibrium. If finite, it would, supposing attractive forces to prevail, concentrate itself through the mutual attraction of its parts, or (if repulsion should prevail) would disperse itself through space, but still there would be nothing to differentiate one part from another. The fact, therefore, that they *are* differentiated proves that something more than mere law has acted upon them; and what can this be but Will?

15. In fairness, however, we should not overlook Mr.

Herbert Spencer's account of the causes which, as he conceives, produce differentiation in a homogeneous aggregate. He enumerates, in his chapter on the instability of the homogeneous, several examples of it both from mechanics and from chemistry. It is not necessary to follow him through those examples; but if I do not mistake, they all seem to me to be chargeable with one notable defect, namely, that they all presuppose a differentiation of some kind, and therefore are not cases of a departure from a primitive homogeneous state at all. For instance, in the case of water in a state of complete quiescence, and of equal density throughout (supposing this possible), he says: "The radiation of heat from neighbouring bodies, by affecting differently its different parts, would inevitably produce inequalities of density and consequent currents; and would so render it to that extent heterogeneous." But surely the radiation of heat from neighbouring bodies presupposes, first, that there are bodies separate, and therefore differentiated, from the water; and secondly, that these bodies are hotter than the water—another differentiation. And again, he instances the oxidation of metal when exposed to air or water as an example of the change from homogeneity to heterogeneity. But this again pre-supposes a difference already existing between the metal and the air or water which acts upon it. The same defect seems to run through all his examples: but inasmuch as he afterwards gives a general explanation as applicable to every case, we need no longer delay upon the particular examples, but proceed to consider that general explanation. His words are these:—"The instability thus variously illustrated is obviously consequent on the fact that the several parts of any homogeneous aggregation are necessarily exposed to different forces—forces that differ either in kind or amount; and being exposed to different forces they are of necessity differently modified. The relations of outside and inside, and of comparative nearness to neighbouring sources of influence, imply the reception of influences that are unlike in quantity or quality, or both; and it follows that unlike changes will be produced in the parts thus dissimilarly acted upon."

16. Here Mr. Spencer divides these supposed forces into two classes: those that differ in kind, and those that differ in amount. It is at once evident that in a homogeneous whole there could be no forces differing in kind, for the simple reason that if there were the aggregate would not be homogeneous. For the same reason there could be no forces differing in amount, except from differences of distance. Bishop Cotterill says, in the paper lately referred to, that if we sup-

pose the homogeneous universe to have been infinite, no change could take place in it, because all the forces would neutralize each other. Mr. Herbert Spencer says the same thing (p. 429), and for so far there is no difference between them. The only hypothesis, therefore, about which a question can arise is that of a finite homogeneous universe. In such a case there would not be equilibrium; but supposing attraction to prevail, a general tendency to concentrate. If the shape be supposed spherical, and the force the attraction of gravitation, the tendency of each particle would be to move in a straight line towards the centre. For if the sphere were divided into two parts, one of which is a smaller sphere, whose radius is the distance of the particle from the centre, and the other a spherical shell surrounding that smaller sphere, this outer shell would exert no effective attraction on the particle, as is well known, and the inner sphere would attract it towards the centre in the same way as if the attractive powers of all its particles were collected at that point. The latter, then, being the only effective force acting upon each particle, the tendency of all would be to move in straight lines towards the centre of the universe. Thus Bishop Cotterill's observation, that the only effect would be the concentration of the whole mass, is strictly true on these two hypotheses, namely, that the universe, when homogeneous, was of a spherical shape, and that the only force exerted on the particles was that of gravitation. If the shape be supposed irregular, or if other forces following different laws from that of gravitation be supposed to have acted, differentiation to a certain extent might follow through the play of natural force, and without the intervention of will. But such suppositions as these are perfectly gratuitous; and it is evident that in making them at all we are out of our depth. If we suppose the universe to have been created homogeneous, we thereby acknowledge a Creator, and the intervention of will; if, on the other hand, we suppose the universe to have existed from all eternity, to speculate upon its original shape or nature involves an evident contradiction; for how could it have an original nature or shape if it had no origin? Seeing, then, that the effect of making suppositions on such subjects is to involve us in contradiction and uncertainty, the safest and most rational course seems to me to be to accept the biblical account of the origin of the heavens and of the earth, which, to say the least, is not less probable in itself than any other conjecture which philosophers have ventured upon, and which, moreover, has come down to us with a warrant and an authority which no man has a right to despise.

17. But to go back for another moment to the observations of Bishop Cotterill on Mr. Spencer's view respecting the original homogeneity of the universe. I have said that on the supposition that its shape was spherical, and gravitation the only force acting on its particles, the Bishop's conclusion would be correct, viz., that nothing but will operating upon it could have produced the variety which it now exhibits. But inasmuch as it is impossible to prove the correctness of these suppositions, we are not warranted in asserting that will *must* have acted. All that I have undertaken to show, and all that need be shown is, that will *may* have acted; in short, that Dr. Tyndall has no ground for his assertion that no nook or crevice is left for spontaneity. For this it is sufficient that the universe, if it ever was homogeneous, *may* have been spherical in shape at the same time, and that the force or forces acting on its particles *may* have observed the same law as that of gravity. In truth, I believe we might go much further, and say that if the universe was once homogeneous and finite, it is not only possible, but highly probable, that it was at the same time of the shape and nature here supposed, and therefore proportionally probable that the variety now existing has been the result of will. The fact more than once alluded to by Mr. Spencer that nebulous matter precipitated from a resisting medium would acquire a rotatory motion which would lead to further changes need not be considered in this connection, inasmuch as precipitation necessarily presupposes two different kinds of matter, the precipitant and the precipitate, whereas our present hypothesis is that only one kind of matter was in existence.

18. I had occasion, near the commencement, to allude to Professor Tyndall's denial of free-will to the human race, but it would carry me beyond the limits which I have assigned to myself were I to enter upon that subject, however interesting in itself. My object is to make it appear that the chief arguments made use of to the effect that there is no room for the operation of the Divine Will are without foundation; and I only mentioned human will for the purpose of observing that the arguments against its freedom being drawn from material considerations are wholly inapplicable (be they sound or unsound) to a pure spirit, such as we Christians believe our God to be. We are, therefore, at liberty to describe the will of God as "spontaneity," whatever we may think of the will of man.

19. In reference to the will of the Deity acting on matter, it will not be irrelevant to state what my friend, Professor Jellett, of Trinity College, Dublin, in his Donnellan Lectures

for 1877 on the *Efficacy of Prayer*, specifies as the essential difference between a miracle and an ordinary occurrence. According to him it is this—"that in the case of a miracle there is an immediate transition from a volition to an external result." By an external result he means a change external to the being or person by whom it is caused. Such a change cannot be effected by man except through the movements of his own body, caused by an exertion of his will; and a change so effected, however wonderful, is not a miracle. But we believe that an exertion of the Divine Will can produce results without any corporeal intervention; and when such is the case, the result is properly called a miracle. To use Professor Jellett's own words—"You cannot cause a pebble to rise from the ground, however earnestly you may desire it, without the intervention of your body; you cannot affect the mind of your fellow-man, however strongly you may will it, without the intervention of your body. Thoughts the most burning, until they are clothed in words, or find some other bodily expression, have no power beyond the individual in whose heart they are formed. So it is with the work of man. But it is otherwise with the work of God. There a mental antecedent *is* followed by an immediate external consequent" (*On the Efficacy of Prayer*, p. 39). And again he says:—"Notwithstanding some asserted phenomena (meaning, we may presume, those of mesmerism), it does seem to be a natural law that man's will, without the intervention of man's body, is powerless upon the external world. But we have no right to extend this law to the Divine volitions; nor, indeed, could we do so consistently with any system of Theism which prescribes action at any time to the Divine Being. If a divine volition cannot be followed by an external consequent, it is hard to see how the Deity, unless corporeal, can act at all, or could have acted at any time. Only an Epicurean theology would be possible under such a limitation" (*Ib.*, p. 56).

