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ORDINARY MEETING, FEBRUARY 3, 1868.

THE REV. WALTER MITCHELL, M.A., VICE-PRESIDENT, IN THE CHAIR.

The Minutes of the previous Meeting were read and confirmed; after which it was announced that the following books had been presented to the Institute, viz. :—

Plain Sermons for Perilous Times. By the Rev. W. Niven, B.D. *From the Author.*
Thoughts on the Kingdom of God. By the same. *From the Author.*
The Victory over Death. By the same. *From the Author.*

The following Paper was then read :—

LIFE: WITH SOME OBSERVATIONS ON ITS ORIGIN.

By J. H. WHEATLEY, ESQ., M.V.I., Hon. Loc. Sec., Sligo.

THE grand economy of nature is laid bare by science, to an extent inconceivable by our fathers. Yet by the independent study of organic and inorganic nature, the introduction of life appears to be involved in impenetrable obscurity: and with all the skill, and all the industry, and all the talent, which have been applied to investigations of the heavens and of the earth, of the visible and of the invisible—what is the result but degradation, and defeat, and monstrous deductions, and absurdities rising above absurdities—the whole crowned by infidelity—if the vivifying breath of the Eternal be disallowed?

A proposition is very plainly put by Professor Huxley in expounding the development theory:—"Given the existence of organic matter, its tendency to transmit its properties, and its tendency occasionally to vary; and given the conditions of existence by which organic matter is surrounded; that these, put together, are the causes of the present and of the past condition of organic nature."

This really sounds like a grim jest, at the expense of mathematics;—given everything to find everything;—and

from these premises are deduced that the past was what it was, and that the present is what it is. We may hardly dispute the conclusion.

Grant everything that does exist, or ever did exist, and there is nothing to deduce but the method of descent;—on which subject much eloquent writing has found its way into circulation; and, though it has been elaborated with great abilities, copiousness, and perseverance, what reliance can be placed on any hypothesis of descent, where the cause of the introduction of organisms is ignored?—where the source of vitality is unacknowledged?—or where homage is paid to the dead framework of creation, as the parent of all the living glories we see?

Allow that we can trace back all the complications of form manifested in us and around us, to a cell for the vegetable kingdom, to an egg for the animal kingdom, and these to a primordial unit—will this unit represent all the phenomena? We are of, and from, the inorganic, but not by it. The clay is there; but where is the Potter? The entire of the visible is from the inorganic—whether of the most intricate complexity or simplest cell—though much of it is built up by an independent power. But, notwithstanding that the visible is from the inorganic, is, also, that which animates the smallest portion of the visible? I believe not. It may be well, therefore, to attempt to show—

That it is not sufficient to grant the existence of organic matter, with its transmitting and varying tendencies, and the conditions of existence by which it is surrounded—in order to establish true deductions;

That the origin of life was not through any of the means to which we apply the term, natural; such as chemical combinations—electro-magnetic or other forces; that, in fact, from the inorganic the organic could never—through the agency of the inorganic alone—proceed;

That neither from geology, nor from any other science, can we glean the real history of life;

But that it is, nevertheless, required to know and to explain—to have a true and perfectly clear and comprehensible conception of the origin of existence—in order to establish the true relation between the various phenomena of nature; and I do most honestly believe that the plain speaking of science and the plain speaking of the Bible are parallel roads; along either of which, or both of which, the highest scientific student and the lowliest believer can walk with eqnal profit and honour.

Life assumed, we can bend it to subserve almost any

hypothesis; but if its origin be acknowledged, our flights of imagination and our scientific inquiries will necessarily fall into accordance with our cognizance of what that origin is calculated to effect.

The strangest of modern instances which sustains the position that assumed life will sanction almost any hypothesis, is the derivation of man, by the developists, from the lowest forms of life. According to these, man began his career, it is difficult to say where. They track him, however, to the sponge; thence to the star-fish or sea-urchin; thence to the limpet or lobster. An osseous structure next falls upon him: he becomes invested with fins and scales—lo! man is a fish. Subsequently he rose to the dignity of a reptile; he hissed in the serpent or croaked in the frog. Then feathers appeared; and he took to pecking grain and grubs as the crow, or tore flesh as the eagle. In due time, down he came from the regions of air—fur sprouted where feathers grew—and he was found, either burrowing underground as the mole, or springing from branch as the nimble squirrel, or preying upon what was once himself as the otter; but which of these does not seem to be quite clearly made out. Passing upward, he appeared in his present form as the child of an ape; or, to account for diversity of race, at least three monkey mothers were concerned in the prodigy or progeny;—both, indeed.

Hence, we see, man was not created at all; but "growed" like poor Topsy—growed, gradually, from vegetable to intellect; mind—the intelligence to will and to do—having wriggled itself out of a fucus, or some such thing; and appeared on the stage of humanity—intellect, speech, and all through the monkey medium. I don't think we are anywhere told how it was that the first monkey-man was not both first and last of his race.

The development theory is a fair illustration of what may be imagined under life assumed, without reference to its origin. A latitude is thereby afforded for all kinds of absurdities; and, instead of a steady research, under control, the mind is apt to wander off into the very burlesque of science. I only allude to this fanciful theory, to show the necessity for a thorough understanding of the introduction of life.

Different attempts are made to set up some sort of origin for the living. Time is by some quoted as an indispensable element in the production of life. Old Edax Rerum has a task assigned him directly opposed to his usual labours. Instead of the reaper, he is the sower of the seed. Instead of remorselessly mowing us down, we are his cherished offspring. Geology, very modestly, requires millions of years. Allow but

this for nature's preparatory course of study, and she manufactures life through the agencies of electricity and chemistry; perhaps aided by occult forces of which we know nothing. She bestows, likewise, determinate forms.

According to others, when the physical world was prepared for the living, "life pressed in," the conditions being suitable. Pressed in—where from? how came the life to be? And how came it to be at hand, just in the nick of time? It must have come from somewhere; it must have had previous existence. Whence came it? and what was that previous existence? No matter; it pressed in; and that is, doubtless, satisfactory to the theorist.

But all are not content with this sort of off-hand proceeding. For instance, they call in the aid of chemistry and electricity. "It may be," says Professor Huxley, "that it is impossible for us to produce the conditions requisite to the origination of life; but we must speak modestly about the matter; and recollect that science has put her foot upon the bottom round of the ladder." This is passing strange; for he himself, in another place, quotes M. Pasteur's experiments, to prove that there is no such thing as spontaneous generation; and gives in his adhesion to that doctrine. He adds, however, that it in no way interferes with the possibility of the fabrication of organic matters, by the direct method to which he referred —chemistry. If so, I confess I fail to understand what is spontaneous generation. Surely, life resulting from chemical processes—supposing the production possible—could only be by bringing together the necessary ingredients, in the proportions required, and under the conditions demanded—when life would spontaneously appear. If it be pretended that spontaneity signifies an arising at its own will—voluntarily—in fact, self-evolving—still, what do these phrases mean? They all presuppose existence before manifestation.

In these three last words—existence before manifestation—lies the great mystery of life. Life must have been for life to be. Who pretends to explain how life comes to be before life was? We have heard and read much assertion that so it is;—but may we be allowed to ask for the evidence? If Professors Huxley or Tyndall, or any other man of science, will favour us with reasons why or how matter can produce what it does not possess, it would greatly facilitate a settlement of the question. Matter may form, by the agency of elemental disturbances, the shape of a pig; but where is the grunt to come from?

In relation to life, matter is nothing. Life is independent of matter. This is plain; for the tissues dissolve as soon as,

and not before, life has departed from them, nor can matter detain life at its will; therefore, *ex nihilo nihil* applies to the argument of matter evolving life;—otherwise it has evoked a force it cannot control, for it has no more power to eject life than to preserve it. And as we cannot conceive such a thing as the maker subordinate to the made—inasmuch as the producer infers higher intelligence than the produced—does not this conflict with nature-creation of life? as no one, I apprehend, can reasonably dispute the inferiority of the inorganic kingdom to the organic. Moreover, it is not denied that organisms are formed out of the material world. Vital power builds up matter into flesh and blood, and bone, and muscle, and hair, and feather, and fur, and scale, and every organism on the globe. Produce the agent, in matter, that can do this. No. Well, but you have as much right to assume that natural forces set up the living fabric, as I have to assume a vital power. I think not. Let us sit down to the microscope, and I show you the gradual development of forms where vitality is, with all the marvellous effects of its stimulus on the material body; show me what we call natural forces, at the same work at which I show you vital power. You cannot! have your natural forces the power to instruct me how the mechanism is calculated to perform, which I have shown you in operation? No. Since, then, they cannot point to so much as one creative act—one smallest vestige of anything proceeding from their own volition—why do you call upon us to grant them the power to elaborate all the wonders and complexities of the living? When you can place before us the most trivial self-advance in the inorganic, as under the microscope, I place before you the action of life on the most insignificant atom, our respective evidence may be taken to be on a par; but until you can, there is eye-witness on my side, against assertion on yours. Which would the jury convict?