20. We have now to consider Mr. Herbert Spencer's arguments against the doctrine that there is a personal and intelligent Creator of the universe. He ultimately reduces them all to one, namely, that founded upon the persistence of force; but as he first gives them separately, it will be most convenient to take them in the order in which he has laid them down in *First Principles*. They are chiefly founded on:—1. The implied self-existence of the Creator. 2. The Indestructibility of Matter. 3. The Continuity of Motion. 4. The Persistence of Force (Part I., p. 31, and Part II., chapters 4, 5, and 6). Speaking of creation by external agency, he makes the following preliminary remark:—"Alike in the rudest creeds and in the cosmo-

gony long current among ourselves, it is assumed that the genesis of the heavens and the earth is effected somewhat after the manner in which a workman shapes a piece of furniture" (p. 35). As holding the belief of a Christian I must protest against this statement as unfair. No assumption whatever is made by those who receive "the cosmogony long current among ourselves," viz., the account contained in the Book of Genesis, with respect to the manner in which the universe was called into existence. And if they did make any such assumption it certainly would not be the one specified by Mr. Spencer in this passage. Their belief is that Creation took place in a manner which, whatever it may have been (for this they do not profess to know), was at any rate *totally unlike* that in which a workman shapes a piece of furniture. I cannot, in exposing the unfairness of such a representation of the belief of Christians, use clearer language than that of Mr. Spencer himself, who writes thus in the very next page with respect to it:—"Though it is true that the proceedings of a human artificer may vaguely symbolize to us a method after which the universe might be shaped, yet they do not help us to comprehend the real mystery, namely, the origin of the material of which the universe consists. The artisan does not make the iron, wood, or stone he uses, but merely fashions and combines them. . . . . The production of matter out of nothing is the real mystery, which neither this simile nor any other enables us to conceive; and a simile which does not enable us to conceive this may just as well be dispensed with." True, it may as well, nay, *ought* to be dispensed with. Only instead of believers in "the current cosmogony" being called on to dispense with it, it is *they* who are entitled to call on their opponents to dispense with it as representing their belief. The simile has been used not by believers, but by their antagonists, in order to turn the doctrine of Creation into ridicule, and on the part of believers I would take this opportunity of distinctly repudiating it. I do not mean to accuse Mr. Spencer of intentional unfairness. He may not have been the original inventor of the simile of the human artificer. It has served Dr. Tyndall also more than once as a weapon of attack upon the Christian religion, especially in his Belfast Address. But with whomsoever it may have originated, Mr. Spencer's own remarks, just quoted, ought to have saved him from so misrepresenting the Christian doctrine of Creation.

21. After the little prelude which we have had under consideration, Mr. Spencer proceeds to something which looks more like an argument, although I hope to make it appear that

it is not a conclusive one. "Those," he says (p. 35) "who cannot conceive a self-existent universe, and who therefore assume a creator as the source of the universe, take for granted that they can conceive a self-existent creator. . . . But they delude themselves." That any thing or being should be self-existent he had a little before pronounced to be impossible, because inconceivable. His words are (p. 31): "Self-existence . . . necessarily means existence without a beginning; and to form a conception of self-existence is to form a conception of existence without a beginning. Now, by no mental effort can we do this. To conceive existence through infinite past time implies the conception of infinite past time, which is an impossibility." Surely, the weakness of this argument is at once apparent. It contains the latent assumption that whatever we are unable to conceive is in itself impossible—an assumption whose falsity is nowhere more clearly brought out than in the present instance. For if we are unable to conceive infinite past time, we are just as unable to conceive finite past time; and if the argument were sound in the one case it would be equally sound in the other—that is to say, if infinite past time be impossible, because inconceivable by us, finite past time is impossible for the same reason. Therefore past time is neither finite nor infinite, which is a glaring contradiction. Mr. Spencer's argument against self-existence, and so against a self-existent Creator, being thus, as I believe, shown to be fallacious by its involving a contradiction, the objection to the universe having been created by external agency, which he has built up upon it, falls to the ground.

22. Mr. Spencer's next argument against the doctrine that the universe was created is derived from the supposed indestructibility of matter. This he calls a "physical axiom." But if we adopt his description of physical axioms, we must, I think, arrive at the conclusion that these are different from all other axioms, or rather, that they ought not to be called axioms at all, but should be denoted by a different word. An "axiom" is generally the word used to express a self-evident proposition—a proposition so evident that (according to the etymology of the word) an opponent in argument has a right to *demand* assent to it. But physical axioms, according to Mr. Spencer, are of quite a different character. He describes them as follows:—"There are necessary truths in physics, for the apprehension of which . . . a developed and disciplined intelligence is required; and before such intelligence arises, not only may there be failure to apprehend the necessity of them, but there may be vague beliefs in their contraries. Up to comparatively recent times, all mankind were in this state

of incapacity with respect to physical axioms, and the mass of mankind are so still. . . . But though many are incapable of grasping physical axioms, it no more follows that physical axioms are not knowable *à priori* by a developed intelligence than it follows that logical relations are not necessary because undeveloped intellects cannot perceive their necessity" (p. 176 of *First Principles*).

23. Now I venture to think that, in this passage, Mr. Spencer overlooks the distinction between "necessary truths, knowable *à priori*," and "axioms." Many truths are knowable *à priori* which, so far from being self-evident, require a long series of arguments to satisfy the mind that they *are* truths. To call such *à priori* truths axioms seems a new and misleading application of the latter term. The 47th Proposition of the first book of Euclid is a necessary truth, knowable *à priori*, and therefore is an axiom in Mr. Spencer's sense of the word; yet so far from its being self-evident, forty-six propositions have to be proved (after the axioms have been stated) before the intellect can have become sufficiently "developed and disciplined" to see its necessity. Much more is this the case with the more advanced truths of geometry. Surely then we are justified in asserting that physical propositions which "all mankind" (including the most learned) were incapable of seeing until recently, and which the mass of mankind are still unable to recognise, even when plainly set before them, have no pretension to be classed under the head of axioms. The importance of this remark will be seen in the sequel, when we shall have to consider propositions which are propounded as possessing the two characteristics of axioms, namely, self-evidence and incapability of proof, but which in fact only possess the latter.

24. One of these physical axioms (to use Mr. Spencer's phraseology) is the indestructibility of matter. He says (*First Principles*, p. 177): "Conceive the space before you to be cleared of all bodies save one. Now imagine the remaining one not to be removed from its place, but to lapse into nothing while standing in that place. You fail. The space which was solid you cannot conceive becoming empty, save by transfer of that which made it solid." Now, the only way in which I, as an individual, can reply to this argument is by saying that my intellect is not sufficiently "developed and disciplined" to be able to recognise this as a physical axiom. Mr. Spencer would, no doubt, say that this is owing to my having imagined, previous to the attainment of better scientific information, that bodies could be in great part annihilated by combustion, or that water could be made to boil

away by the application of heat sufficiently great for a time sufficiently long. He would probably say that my mind had become familiarized to the idea by the apparent destruction undergone by matter in circumstances of this kind. But what circumstances could familiarize the mind to the negation of an axiom? What circumstances could make any man believe that quantities equal to the same thing are unequal among themselves? or that four and one added together could result in any other number than five? Nothing, in short, can familiarize the mind to the denial of an axiom.

25. That there is something inconceivable about the annihilation of matter may be conceded. But I think it will be found, on examination, that it is not annihilation itself that is inconceivable, but the manner of it. That the thing itself is not inconceivable seems sufficiently manifest from the fact that the scientific world in general (with but few exceptions) has always believed that God could both create and annihilate. I say "but few exceptions," because I believe that even now a very goodly portion of our men of science recognise a personal Creator of the universe, notwithstanding some very confident assertions to the contrary. Witness the many men of scientific renown who belong to this Society, if there were no others. To say, therefore, that the creation and annihilation of matter are in themselves unthinkable is to pay but a poor compliment to such men. But I believe it to be quite true that we cannot conceive *how* this could take place; and I cannot help strongly suspecting that they who rely so much on the argument from inconceivability frequently confound these two ideas.