Again—where, in all nature, do we find the inferior producing the superior? Where, in all creation, animate and inanimate, does the stone give us bread? Can we point to one instance of the globe, with its rock and its soil, and its so-called imponderables, and the whole of its inorganic constituents, improving itself? Can we find matter working? —holding up before us independent power? Can the skeleton of our planet unfold this to us? Can the dry and the sapless clothe themselves with flesh and with leaf? Can we point to one single instance of even vegetable or animal rising above its original? Until we can do this, is it not a little premature to credit that which has not life—and of whose improve-

ment since its creation there is no record—with the vast step in advance of giving birth to the wondrous world of the living? I may go further; Mr. Page says in his work on Man:—"No observation from the external world—no analogy, however plausible—no analysis, however minute—can solve the problem of an immaterial and immortal existence." Exactly so. And though Mr. Page is an opponent of the views I am endeavouring to maintain, he has uttered a broad and indisputable truth. Since, then, immortality is the prolongation of life to endless duration, there is precisely the same impossibility, from the external world, to solve the problem of the first condition of immortality—life. As immortality cannot be without life—and as nothing like immortality can be made out of the inorganic—they who say at the same time that the inorganic can produce life, contradict themselves. Perhaps they can reconcile this. I confess I am too obtuse. I have already considered that it is physically impossible for the perishable to confer immortality; and that it is consequently impracticable for life to have been the fortuitous offspring of merely natural forces. Does not even perpetual motion defy the skill of the highest organization on earth? Yet insensate matter is called upon for perpetual life. *Cras credo,* as Dr. Jortin said of Swift's learning.

To show the impossibility of chemistry being competent to effect the production of life, it is perfectly well known to chemists that there are peculiarities of composition in organic substance and structure, marking it off from the rest of creation by a deep and a wide valley, across which no human arm can throw a bridge. There are many elementary substances found in organic matter, the whole of which are not, however, present in all organisms. The four principal do pervade all that is organic, hence commonly called organic elements;—they are oxygen, hydrogen, nitogen, and carbon. The presence of those in the organic is universal. They are also of the inorganic: and thus far, being common to both, why may not the one produce the other? the lifeless, elaborate life? The peculiarities of their distribution forbid it. The elements generally form a binary combination in minerals; but in the organic world, at least three—usually four—of the elementary principles, enter into combination to form the proximate principle—to educe each simplest substance. We have also, in the inorganic, the elements commonly united in a simple ratio to one another; as 1 atom of the one kind to 1 or 2 or 3 of another; while in organic bodies there is no such uniformity; several volumes—ten or a dozen—of one, unite with some

of each of the others, toward the making one compound atom.

Now since the same elements are found, forming constituent parts both of that which has, and that which has not life, why should their combinations so greatly differ? why should one remain dead matter, and the other assume the almost infinite varieties of living forms? I do not see how we can account for this, by any elemental action, *inter se*. The activity which produced the material universe, could only, by the exercise of the same means, continue to produce the material. The material, therefore, can but throw off varieties of the material —can but effect architectural changes. There must, consequently, be some power at work, independent of, and beyond, the inorganic components. Dr. Beale calls this the vital power; and uses some very strong arguments in favour of its distinctive operation. I believe it is vital power, which, as well as the common inorganic forces, sprang from the same agent—a Power above both.

But why should not the means which established the inorganic have suddenly changed on the completion of that work, and endowed it with the property of producing life? This would be the employment of other means;—that is to say, it would be changing what was already made. Nature affords no warrant for assuming change of any kind. The external world of to-day is the external world of the past. The form alone changes; the substance is unchanged. May it not, then, have been endowed, from the first, with life-creating power? Here we come back to the arguments of the inferior producing the superior—which, in the whole range of nature, I apprehend is unknown.

It would seem, therefore, that life itself was the cause of the great difference between the elemental combinations of the two creations—organic and inorganic: and though we are acquainted with the constituents of both, and their combinations, we cannot introduce life into the inorganic, nor can we extract life from it.

Cuvier says, "Life, exercising upon the elements which at every instant form part of the living body, and upon those which it attracts to it, an action contrary to that which would be produced without it, by the usual chemical affinities, it is inconsistent to suppose it can, itself, be produced by these affinities,"—an old argument, and none the worse for keeping.

The unceasing chemical changes of the body are unmistakably subsequent to the introduction of vitality into structureless matter; and dependent upon it. Life is,—and the hour

in which it was first seen for ever interposed an impassable gulf between that portion of creation which felt the living breath of the Eternal and that which was destined to remain inert.*

If life can be generated by the inorganic—of course, it produces the forms of the living. Crystallography has been appealed to as evidence that nature does evoke regularity of shapes from the shapeless; and that man can imitate nature with her own materials. It is quite true. Nature's only regular form is the crystal; and though there are several primaries, and a multitude of secondaries, they are all solid bodies, having plane and smooth surfaces. In carbonate of lime, for instance, these secondary forms are amazingly numerous. Pseudomorphous forms arise; but the laws of crystallography are for all practical purposes irrefragable.