The action of gravitation through space is inconceivable, and yet it is an undoubted reality. Mr. Spencer has himself shown (*First Principles*, p. 60) that the hypothesis of its acting by means of an æther which extends throughout space brings us no nearer to a conception of the mode of its action, because the æther itself must be supposed to consist of atoms infinitely small in comparison to the intervening spaces; otherwise it would not be imponderable. "Instead then," (he goes on to say,) "of a direct action by the sun upon the earth without anything intervening, we have to conceive the sun's action propagated through a medium whose molecules are probably as small, relatively to their interspaces, as are the sun and earth compared to the space between them; we have to conceive these infinitesimal molecules acting on each other through absolutely vacant spaces which are immense in comparison with their own dimensions. How is this conception easier than the other? We still have mentally to

represent a body as acting where it is not, and in the absence of anything by which its action may be transferred; and what matters it whether this takes place on a large or a small scale?" Now, taking into account, what all must admit, that the action of gravity at a distance is an undoubted fact, notwithstanding that the mode of its operation is inconceivable by us, it appears that the creation and annihilation of matter may also be real facts, although we are unable to form a conception of the *how*.

26. But not only the inconceivability of the manner in which a circumstance takes place, but the inconceivability of the circumstance itself, may be quite consistent with its possibility. For this we need go no further than the fact noticed a short time ago, that finite and infinite time are both alike inconceivable, and yet one or the other, if not both, must necessarily be a reality.

27. Mr. Spencer's third argument is founded on the continuity of motion. "Like the indestructibility of matter," he says, "the continuity of motion, or, more strictly, of that something which has motion for one of its sensible forms, is a proposition on the truth of which depends the possibility of exact science" (p. 180). Then, after instancing the movements of the planets, whose velocity, though variable, owing to the ellipticity of their orbits, preserves a constant mean value, as also the vibrations of the pendulum, which, "with speed now increasing and now decreasing, alternates between extremes at which motion ceases," he asks, "What, then, do these cases show us in common? That which vision familiarizes us with in motion, and that which has thus been made the dominant element in our conception of motion, is not the element of which we can allege continuity. If we regard motion simply as change of place, then the pendulum shows us both that the rate of this change may vary from instant to instant, and that, ceasing at intervals, it may be afresh initiated. But," he adds, "if what we may call the translation-element in motion is not continuous, what is continuous? If, watching like Galileo a swinging chandelier, we observe, not its isochronism, but the recurring reversal of its swing, we are impressed with the fact that though, at the end of each swing, the translation through space ceases, yet there is something which does not cease; for the translation recommences in the opposite direction. . . . The truth forced on our attention by these facts and inferences is, that the translation through space is not an *existence;* and that hence the cessation of motion, considered simply as translation, is not the cessation of an existence, but is the cessation of a certain

sign of an existence—a sign occurring under certain conditions" (pp. 183, 184). He then explains the difficulty about the principle of activity continuing at the extremities of the vibration, although at those points the pendulum would offer no resistance to the hand, by observing that its activity is then latent, as proved by the fact that it forthwith begins to pull in the opposite direction; and adds, "Here, then, is the solution of the difficulty. The space-element of motion is not in itself a thing. Change of position is not an existence, but the manifestation of an existence. This existence may cease to display itself as translation; but it can do so only by displaying itself as a strain. And this principle of activity, now shown by translation, now by strain, and often by the two together, is alone that which in motion we can call continuous" (p. 187). Without further quoting Mr. Spencer's words, the conclusion at which he arrives at length is, that the continuity of motion is known to us really in terms of force, and that the principle of activity just described involves the postulate that the quantity of force is constant. This force, in the case of the planets, is the sun's attraction, and in that of the pendulum it is the earth's attraction. There is a very short formula to be found in elementary works on dynamics, occupying not so much as one line on the page, which, unless I greatly mistake, teaches very concisely all that Mr. Spencer has here said. It shows, when closely examined, at what parts of its path the motion of a body acted on by any force increases or diminishes, at what points it attains a maximum or a minimum, where it changes its direction, and, if it ever ceases, at what part of its path it does so. It also shows that its kinetic and potential energies are complementary, and make up together an unvarying sum, and that all this can be true only on the supposition that the coefficient of the quantity expressing the force remains constant throughout.* That coefficient, in the cases brought forward as examples, is the gravitating force exerted by the unit of mass at the unit of distance, and is, in fact, that "existence," or "principle of activity," which, as Mr. Spencer expresses it, "is alone that which, in motion, we can call continuous." The upshot of it all then is, that the sun's attracting power, in the case of the planets, and the earth's attracting power in the case of the pendulum, are assumed to undergo neither increase nor diminution during the time that the bodies respectively affected by them are the subject of observation or calculation. The ground of this assumption has now to be considered;

* See Appendix.

which brings us to Mr. Spencer's fourth and last great argument against creation, derived from the persistence of force.

28. This principle he describes as "the ultimate of ultimates" (p. 169). It cannot be proved experimentally, because this could only be done by weighing or measuring, in which processes it must be assumed, before any result can be relied upon, that both the force of gravity and the quantity of the matter which constitutes the weight, remain unaltered. Neither can it be proved *à priori*, because it is the most general of all principles, and while it comprehends all other principles, is itself contained in none (*First Principles*, pp. 192 B and 192 C, 3rd ed.). Since, then, it cannot be proved either experimentally or *à priori*, it must, he argues, be an axiom. Now, what I have already said about the alleged axiom that matter is indestructible applies equally to this. I cannot myself see it to be an axiom, because I persuade myself that I can very well conceive its contradictory to be true. I can conceive terrestrial gravity to diminish, just as I can conceive the caloric resident in a heated body to diminish by radiation. It is generally believed that solar heat is gradually diminishing from that cause. Why, then, should it be inconceivable that solar or terrestrial attraction might in some similar way diminish? Let it be remembered that the question before us is not whether this be a fact or no, but whether it is *thinkable*—whether it can be mentally pictured; for if it can, its contradictory is not an axiom. As to the fact, Professor Challis has shown that gravitation can be accounted for on the hypothesis of a reaction of the atoms of which matter is composed against æthereal pressure. If that be the actual cause of it, it appears to me that the attraction of any particular mass, such as the sun or the earth, would not diminish or increase, because, according to his theory, the atoms always continue to be of the same size and shape (being absolutely incompressible), and there seems to be no reason why the pressure of the æther upon them, and consequently their reaction against it, should alter. But whether this be so or not, the contrary is as conceivable as it is that heat should radiate. It should be observed that the theory of Professor Challis, although it is, if true, an important advance in hydrodynamical science, does not in the least vitiate what has been said by Mr. Herbert Spencer as to the inconceivability of the *manner* in which gravitation acts, owing to there being always intervals between the atoms of the æther. Professor Challis distinctly says of this æther, that it is "itself atomically constituted" (*Transactions of the Victoria Institute*, vol. XII., p. 7); and more fully he says in the

Philosophical Magazine for September, 1876 (p. 173), "The æther, being assumed to be susceptible of variation of density, must be conceived to be atomically constituted, because we have no experience of variation of density and pressure which is not the result of atomic constitution. But for the purposes of physical research, it suffices to regard the æther as a *continuous* substance, and apply calculation to it as such, just as the air is treated mathematically in hydrodynamics, although it is known to be composed of discrete atoms." Thus, Professor Challis, while treating the æther as continuous for convenience of calculation, declares that it, in fact, consists of discrete atoms, like the air. There is, therefore, nothing in the view adopted by him which at all militates against Mr. Herbert Spencer's remark, that by supposing the intervention of an æther we are brought no nearer to the conception of action at a distance than we were without that supposition, because the atoms of the æther itself are at distances from each other which are very great when compared with their magnitude. Since, then, we cannot conceive any mode by which gravitation produces its effects, surely it would be taking a great deal upon us to accept it as an axiom that its amount can never vary. Unless we knew its mode of action, we could not possibly assert this even as a fact, much less as an axiom. If we did not know it to be a fact that a heated mass gradually loses its heat, it seems to me that there would be quite as much reason in pronouncing upon the invariability of its heat as upon that of its attracting power. If one power of matter can be subject to variation, why not another; especially when both are believed to act through the same medium, viz., the æther?

29. It might perhaps be said in reply, that even the supposition of a gradual diminution of the attracting power of the sun or the earth would not be inconsistent with the persistence of force, because that power might be dissipated, as heat is believed to be dissipated, but never actually lost. But the question which is now being dealt with is the persistence, or rather the invariability, of the attractions of the sun and of the earth upon bodies to which their attractive force can reach; for it is by examples drawn from these that Mr. Spencer illustrates his principle. To admit that these forces may be dissipated would be to admit that the conservation of energy is not an established principle; for then the kinetic and potential energies of a planet or of a pendulum would not be complementary, the unit of force which is assumed in dynamical calculations to be constant being no longer so. Thus, Mr. Spencer's principle of the persistence of force would not only

cease to be an axiom, but would be actually untrue. The supposition, therefore, that the force is dissipated in the cases which we have been considering, so far from favouring Mr. Spencer's view, would be fatal to it. It would assume that the attractions of the sun and of planets may alter, whereas Mr. Spencer's position is that they cannot alter, for that if this were supposed possible all dynamical calculations and all astronomical predictions would be uncertain.

30. But it may be asked—Why, then, is the constancy of the unit of force so confidently assumed, if it be true that it is not an axiom, and yet that it cannot be proved either *à priori* or by experiment? The answer is, that there are various kinds and degrees of proof; and there are degrees of probability which amount practically to certainty. Most of us must remember the instance given by Bishop Butler of this very high degree of probability, viz., the confident expectation entertained by all that the sun will rise to-morrow. No proof of this can be given which would lead to absolute certainty, and yet all our arrangements for the future are based on the assumption that each day will be like those which precede and follow it. Mr. Spencer would say that this necessarily follows from the persistence of force, which causes the earth to revolve uniformly on its axis. But as the persistence of force is the principle actually under discussion, we cannot accept it as demonstrating to an absolute certainty the recurrence of a terrestrial day. We are practically certain of such recurrence, but we have not the certainty of demonstration. Now, I believe that we have a similar kind of certainty of the persistence of force, derived from our experience, which enables us to assume for practical use the consistency of the unit of force, and to believe that it neither has varied nor will vary in the course of any time with which we have to do, unless it should at any time seem good to the great Creator of all things to alter or annihilate it. And this I believe for the following reasons:—

31. Force is known in dynamical reasoning simply as a commencement or change of velocity, the mass remaining the same. Metaphysically, we believe that every change has a cause; and, therefore, that when the velocity of a moving body commences or changes, there must be some cause for the change, and to this unknown cause we give the name "force." But this cause does not enter into the mathematical process. All that is there taken account of is the velocity, or change of velocity, produced in a given time. Now, since velocity is a function of time and space, and force is a function of velocity and time, the elements, and the only elements, whereby we

can judge whether a force varies or no are time and space. If we can ascertain that the portions of each of these, in which a certain amount of velocity is produced, are equal, we are entitled to say, in Mr. Spencer's language, that the force has persisted. Now, this is to be ascertained by measurement. Space is measured by a bar (we will suppose) of a certain length, and time by the vibrations of a pendulum or balance. If two portions of space are covered successively by the measuring bar, we say they are equal; and if two portions of time are occupied successively by a vibration of the pendulum or balance, we say they are equal. In doing so, however, we assume that the bar has not altered in length between the two space-measurements, either by extension or compression, or by gain or loss of matter; and that the force of gravity, or the elasticity of the springs (according as a clock or a watch is used), has not altered between the two time-measurements. What, then, is our ground for these assumptions? Not, surely, that such variations are inconceivable; for I persuade myself that I, for my own part, can very well conceive them, if a sufficient cause were to occur; but, in the first place, because we know of nothing to cause these quantities to vary, which makes it at least very probable that they did not vary between the two measurements; and in the next place, because bars of different materials and different degrees of compressibility could not give (as they do) the same result in the successive measurements unless their length were invariable; and the improbability, on any other supposition than that of the constancy of the forces, that a clock and a watch should give the same result in successive trials (the former being acted on by gravity, and the latter by forces quite independent of gravity, viz., the main and balance springs) is next to infinite. Greater still is the improbability that variations in both these standards of measurement (the space-standard and the time-standard) should take place together, and in such proportions that it should be impossible to detect the slightest difference in the total effect.

32. It is by reasoning of this nature that I, for my own part, have convinced myself that force is persistent, and not from any inherent impossibility that it should be otherwise. I am reluctantly obliged to instance my own power (or rather powerlessness) of mental conception in this matter, because when we are called upon to admit any proposition to be an axiom, the appeal is to each man's understanding, and to that alone. And unless I much mistake, I am not the only person in the world who cannot see the axiomatic character of the principle of the persistence of force. Granted a sufficient

cause, such as the will of a Creator, and there are, I am sure, many who will see no absurdity in the supposition that the unit of force might be altered, however certain they may feel, from experience, that it has undergone no change since the universe was formed. Mr. Spencer, it is true, looks upon the hypothesis that the universe was ever formed as itself inconceivable, because it is equally inconceivable with that of the destructibility of matter. This view has, however, I should hope, been already sufficiently considered in this paper, and I need not go back upon it.

33. If this principle of the persistence of force, which, according to Mr. Spencer, is the ultimate of ultimates, not only including the indestructibility of matter, the conservation of energy, and the equality of action and reaction, but extending to all circumstances, historical, moral, and social—if, I say, this principle be not an axiom (as I hope has been shown), the great argument of that writer against belief in a personal Creator of the universe falls to the ground. Hence the vast importance of carefully examining into the alleged axiomatic character of the principle. The foregoing considerations have reference chiefly to force in the ordinary sense of the word, *i.e.* dynamical force; partly because it is the kind of force on which I have bestowed the greatest amount of thought, but chiefly because all that the author says about historical, moral, and social forces is professedly deducible from the dynamical principle (*First Principles*, p. 429, edit. 1875), and therefore must stand or fall with it. I am quite prepared to have many defects, and even errors, pointed out in what I have said. I can sincerely assert that I have ventured upon the foregoing remarks with the utmost diffidence, at the kind request of our Secretary, and shall thankfully accept any corrections or criticisms that may be made upon them. But whatever errors I may have committed in detail, I think the main conclusion for which I contend is still made out, namely, that the recently established principles (if they may be looked upon as established) of conservation of energy, persistence of force, and others akin to them, are unwarrantably and without reason pressed into the service of unbelief by men of science. The principle that kinetic and potential energy are complementary, which is one form of the persistence of force, can go no farther than to show that the algebraic sum of the forces of the universe *has not been known* to change. The inference that it *cannot* change is quite illogical, and it is on this unwarrantable inference that the whole structure of scientific unbelief rests.

APPENDIX.

As some readers might wish to know the formula referred to in the text (sec. 27), I may state that it is, in its most general form—

$$\Sigma mv^2 = 2\Sigma.m\int(X dx + Y dy + Z dz) + C \quad (1)$$

in which m denotes the mass of some one of the bodies or parts of the system, v its velocity, X, Y, and Z the resultants of the forces resolved along the axes of co-ordinates respectively, Σ the sum of like quantities (for instance, Σmv^2 is the sum of the products of the masses multiplied each by the square of its velocity—called also the sum of the *vires vivæ*), and C a constant quantity to be determined according to the value of Σmv^2 at some determinate position of the system.