This science does not appear to yield very satisfactory evidence in favour of what we may call Artificial Life. Crystals are made, artificially, through electric agency; and it is hardly possible to conceive anything more distinct from the forms of organic bodies. The crystal is a solid with plane surfaces;—and the organized structure, from the lowest and most simple examples to the highest and most complicated—whether plant or animal—has a more or less membered form, whose boundaries are curved lines, and whose surfaces are either concave or convex,—as widely different from crystallization as arctic from tropic.

Does it follow that, because we can make one of nature's products from nature's materials, we can make the forms of life, which we have no right to assume nature itself ever made? Even could we find the most remote trace of such a thing, our making the insentient crystals would by no means infer the capacity for producing other forms, at such an immeasurable

* Dr. Odling's *Animal Chemistry* has just come under my notice. I hope, hereafter, to give a more detailed reply to this, and one or two other works of strong materialistic tendencies. The only observation there is now time to make, is, that on casually opening the work just named, I came upon the following passage. Speaking of vital force, Dr. Odling says,—"So far as I can make out, it seems to be a sort of internal, intransferable, immeasurable, self-originating power."—I believe it to be internal, not intransferable, immeasurable, not self-originating. If this view be correct, any train of argument, founded on Dr. Odling's idea, must be utterly inconclusive; there being no more evidence of self-originating vital power than of self-originating matter.—I think before any argument can be raised on self-origination, a definite meaning should be given to the phrase. It would avoid much misconstruction; and, if I mistake not, greatly simplify the present question.

distance from those we can make, as the distinction between living and dead. If we could even do this, how are we to perfect the work by infusing the vital principle?

When the electric force is brought to bear on chemistry, may there not be better hope of success in the attempt to make life? Admitted that electrical action and chemical action bear direct relation to each other—that during the decomposition of each equivalent of a compound, a constant quantity of electricity is evolved — any speculation on the chemical and electrical action on each other is immaterial. It suffices that the electric force works in conjunction with the chemical elements. To my mind, the experiments of M. Pasteur most conclusively negatived those of Mr. Crosse and Mr. Weeks, who found a species of acarus appear in solutions of nitrate of copper, silicate of potash, and ferro-cyanate of potassium—on which a powerful battery was brought to bear. A pretence of creative power was thereupon sought to be established. May there not be an attempt to prove rather too much here? Three distinct solutions, acted upon by electricity, each disengaged the same form of life. If the forces employed, the solutions used, and the surrounding conditions, are all precisely the same, to the greatest possible exactitude, it is quite comprehensible how the same creature should appear, supposing that any could. But it is surely incredible that by the employment of various media, the same animal appeared, unless on the supposition of the introduction of germs from outside.

Mr. Milton, speaking of the relation between electricity and the vital power in connection with the human frame, says, he thinks it possible, "that under certain circumstances, the one becomes the other." I do not understand how this can be. We cannot argue from any abnormal condition of the frame; but taking the whole to be instinct with life, the nervous system will interfere with that theory; for the arrangement of the nerves is such that there does not appear to be any perfect circuit; wherefore, as electricity has no means of circulating, it cannot, under any concurrence of events, ever become life where the nervous system is part of the organization.

Let us turn for a few minutes to geology; for though it makes no pretension to account for the origin of life on the globe, it yet deals somewhat liberally with successive re-introductions of life.

It can hardly be disputed that the earth's strata are volumes of deep learning—studies worthy intellectual man. But, for the most part, its expositions go far beyond its real

teachings. Fancies and fallacies flit about thick as motes in a sunbeam. Their inventors are of those who imagine that two and two make five. They are spendthrifts of generalization—often jumping to conclusions on very meagre data. They insist that the evidences of geology are conclusive of other systems of organic life having passed away, and been replaced by new creations. Yet, teaching this, (to me, false doctrine,) they go far toward contradicting themselves; for, without geology, I can scarcely understand how we could, scientifically, prove the similarity in all cases, and identity in some, of present existences with the earliest past known.