This equation takes different forms for different cases. In that of a planet revolving round the sun, where the mass of the planet may be taken as the unit, and the mass of the sun as immensely great, when compared with it, it is shown in books on physical astronomy that $X dx + Y dy + Z dz = -\frac{\mu dr}{r^2}$, where μ is the sum of the attractions of the sun and planet, and r the distance of the latter from the former, or, more strictly, from their common centre of gravity, which is, *quàm proxime*, at the centre of the sun. Hence $2\int(X dx + Y dy + Z dz) = \frac{2\mu}{r} + C$. The left-hand number of equation (1) is evidently in this case $MV^2 + mv^2$, where M and m are the masses of the sun and planet respectively, and V and v their respective velocities round the common centre of gravity. Now, we know that the quantities of motion MV and mv are equal; therefore $V = \frac{mv}{M}$. And if we suppose $M = mn$, n being a very large number (in the case of Jupiter, the largest of the planets, in which n is smallest, it is 1,048), this equation becomes $V = \frac{v}{n}$. Hence $MV^2 + mv^2 = mv^2\left(1 + \frac{1}{n}\right)$, in which $\frac{1}{n}$ may be neglected without sensible error. Thus equation (1) becomes in the present case, $mv^2 = \frac{2\mu}{r} + C$. This is the kinetic energy of the planet at the part of its orbit where its velocity is v, v being variable. If we take $m = 1$, and suppose v' the velocity at

nearer apsis, where $r=a(1-e)$ (a being half the axis major of the planet's orbit, and e the eccentricity of the same), we have $v^2=\frac{2\mu}{r}+C$, and $v'^2=\frac{2\mu}{a(1-e)}+C$, whence, subtracting, we have

$$v'^2-^2=\frac{2\mu}{a(1-e)}-\frac{2\mu}{r}. \quad (2)$$

Since $a(1-e)$ is the least value of r, it is evident that v'^2 is greater than v^2, except when the planet is at the nearer apsis, and then they are equal. At any other place v'^2-v^2 is the kinetic energy lost since the planet was at the nearer apsis, and which, as it will be regained on its return thither, is the *potential* energy. Now, if v^2 be put to the right-hand side of equation (2) (its sign being of course changed), we learn that $v^2+\frac{2\mu}{a(1-e)}-\frac{2\mu}{r}=v'^2$, that is to say, that the sum of the kinetic and potential energies is constant, and equal to the maximum kinetic energy. The maximum potential energy is at the point where r is greatest, because $\frac{2\mu}{r}$, the quantity to be subtracted from the constant $\frac{2\mu}{a(1-e)}$, is then least. It is therefore at the point where $r=a(1+e)$, *i.e.*, at the remote apsis. After this point has been passed, the potential energy diminishes, and at any point in the return half of the orbit both kinds of energy are of the same amount as they were when the planet was equally distant from the sun in the former half.

In the case of the pendulum vibrating through small arcs, equation (1) takes the form $v^2=-2g\int sds+C$, where s denotes the variable distance of the pendulum at any point during its oscillation from the lowest point (that distance being measured on the arc which it describes, and g being the constant force of gravity). Performing the integration, we have $v^2=-gs^2+C$. If we denote by s' the distance of the point where the motion ceases, $v'=0$, and we have $0=-gs'^2+C$, whence $C=gs'^2$. Substituting this in the equation $v^2=-gs^2+C$, and subtracting, we get the equation

$$v^2=gs'^2-gs^2. \quad (3)$$

This is the actual kinetic energy at the distance s. It vanishes at the greatest distance s', since there $gs'^2-gs^2=0$, and it increases as s decreases until $s=0$ (*i.e.*, until it reaches the lowest point), when it is greatest, being equal to gs'^2. If now we remove gs^2 to the left-hand side of the equation, we have $v^2+gs^2=gs'^2$; and as gs^2 is the difference between the

kinetic energy at any distance s and the maximum kinetic energy, it represents the potential energy. We learn, therefore, from this last equation that the sum of the kinetic and potential energies is constant, and equal to the kinetic energy when the latter is greatest. After the pendulum has passed the lowest point of the arc, s changes its sign, and the pendulum ascends on the other side until it reaches the distance $-s'$, when the motion again ceases; and if we do not consider the resistance of the air or the friction between the pendulum and its support, it will vibrate back and forwards without limit of time. The change in the sign of s and s' makes no difference in the formula, as s^2 and s'^2 are still of the same sign.

Assuming in all this the invariability of the unit of gravitating force, the theorem that the kinetic and potential energies make together one unvarying sum has no more to do with religion than has the statement that if I am travelling with a view to reaching a certain distance, the space I have already travelled and the distance I have still to travel make together a constant sum, namely, the whole distance. By assuming the invariability of the unit of force, I need scarcely say I do not mean "assuming that it *cannot* vary," but "assuming that, under ordinary circumstances, it *does* not vary."

The CHAIRMAN.—I need not ask whether I am to return the thanks of the meeting to Lord O'Neill for his exceedingly well-reasoned paper. His lordship has invited corrections and additions, but I am only afraid that the debate will drop still-born on account of the general agreement, which I am sure there will be with what he has said. I would call particular attention to his having so strongly brought out the principle that we ought not to consider a thing impossible because we cannot conceive how it can take place. The simple fact of a stone falling to the ground is inconceivable as regards the "how," and Lord O'Neill has brought out strongly that no philosopher has ever been able to give a satisfactory explanation of it. I have not read the investigations of my friend Professor Challis; but it is well known that the action of gravity at a distance perplexed no less a mind than that of Sir Isaac Newton; and it is to ordinary faculties perfectly inconceivable how one body can act upon another through space. While we know by our every-day experience that this kind of action does take place, it ill-befits us to say we will not believe in a thing because we cannot see how it is possible. If any member present has any of those corrections or remarks to make which Lord O'Neill has so modestly invited, the Society will be glad to hear them.

Mr. D. HOWARD, F.C.S.—I am afraid it would require considerable boldness to attempt corrections of Lord O'Neill's paper; but there is

much in it that offers an extreme temptation to comment on, although I do not think that I at least could improve a paper that is so clearly and lucidly put. There are, however, one or two things I should like briefly to call attention to as being, in my opinion, very important, and which I only touch upon, on the principle of commending what has been said to the careful re-reading of those who have heard the paper read, and to the careful perusal, also, of those members of the Institute who, although not present, will receive a copy of the paper. I would first refer to the immense importance of what has been so well put, as to conceivability not being a measure of knowledge. It is perfectly true that the discipline of human intelligence is of immense value; and it is true that the opinions of men like Tyndall, Huxley, and Herbert Spencer, are of great value in proof of the positive of matters coming within their own line of thought. If Huxley, Darwin, or Professor Tyndall say they can conceive a thing, we may well consider that the thing is probably conceivable; but to conceive a negative is so extraordinary that one can hardly imagine how these able thinkers can suppose that the inability to do so disproves anything. It has been well put in the paper that the later propositions of Euclid are not less true because they require a trained intellect to appreciate them. Surely most of us have had schoolfellows who have shown an utter inability to understand the propositions in the first book, and who, in fact, have gone far to disprove them, if it be true that inability to conceive a thing can prove a negative. There are many people who are totally unable to conceive the differential and integral calculus; but this does not amount to anything like a disproof of the propositions involved. On the contrary, we should rather be disposed to say of them that the fact that other people can conceive these things proves that such things are; and why, I ask, should we not apply the same argument to those unbelievers who say they are unable to conceive the existence of a Divinity, and that, therefore, there is no Divinity? I should say, "Does not this prove the imperfection of your faculty of conception, rather than the non-existence of a Deity?" A man may have the keenest ear for music, so as to be able to detect a subdivision of a semitone, which nine people out of ten are utterly unable to perceive, but that does not prove that he has a correct eye for colour, as he may be colour-blind. I have known men who are unable to perceive the difference between green and red—who were such excellent musicians, that they could readily detect a difference between two sounds that was far beyond my perception. To put it in this way: as a man affected with Daltonism can conceive no difference between red and green, so there are people who are affected with a spiritual Daltonism which prevents their being able to conceive of the Creator. Do not let us forget the statement that if any man will do His will he shall know. The close connection between the action of the will and the power of the intellect is one of those things that are far beyond our ability to understand, and which cannot be measured by our powers of understanding. I am very glad the paper read to-night has so clearly and

forcibly worked out one particular point by showing that the argument as to continuity of force does not depend on the observations of a trained intellect. It is not so very long since the doctrine of continuity of force was discovered. Surely there was accurate thought before then. It is simply like the question of the indestructibility of matter which has for long engaged human thought, namely, whether matter did not exist from infinity, a defined quantity of matter which chemistry declares to have always been the same. A piece of wood does not vanish into nothing because you burn it, but simply becomes gaseous, the same weight of matter remaining at the end of the process as at the beginning. The doctrine of the quantitative estimation of the forms of matter has infinitely promoted the modern knowledge of chemical and physical science; but has this in the smallest degree shaken the Christian faith? I really cannot see that it has done so; on the contrary, the Christian faith has survived unchanged. The modern chemist is neither more nor less a Christian, although he believes that the quantity of matter is for all practical purposes the same at all times. Why, then, should the doctrine of the conservation of energy and of a defined quantity of force being the same for all practical purposes, have the slightest effect on the Christian faith? We are not more or less atheists or more or less Christians, because we believe that when the diamond is heated to a certain degree it becomes carbonic acid, which we cannot see, and ceases to be carbon; and we are not more nor less believers, because a piece of charcoal becomes dissipated into carbonic acid, leaving very small traces behind. The fact is that we are simply obliged to come back to this point, that a great many modern scholars will not believe, and they cannot believe because they will not. There is such a thing as the will, and this will, which is denied by some of these men of science, is, after all, exerting the most extraordinary force over their own convictions. These scholars are themselves governed by the will they deny, and the very denial of their will is a proof of that will which brings them so to exercise their minds as to deny the will by which they are at all times influenced.

Rev. Professor DABNEY (of Virginia, U.S.A.).—I wish to add my modest word of obligation for the paper read this evening. I confess myself very much instructed by it. I also wish to express the great gratification with which I have heard the declarations that have been made, that the power of conceiving a proposition is not really necessary to its truth. I was reminded by what I heard, of the emphatic way in which the great Dr. Parr put this fact before the mind of a conceited young theologian who was advancing a scheme of theology of which this proposition was somewhat the corner-stone,—that nothing was to be believed except what was conceivable. As the anecdote goes, the old doctor said, "You, sir, must perforce have the shortest creed of any young gentleman in the kingdom." And I think that the more widely we extend our knowledge of theology, philosophy, and physics, the more must we comprehend and believe things which otherwise are beyond our comprehension. A gentleman in this room, to whom I listened with much satisfaction, suggested a protest which has more than once arisen in my own

mind on the important subject of this paper. Scientific writers are never tired of using expressions of contempt for theology—witness, Professor Huxley. They tell us that science—real exact science—is the knowledge of the facts of observation, and then comes the point against which I wish to raise my protest. When they endeavour to define what they mean by facts of observation, they limit definition to the observation of facts and sensations. Now, if they define science as the knowledge of facts, and observation as the observation of sensations, they have the game in their own hands ; but against this I do most vehemently protest, and I would endorse the remark that has been made with so much justice this evening, that we cannot construct any system of knowledge. The knowledge of the observed facts of motion and dimension and sensation, implies a knowing agent. I defy any of these physical philosophers to go on without making that admission. As knowledge implies a knowing agent, you cannot construe sensations without the admission of the *ego* receiving the sensation. Now, I must ask myself a simple question, raised by what I have heard in the discussion in this paper, as to the ultimate effects of consciousness. There is a relatiou between the cognition of the *ego* which perceives and the sensation perceived. The answer given by my common sense is, that I must be conscious of my recipient power in order to receive. I am ready to say that all exact science is the science of observed things ; but when we speak of observations we should also include the observer. These are the primary elements of our knowledge. The accurate knowledge of ourselves is *à priori* the condition before our perceiving that which is outside ourselves. With regard to the doctrine of spontaneity, when Professor Tyndall calls my attention to an optical phenomenon, am I not immediately conscious that he is exercising spontaneity in the construction of his experiment and the selection of its means? I know that I have spontaneity ; but then I know that light is refracted. Having recognised the subjective facts, the recognition of which is *à priori* essential to the recognition of the objective facts, we are led to take a similar view before enforcing the arguments of this paper. Does not universal experience teach us that the evolution of spirits is perpetually modifying the laws of physics? Every originative motion, as far as our knowledge goes, is traceable to an act of spontaneity. Now, according to the spirit of inductive physical science, what is the probable conclusion? Why, that the first motions also originated in a spiritual act of spontaneity. The soldier, for instance, hears, and possibly sees, the cannon-ball hurtling through the air. The question is asked, what propels it? The physicist will say, the expansive power of a fiery gas. Well, what liberated that power? The spark applied to it. What applied the spark? The detonative power of the friction match. What produced that detonative power? The action of the lanyard spring. What liberated the lanyard spring? A human finger. What moved that finger? Would you say the word of command of the sergeant of the gun? What moved the tongue to give the word of command? The will of the sergeant. This is a very homely instance, but I hold it is a fair one, and if you reflect upon and

examine it, you will say it is a good explanation of a fact coming within human experience as to originative motion, which is the evolution of spirit. To what, then, shall we trace the grand system of motion we see in the material universe? It is curious that we so seldom hear in these recent speculations any reference to the fact that grand old physical philosophers like Newton, Leibnitz, Galileo, Torricelli, and all that great school, who created modern physical science, recognised inertia as an essential attribute of all matter. They held that the nature of matter is inert; that if it be in a state of motion it has no power of self-rest; if in a state of rest it has no power of self-excitement. If this be true must we not go outside of matter for the origination of motion? The argument put thus seems exceedingly short and simple—so simple, indeed, and so short, that it almost produces a feeling of indifference when we seem to imply the charge that learned men overlook it. Then, I think, the practical mind will rest, and derive another simple confirmation of the thesis of this important paper—"You must recognise will in the universe." It has been well said that force implies substance on which it acts; that you must go outside the material substance to find the origin of force. Spirit moves matter, and it is the Infinite spirit that moves this vast universe.

Rev. S. WAINWRIGHT, D.D. —If I understand the last speaker aright, he contends that there must be such a thing as will, because he is conscious he possesses it. Huxley asks us to demonstrate this proposition, to demonstrate that consciousness, and the speaker has given us many reasons that come admirably near doing so. To refer to the paper, the writer says, "What greater break in the uniformity of nature can be imagined than the commencement of life?" I would have preferred the sentence without the last two words. He then continues, "If"—I would have preferred the word "since,"—"terrestrial life had a commencement, there can be no great difficulty in believing that the whole universe had a commencement also." Now, science makes it certain that there was a time, to use Professor Tyndall's words, in his Midland Address, "when there was nothing living on our planet," and a temperature at which no life was possible. Huxley affirms that whatever there is in the living being there is in the dead, and he calls it protoplasm, and tells you that living protoplasm is never produced except under the influence of living protoplasm, I think we have a right to ask how the first piece of protoplasm acquired life. On his own showing there was therefore a time when life was not in action in matter; and all the assumed eternity of matter, and all the "inheritance of laws," &c., will not enable those men of science who deny the existence of a Creator, to account for the phenomena that they themselves assert to have been produced in the inorganic world. Tyndall speaks of the atoms that were eternally falling, and that when they ceased to fall they began to think; but without life there could be no thought. Again, there must have been a beginning of the atoms, of their motion, a beginning of the process whatever it was, out of which the inorganic generated the organic. Science at present knows nothing of this beginning. Writers admit the material on

the one side, and the intellectual on the other, but have not bridged the difficulty which Tyndall admits when he says we may trace the nerve-process and the operations of consciousness, but that to connect the two is beyond his power. I think we are much indebted to Lord O'Neill for his paper.