We learn much from it. We learn that chemistry and electricity were the same in time's former day as now. We find precisely the same elemental proportions in the earliest known formations as in the latest. The law which regulates crystallography, too, is unchanged. The crystals of the oldest rocks are identical with the modern. The rocks furnish us also with evidence that the physiological laws are unchanged; they tell us that death and reproduction have ever been the same; that respiration and nutrition have always depended upon the same organs and the same constitution of the atmosphere; and the comparative anatomist testifies that the laws of his science were then as in the later ages. We might therefore rationally conclude, that the animal kingdom would supply the same great classes. And so it does. The four leading divisions are fully represented—the vertebrates, the molluscs, the articulated, and the radiated. After observing that the three lower divisions greatly preponderated over the vertebrates of the olden time, Hitchcock says, "thus we find, that the more perfect animals have been developed gradually; becoming more and more complex as we rise in the scale of the rocks. But in the three other classes, there does not appear to have been much advance upon the original types, although in number and variety there has been a great increase." The inference here is, they were either developed from inferior forms or in the way of new creations; neither of which do I think the witness of geology warrants. The facts seem to be truly detailed. In the lower strata there are no vertebrates, save a few fishes, and certain tracks of possible batrachians. In the oolite, mammals appear. In the tertiary, they are more plentiful; at present more plentiful still. Without inventing new creations, or "cudgelling the brains" for any hypothesis of development, to account for the geological order—the task would have been quite as easy, quite as philosophical, and it seems to me infinitely more natural, to have argued up to a widely different conclusion, namely,

that vertebrates (with the exception of fishes—and perhaps next, of batrachians) multiply much slower than the inferior tribes. Their fossil remains must therefore, of necessity, be very much fewer in the ages when life was young, increasing by degrees as the world waxed older; till, in these latter times, they have expanded into growth, proportionable to lengthened existence. Fishes are of all vertebrates the most prolific; a fact which may not unreasonably be supposed to account for their traces, at an earlier date than their more slowly multiplying contemporaries. The greater the number, the better chance of specimens being preserved through the revolutions of at least 6,000 years—or, at any rate, of being found; for it must not be forgot, that it is little more than an infinitesimal part of the earth's surface which has yet laid bare its secrets to the persuasions of the geological hammer.

The extinction of genera may seem to lend something like a sanction to the renewal of life, by new creations. But it is only seeming. If one single example were found of a persistent form, through all the geological ages up to the present time, the *necessity* for new creations would be at an end; as others may be detected on more extensive examination; or, if utterly destroyed, might still have continued had the economy of nature required it. Many, certainly several, instances of this perseverance are found. Sir C. Lyell, in commenting on Mr. Davidson's monograph on the British Brachiopods, names four genera of molluscs that "still retain in the existing seas the identical shape and character which they exhibited in the earliest formations." So the necessity for new creations is not very apparent.

I believe I am speaking the truth in saying no man of science assumes that since the introduction of man one single new denomination, or race of beings, has appeared; but that mere varieties of existing races—forms of known species—have spread by degeneration; sprung up, if that term be better liked, though "by degeneration" seems to me more correctly expressive. Geology speaks—and speaks truly—of extinct species. Even in our own day, several have disappeared from the face of the earth; the dodo, for instance. And Dr. Guyon gave an account, not long since, to the Academy of Sciences in Paris, of the recent extinction of some animals in Martinique and Guadaloupe, and, indeed, from the West India Islands generally—the anli, a kind of dog; two large parrots; two paroquets; and a species of frog. Of course, species may have fulfilled the intentions of their creation, and become extinguished. This may, and probably does, occur in every latitude where there is life. But where

is the evidence of new creations? Geology points to several. But until it be finally settled that the igneous theory is properly quenched by the aqueous; or whether the aqueous itself have any pretensions to the dignity of upholding the science at all: in short, whether the science, as taught and commonly understood, have a leg to stand upon; until then—until its principles are a little more settled—until, in fact, it has sown its wild oats, we may be allowed, at least, to entertain grave doubts as to the credibility of its teachings when sanctioning plurality of creations. I think they can be very differently accounted for.

To my mind, the error, the grand fundamental error of our geological head-quarters, is not recognizing the former geographical position of the earth's surface, whereby the buried botany and zoology, and the periods when they flourished, have been grievously misinterpreted.

As I have said before, the great divisions of life are there; but for the most part, in the earlier formations, different from later forms. Why so? They are the forms of a tropical land. How then came they into these climates? for sure it is, they neither do nor could flourish here now. What is there wanting wherewith we cannot supply them? There must be something. So there is—a vertical sun. According to the distribution of the sun's glorious rays, so is vegetation, so is animal.

It has been customary to account for climatal changes chiefly by atmospheric alterations, brought about by the great currents of the ocean taking a new course; by sea usurping the place of land, or land that of sea. But with our northern sun, alterations could never account for the lion and tiger in our forests, nor the palms and tree-ferns of the tropics on our uncongenial soil. Hitherto, every change of surface on the globe has been attributed to upheavals and subsidences—an upward and downward movement in the same spot—even to the reversing large tracts of country. And the geological mind has been satisfied with it—has given its best attention to it—has become saturated with it—has assumed hypotheses, and drawn inferences, very much to its own satisfaction;—children of imagination, bright and delusive.