Rev. J. JAMES.—It seems to me that the difficulties which certain men of science find in their pursuit of science, and their avowed inability to explain some of its patent phenomena, arise from what deprives them of a claim to be true philosophers, viz., that they studiously ignore a large portion of existent phenomena, as being out of their pale. I trust they may some time come to see, what has been so ably put by a previous speaker, that as scientific men they are in the wrong, and are even sinning against science, in limiting, as they do, the investigations of science and the discussions of science exclusively to physical phenomena. I cannot but hope that they will come to see that, as philosophers, they must take into account the phenomena of life and of mind; they will then find no difficulty in acknowledging that there is a power beyond, which is sufficient to account for the existence of life or soul, and mind or spirit; a power which must therefore be taken into account in the endeavour to explain what they cannot now explain. It seems to me that the very name "agnostic" disowns for it all claim to philosophy in the true sense of the word, as taking note of *all* existent phenomena—all objects of human wisdom and knowledge. By that term itself they seem to say, "we refuse to recognise any but self-chosen phenomena," and I think it is a great point for us to insist on, that men of this school of agnosticism, with all their prestige of physical science, are untrustworthy by reason of their acting in this way. I earnestly hope they may have more light thrown upon their researches, and may be enabled before long to acknowledge themselves to have been shortsighted and narrow-minded and unphilosophical, in so far as they have put aside and ignored the psychical and spiritual indications of a Creative and Regulative Power.

Lord O'NEILL.—I have to thank those who have heard this paper, and to acknowledge the kindness with which it has been received on the part of those who have made observations on it. Those observations have been so very much in accordance with my own views, that I really have nothing to reply to. I can only once more thank the gentlemen who have spoken so kindly, and who have made such valuable additional observations on the subject; and I may add, with regard to Dr. Wainwright, that I accept the corrections he has made as to my way of expressing myself. He has quite caught my meaning. When I spoke of the commencement of life, I meant it as an example of the commencement which might be joined to everything else. If we believe in a commencement of life, we must believe in a commencement of everything. There is nothing that calls for any further observations on my part.

The meeting was then adjourned.

REMARKS BY THE REV. PROFESSOR CHALLIS, M.A., F.R.S.

I CONCUR in all essential respects with the considerations advanced by the Lord O'Neill in his paper, *On the Action of Will in the Formation and Regulation of the Universe*, and am induced to offer the subjoined remarks only in consequence of the references made in Art. 28 to principles on which I have founded a theory of the force of gravitation. The views I hold on this and like questions are given in two communications published in the *Transactions of the Institute* (Vol. XI., No. 42, and Vol. XII., No. 45), and in various productions contained in the *Philosophical Magazine*. My present purpose is to supply some additional explanations which appeared to me to be called for after reading certain statements made in the Lord O'Neill's paper.

It is true, as he says, that I propose to account for gravitation "on the hypothesis of a reaction of the atoms of which matter is composed against æthereal pressure," and for the persistence and constancy of the force by supposing that the atoms are always of the same size and shape. But according to my views this is not the only condition of the unalterability of gravitation. In my researches respecting the characteristics of the physical forces, I have uniformly assumed that all *active* force in nature is exerted by the intervention of the æthereal medium, and all *passive* force is reaction at the surfaces of spherical inert atoms of constant magnitude against pressure of the æther. On these principles I have endeavoured to account not only for gravitation, but generally for the forces concerned in the phenomena of light, heat, electricity, galvanism, and magnetism, together with the atomic and molecular forces whereby the constitution of sensible *masses*, as consisting of an aggregation of atoms, is maintained. In all the reasoning applied to these purposes it is assumed that the æther is a homogeneous substance, composed of discrete atoms all of the same size, but incomparably smaller than the atoms of sensible gross bodies; also that it is susceptible of variation of atomic density, and has the property of pressing against its own parts, and against the atoms of all sensible bodies, in exact proportion to its atomic density. In other words, the pressure is equal to the density multiplied by a constant factor, as is the case with respect of air of given temperature. There is, however, this essential difference, that with respect to air the factor is a quantity measurable by experiment; and a theoretical reason for it is derivable, as I have endeavoured to show (*Phil. Mag.*, 1859, pp. 401–404), from the mutual action between the æther and the aërial atoms. But with respect to the æther, the factor must be absolutely constant, inasmuch as it expresses the intrinsic elasticity of the æthereal medium, and there are no antecedent physical conditions whereby this elasticity can be altered. From this argument I draw the conclusion that the persistence of physical force depends wholly on the essential qualities of the atom and on the constancy of the elasticity of the æther, and that these are underiv-

able conditions, generated and maintained by the Will and Power of the Creator of the Universe. It never occurred to me to imagine the existence of any power which could prevent the Originator and Upholder of these conditions from withdrawing them, or altering them, at His will.

I now proceed to the main purpose of the remarks, which is, to meet the argument, accepted by the Lord O'Neill, by which Mr. Herbert Spencer maintains that the consideration of what is called "action at a distance" is not got rid of by the action of the æthereal medium assumed to be atomically constituted in the manner already stated. In the first place, I do not admit that any argument respecting the relative magnitudes of the atoms of the æther and the spaces separating them can be drawn from the imponderability of the æther, because I hold that the weights of all bodies are due to the action of the æther upon them, and consequently that neither weight nor non-weight can be predicated of the constituents of the æther itself. The æther, for instance, does not gravitate towards the mass of the sun, because it is by the intervention of the æther that the sun attracts. Thus the argument for the reality of action at a distance based on the supposition that the æther is imponderable falls to the ground.

In my scientific productions, published in the *Philosophical Magazine*, I am wholly at issue with Mr. Herbert Spencer and most modern physicists as to the possibility of one atom of matter acting upon another by mere emanation of force, without the intervention of mediate substance, and in this view I am supported by the recorded opinion of Newton, who thought that no one competent in philosophy could entertain such an idea. I have in fact argued, I think with some success, that all the physical forces recognised by experiment, including the molecular forces by which the atoms of sensible bodies are held together so as to constitute masses, are effects of mutual actions between the æther supposed of invariable intrinsic elasticity, and atoms supposed to be inert, movable, and of constant spherical form and magnitude, and that on these suppositions the effects admit of being ascertained by mathematical calculations. According to these premises the action of one atom on another is shown to be produced by means either of propagated vibrations or of currents of the æther, so as to exclude action at a distance. It may, however, be urged that such action must still take place between the atoms of the æthereal medium in order to account for its pressure. To meet this objection it occurred to me, in my first speculations on the nature of physical force, that as the law connecting pressure with density in air of given temperature might be shown to be the result of mutual action by pressure between the aërial atoms and the æther, the same law might be supposed to be produced in the æther itself by like action of another æther of still greater tenuity; and so on *ad libitum*. This idea of *successive æthers* which, probably, would be received with favour by those who adopt materialistic views, I shortly afterwards discarded; and in place of it I now propose the following theory, which, I think, may be considered to give a reasonable account of the origin and character of physical force. To render the theory intelligible I begin with an illustrative instance. The production of phe-

nomena of sound may be traced, by experiment and mathematics, from agitations of the air to the action of the generated vibrations on the auditory nerves; and the sound as to *quality*, *intensity*, and *pitch*, results from the character of the initial disturbance. But these are *non-material*, or *spiritual sensations*, in exact co-ordination and correspondence with their immediate material antecedents, but in essence they are in quite a different category. The same kind of argument applies to *light* as produced by vibrations of the æthereal medium. Hence it follows that physical science, as understood by indications of the senses, is concerned with *non-material* as well as *material* entity. Just so, after we have derived the material conditions of the action of physical force from the qualities of the atoms and the æther as above defined, we have not reached the essential quality of force. To do this we must take account, as has just been illustrated, of non-material as well as material essence. We must admit that the production and maintenance of those primary conditions from which it is the province of mathematical reasoning to show that the action of physical force flows, are due to the operation of *Mind*; the conditions, namely, of the permanence of the qualities of atoms, of the constitution of the æther and its intrinsic elasticity, and as depending thereon, its pressure, and law of pressure. *Intelligence* was employed in designing the qualities appropriate to the intended purposes; *Will* and *Power* were required for giving them existence, and are also constantly exercised in maintaining their effects. Our own consciousness tells that will and power are concerned when we move our limbs, which we are enabled to do by means of the control, limited by the conditions of organization, which our Creator has given us over the physical action of the æthereal medium. "In Him, we live, and *move*, and have our being." These views exclude action at a distance, and at the same time assign its truest meaning to the law of the Conservation of the Energy of the Universe, the word energy in this acceptation not having the mechanical meaning assigned to it by modern physicists, but being a definite expression of the exercise of spiritual power.