We can understand the sudden coming on of an icy period. Let the gulf stream be deflected from our shores, and a raising of the land take place—a climate might be produced wherein life must give way under its intensely glacial aspect. Ice and snow which no summer's sun could melt—or whose rigour could be even mitigated—would reign undisputed. But so long as our latitude is unchanged, how can we have the heat

of Bengal, the burning plains, the steaming jungles? How enjoy the pleasures and pay the penalties of those districts where lurk beast and reptile of surpassing beauty, and where vegetation rises in all its grandeur? Where else is this to be found? Where else? here, under our very feet are buried races of the tropics. We see it in multitudes of shells; we see it in vast numbers of animals; we see it in trees, having at this hour their roots in the very soil in which they grew luxuriantly under warmer skies, showing the impossibility of their having arrived where we find them by any accidental occurrence—any convulsion of nature. Long is it since the beams of a sun which did this have ceased to visit our land.

It is even so. Then how did they get here? The answer to that question involves the utter destruction of the fundamental doctrines of geology, as hitherto taught. In the present state of science I do not think any man would be justified in pledging himself to the truth of the reply. There are, however, some very strong reasons in its favour.

Geology has not, heretofore, reasonably accounted for the contents of those strata lying below the more recent deposits. That the denizens of a hot climate could never live under our skies is unquestionable. The late Mr. Evan Hopkins advocated the theory that these and many other lands arose from the sea, if not within the tropics, at any rate in such a latitude that the then surface could only bear the tropical plants, and nourish the tropical animals of which we find the rocks bearing such faithful and ample testimony—a very simple solution of seemingly formidable difficulties; and that, too, in strict accordance with our Bible, leaving not one inch of room for conjecture.

Both astronomy and geography point to these northern countries as having once been in or near the tropics. Granting this to be the true means of accounting for our tropical fossils, it is not the most important matter for which we shall have to thank it. Will it not sweep away the whole of that geological mass of assumptions which imputes to the antiquity of the world tens of millions of years? Will it not dissipate the illusion of plurality of creations? The rate of the earth's northernly progress known, the calculation is very simple; and geology's dealings with repeated fresh introductions of life, in the way of new creations, is at an end; they merely become modifications of existences under change of external conditions.

What may be called tropical geology, as telling of all lands having risen in or near the tropics, or having passed through them, shows us both a short chronological career for

the earth, and abundant reason for the changed animal and vegetable life which the rocks disclose to us in their fossils.

Again, on another point, whence could have come the notion that the earth was covered with vegetation and with animal from the lowest forms of life? and even those produced from a vesicle or cell containing the future creature—nay, possibly all from one primordial unit? Most likely because *re*production—all that now exists, or has existed for thousands of generations—all—all—every living thing we see—every living thing, from the microscopic to the most colossal bulk—arises from a tiny germ. This is what we see. But this is not creation. It is the created perpetuating itself. Strange confusion; that creation and perpetuation should have the same origin!—and certain philosophers tell us they have; that the plant, for instance, sprang from a mere point—a nucleated cell. Whatever it may be called, it must contain the perfect plant, which is to all intents and purposes a seed; the thing thence proceeding is therefore reproduced, not created.

I do not understand by what steps philosophy can reach a germ beyond the first plant. If it contain the future plant it involves a contradiction; inasmuch as that infers reproduction. Reproduction proves a progenitor. The first plant could have had no progenitor; therefore the first plant must have been created in a perfect state, and not as a mere atom containing the plant that was to be subsequently evolved.

The perfect plant, then, must have existed before the formation of any minute substance containing itself; otherwise, you would have the astounding incongruity of reproduction before existence. A small nucleated body is the mode of perpetuating. If this body were also the mode of creating—the one and the other being the same thing—we are fighting with shadows, when we attempt to trace the producer from the produced; as in such case they are convertible terms.

What other idea can we attach to a fertile egg, or nucleus, but that of having been generated by a form similar to what it will itself generate? In a natural sense, the plant which produces the embryo of future plants proceeded from a like embryo. In a natural sense, therefore, we cannot point to creation in its embryonic form, its primordial shape. I feel, then, full conviction, that in spite of philosophy—"in erring reason's spite,"—the Revealed Word alone can inform us of the true origin of life.

Nobody can deny an ultimate principle—a first Cause. Creation, as I understand the word, means production by original power. Is the external world—inanimate nature—

original power? If so, this inanimate nature, from the subtilest gas to the densest formation, is existing without cause—which we can conceive of no tangible thing. It is therefore obvious that nature was created. The created cannot create; but only reproduce. Hence, as a mere reproducer, life cannot there have had its origin. Those who deduce life from elemental capacity, invest matter with eternity; which it requires no argument to disprove. Neither does it require argument to prove that the Eternal—as Eternal—must be the great primary cause; and that all besides what is eternal, can only be effects of a cause.

But may not Deity have bestowed on the inanimate the power to produce the animate? I apprehend not; because, since every separate particle of the inorganic is dead matter, how can any aggregation, or combination of dead particles, assume vitality? Pile Pelion on Ossa—and what then? It is only a higher mountain. If we can trace life up to the organic—there we must stop. There ends the track. Nevertheless we recover it. Where? In Revelation; and but for Revelation, I contend we should be utterly in the dark on the subject.

The very word inorganic, as opposed to organic, is framed to show it is neither possessed of animal nor vegetable vitality. If it has been denied life, how can we assign it paternity? The atheist's "fortuitous concurrence of atoms" is hardly so absurd.

In fact, however, a section of modern philosophy does appeal to this very fortuitous concurrence of atoms, for much more than the formation of the material universe. When it arranges certain essences in the chemist's laboratory, and thence announces organic bodies, is it not bringing together by human skill, what it tells us, matter can itself do in the vast laboratory of nature? Unless it tell us this, it is occupied with a mere toy; and if it tell us this, it either invests matter with intelligence, or deifies chance.

Yet man, himself, is of the inorganic? O yes; he is of the dust of the earth;—the dust of the earth did not make him.

But without drifting into Scripture arguments, I would attempt to show—outside the Bible—that the talk about nucleated cells and primordial units, does not account for the origination of life by the inorganic: indeed, that it is impossible the dead framework of earth could have clothed itself with life; impossible that any combination of mechanical appliances, in connection with the agencies of light, heat, and electro-magnetism, could have built up living structure: atoms

of matter which never had life combining themselves into forms possessing life.

Of course, such remarks do not apply to those who shield themselves from an accusation of atheism, by granting that God created some eight or ten forms of life; whence all we see of vegetable and of animal has descended. Even this petty concession appears but grudgingly made. However, a Creator, independent of matter, is acknowledged; and the arguments recently urged against Darwinism, in this Institute, by its Vice-President, Honorary Secretary, and others, seem to me so thoroughly convincing, that it is something very like presumption in me to add to them. I consider that the perfect and complete forms were those created; from which varieties cannot be raised into species. If this be so, not only does it negative the embryonic theory of existence, but the natural-selection speculations of Mr. Darwin. That we must withhold our assent from the former is self-evident; the latter may require a short examination, which, in the present sketch, must be very short indeed.

The vegetable kingdom contains more than 100,000 of these perfect forms or species; the whole of which, according to the natural-selection theory—save four or five at most—have descended from that small beginning of vegetation. This might be more comprehensible, if the 100,000 were only varieties; as although without artificial assistance they will either revert to the normal forms or perish, still there might always be that number, or more, in existence at the same time. But they are species—things reproducing and perpetuating themselves from seed. The few created plants would multiply, and throw off varieties in course of time. They would go on multiplying themselves; while the varieties would gradually disappear, and others supply their places. As man also increased, those varieties which he found useful, or which pleased his fancy, would be preserved and kept on by artificial means: a species would keep itself on. This is judging, both from what we read of past vegetable physiology, and from present experience. I see no grounds for saying that early life on the globe was in any way different to present; which it must have been for the land to have covered itself with 100,000 species descended from so few types.

I have been a grower and lover of plants for very nearly half a century; and, though that is but a point in the world's history, he must be a wonderfully careless observer who failed to notice so striking a curiosity as the establishment of a species from a "sport;" and a variety is nothing else. A hybrid, too, without the intervention of artificial processes,

either reverts to its original, or becomes extinct. Though my own observations are very trifling, they bear out the broad facts, and confirm the generally acknowledged laws of Botany.

With this known inclination of varieties—or, rather, with their known nature—it is hard to say how it were possible, even in the (to me) fabulous ages of the old geology, for the natural establishment of new species from the created few, to have been effected. If varieties could be converted into species, extended time, such as Mr. Darwin requires, seems a most unnecessary step in the process. A variety thrown off by the parent plant is a species at once, or not at all. It is only a temporary variety; for, when it has grown up and become a perfect plant, it must either die out, revert, or perpetuate *itself*. In each case there is an end of the variety. Disappearance, by reversion or death, does not more clearly extinguish the variety than if it perpetuate itself; for in the second generation it is as much an established species as the specific type. Instead, therefore, of the elastic millions of years, called to the aid of the hypothesis in question—a single season in some instances, and only few seasons in any—is all the time for which nature is called upon permanently to set up new species from old. The fugitive character of the plant under observation, or its stability, seems an easy way of marking its rank.