REMARKS BY THE REV. PREBENDARY IRONS, D.D.

If there be any truth in the rumour referred to by the noble Lord who has favoured us with this paper, viz., "that the scientific and even the clerical world is fast drifting into unbelief," the fact cannot be attributed to any scientific or critical successes thus far achieved against the Christian position, but to other and distinct causes. After the experience of the last few years, we are justified in saying that the confident anti-Christian assertions of *literati* and experimentalists have been met and examined, and that the ingenuous fearlessness of educated Christians (specially shown in this Institute) has really silenced the offensive pretensions to "enlightenment" to which the quasi-scientific had accustomed the last generation. Bishop Cotterill's papers, by their careful and analytical

character, will sufficiently indicate this. Still there is no doubt that the controversy between faith and unbelief has now reached a special kind of crisis, which Lord O'Neill's paper this evening intimates. Men of high intelligence, like Professors Huxley and Tyndall, are, of course, aware that the secret of life and primary motion actually lies beyond science. The acknowledgment is made, in sufficiently mystified terms at times, but it is made. Thus Professor Tyndall says :—"Divorced from matter, where is 'life' to be *found?*"—(as if he ignored the whole region of *thought*),—forgetting for the moment that Professor Huxley's "protoplasm" is quite *dead*, or "divorced from life" as he might express it, and therefore life exists somewhere beyond the protoplasm. Again, he says, "the animal body distributes, but it cannot create"; availing himself of the here somewhat ambiguous and invidious term "create"; for what he calls "distributing" is, in truth, the *originating* of a new form of motion. And also when he so speaks of an "animal body," or "the animal body," he does not mean a dead animal, but a living one ; and it had been better, therefore, to say so, and frankly admit, that the "life" is what makes the distinction. A truthful philosophy shrinks from all needless ambiguity.

I would point out, once more—(for it is far from the first time),—that the defenders of truth are not unfrequently ensnared, in the use of abstractions furnished by their opponents. As one example of this, a sentence may be given, as quoted by our paper to-night. The animal body,—sect. 4 (*i.e.*, the live body),—"has a power of unlocking at pleasure the *potential energy* stored up in the nerves,"—which, in the language of common sense, just means, that *a living body* sometimes acts, and always *lives*. With a similar ambitiousness of phrase, Dr. Tyndall says that the "principle of conservation of energy in Nature leaves no nook or crevice for spontaneity to mingle with the *necessary* play of natural force,"—a mere truism ; while, on the other hand, the great Cambridge writers of the *Unseen Universe* maintain that "force is a name for nothing," and that the word "force" had better be dropped, there being "no such thing"!—*Unseen Universe*, 4th edition, p. 104. Under which circumstances even Professor Tyndall would be at a loss to "distribute" force, or give it its natural "play."

This principle of the "conservation of energy," which has found such ostentatious expression of late, really implies very little more than we used to mean by the "uniformity of Nature" (as the Psalm says it, "He hath given them a law which cannot be broken"). This "energy," or "life in itself," as the Pentateuch puts it, being an original constituent of the physical universe in certain departments, is singularly imagined by Professor Tyndall to be a difficulty in the way of Theistical interference ; the fact being that it is really a part of the Theistical hypothesis of creation. It reconciles what might seem mechanical with what we perceive to be vital phenomena. It may even be part of the "uniformity of Nature" that it has non-uniform action dispersed largely, and eluding precise detection. Certainly it does not preclude independent causation from without,—though the suggested exclusion of "force" would imply that.

But the question which cannot, in the long run, be evaded, is that which is raised under the term "spontaneity," and it lies, I believe, immediately before us. Is there in the universe no "originating"? This is not a question that will bear to be superficially disposed of. Our own responsibility, as moral beings, is no less involved in it than the Divine origination and government of all things; nor can we ultimately defend the one without the other. Theologians, as well as philosophers, have too long turned aside from considering what the idea of creation or origination implies, when contemplated in the past (as "before the world began"), or, when contemplated now, in the intelligent agent of variously limited power. The universe has abundant signs now of veiled power,—a being that quickens. It is this that we have to contemplate. Pre-phenomenal power, with the "contingency" really involved in its acting with any freedom, must be re-considered from the very root of the subject. There is no modesty or reverence in refusing to examine it. "Kinetic and potential energy," as they are called—(that is, an energy that *moves*, and an energy that is *able to move*),—open the whole question in physics; as really as "responsibility" opens it in the region of thought. That which has to be accounted for is the *beginning* of any change (whether there be known materials for the agent to act on or not). Too long have current and inherited theories as to "necessity," "fate," and "prescience" been stumbling-blocks in the way of the approach of the scientific mind—the Cliffords and the Spensers—to the truths of our Divine Religion. We cannot, *e.g.*, in any true philosophy, separate between the *reality* of agency in some cases, and not in others, on the ground that some agents are more powerful than others, or than the Highest or Supreme Agent who transcends all. Real agency, operating *de novo*, whether in the regions of thought, or in the field of the phenomenal, must be estimated in one and the same philosophy; and I differ widely, therefore, from one section (18) in to-night's paper, which says, "We are at liberty to describe the will of God as spontaneity, *whatever we may think* of the will of man." The former is, perhaps, the *more* difficult; as Billuart says, it is the "hardest knot in all theology." The truth is, that man who is "made in the image of God," has common cause herein with the Divine Father. We are not at liberty to ignore our human spontaneity. It is vital to religion, to morality, to free thought; and, unhappily, we have been afraid of examining it. Bishop Butler said that it was practically of no consequence which way the question of spontaneity and necessity was decided. But it is the introduction of poison into the system of men's thought when they admit false philosophy. Happily we are so constituted that the sense of responsibility is indestructible in our nature, and the conviction of a retributive justice can never be rooted out of us. They are "facts of human nature." Nevertheless, there is a great wrong that has been done to this generation, in the misdirection of its philosophy of duty by *quasi*-religious theories in harmony with, if not leading to, materialism.

REPLY TO THE FOREGOING BY THE AUTHOR OF THE PAPER.

I have specially to thank Professor Challis for his kind observations.

Dr. Irons's remarks, like everything that he writes, are of great value, and well worth the consideration of Professors Huxley and Tyndall, and of all who hold their views.

In reference to myself, there seem to be only two points on which any observation is called for.

1. When I said that it is asserted in various quarters that "the scientific, and even the clerical world is fast drifting into unbelief," I had chiefly in my mind the following sentence which I had copied down from a lecture delivered at Birmingham some three years ago (if I am right as to the time) by Dr. Tyndall:—"The world,—even the clerical world,—has for the most part settled down in the belief that Mr. Darwin's book simply reflects the truth of nature." This, I admit, is not necessarily identical with the sentence in my paper, for there are some (myself among the number) who do not see that Mr. Darwin's views, however unlikely to be ultimately established, are utterly irreconcilable with Christianity. But there seems to be much reason for thinking that, at all events, Dr. Tyndall himself, in uttering that sentence, identified Darwinism with unbelief. It is gratifying, however, to learn from Dr. Irons that now, at any rate, "the ingenious fearlessness of educated Christians (specially shown in this Institute) has really silenced the offensive pretensions to 'enlightenment'" to which I alluded.

2. I quite believe, with Dr. Irons, that, in regard to spontaneity of will, "man, who is 'made in the image of God,' has common cause herein with the Divine Father," nor had I any idea of implying (however the words to which he takes exception may be open to such an interpretation) that there is any doubt as to man's spontaneity. I merely meant to say that as the subject under consideration was the will of God, and not that of man, and as we believe God to be a pure spirit, Dr. Tyndall's arguments against man's spontaneity, drawn as they are entirely from material considerations, leave the question of the Divine spontaneity untouched. In section 5 of my paper, referring to Dr. Tyndall's assertion that man is a mere machine, these words occur, viz.—"This view has been satisfactorily disproved by many, and among them, by the President of Yale College," &c.—showing that although I may have used an inconsiderate expression, I do not ignore human spontaneity.

I sincerely thank Dr. Irons for his remarks, and especially for the opportunity he has given me for explaining myself on this important point.