Where man interferes, in the way of improving a species or a variety—such as our culinary vegetables and our florist's flowers—he is obliged to continue by industry what he acquired by skill; else would the size and succulence of his parsnips and his celery, and the glory of his roses and carnations, very soon return to what we consider the insignificance of their originals—neither pleasing his palate nor delighting his eye.

Even from a few considerations such as these it would seem probable that neither the organic nor the inorganic, as independent studies—whether in connection with chemistry, electricity, or geology—afford a glimpse of the origin of life; nor, consequently, the true relation of the phenomena of nature. As far as the great question of life is at issue, all is there dark as a futureless grave. We must look to other sources for the information they are not capable of imparting.

Try history. Professor Huxley says that historically we know nothing about the origin of life. On the occasion when this observation was made, it was in allusion to the history of the rocks. But the general tenor of the lectures in which it occurs is tending toward an application to all history.

But there is one which brushes away every conjecture and every doubt—one which has never been disproved by the most elaborate ingenuity or deepest learning that has ever been brought against it—the Book of our Faith.

The Bible-outsiders may think it hard, or beneath the dignity of mind, to be driven to so plain a record. To me it appears the only one through which we can account for the introduction of life upon the globe, or for the globe itself, in truth, simplicity, and consistency.

Infidelity comes not forward with wit and banter, as it did formerly, and failed; nor with the metaphysical subtlety of a past school, and failed. It now winds its insidious way under the mantle of science—and will fail too. Stripped of its externals, we have, instead of true science, an eccentrically put together and fantastic image of conjecture, girt about with the more pretentious matters of chemical experiment. Its votaries are not few; and the intellectual wealth poured out at its shrine is very considerable. To some minds there is a fascination in the meretricious more intoxicating than strong drinks;—how else could the gifted investigator condescend to such teachings as these? "No competent man of science now believes in Adam and Eve." "The inroads which science is making in the established interpretation of the Old and New Testaments." "No organism is, nor ever has one been created which is not microscopic. Whatever is larger has not been created, but developed"—and so on, ad infinitum.

One notable instance may, however, supplement the above. An attempt is being made to introduce a "new science," under the name of "Atomechanics." It happens that this, or something so like it as to be of the same tendency, was propounded by Swedenborg more than a century and a quarter ago (1734). He says, that in the first finite which arises from the simple substance, there is a spiral motion (proceeding from such tendency in the simple substance), and that, "in the effort of the simple towards spiral motion, lies the single cause and the first force of all existences." This appears to be identical with the pantogen, or primary chemical principle of the inventor of the new science, M. Hinrichs.

The idealist's pride of intellect will not bend to seek where it may find. He works in the cause of his nature-deity—the aberrant, uncontrolled, unintelligent. Even though he may not designedly seek to overthrow our faith, but only point out some new paths—from the smooth and trimly-kept, to the savage and the fantastic—I think endeavour should be made to arrest the steps of those who have put foot on the dan-

gerous way, or are, as yet, only listeners to the voice of novelty—so especially attractive to the young, and to the lowly educated.

No manipulation of dead matter has instructed us in the origin of life; nor does there appear the slightest chance that it should. It is, therefore, to living structure we must turn for information; and that confirms the Mosaic history of its introduction; in my humble opinion, at least, the only true theory, the only consistent account we have of the existences of the three great orders—living plants, water animals, and the creatures of earth.

"And God said, Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind."

"And God said, Let the waters bring forth abundantly the moving creature that hath *life*." The same term is used in the creation of the creatures of earth.

"And God said, Let the earth bring forth the *living* creature after his kind." But in the creation of man we are told, that God "breathed into his nostrils the breath of life; and man became a living soul."

What I wish to bring more particularly under your observation is the distinction made between the creation of plant and all the inferior animals, and between all the inferior animals and man,—resulting in the impossibility of life passing from one organism to another between the three marked divisions of existence.

The plant has a sort of life. It has growth and reproduction. Revelation does not even call this life. But it is remarkable that both water and land creatures are, at their creation, summoned into being as living things.

I said living structure confirmed the Mosaic cosmogony. Is it not broadly outlined here? What was created distinct continues distinct. The existence granted to vegetable, passes not into animal life; improves not upon its Author's impress; trangresses not the boundary marked out for it by Divine Power; can never give unto itself that which its Creator has denied it; and cannot, therefore, transmit other than it received. Hence the zoophyte is an imaginary thing—obscure as may seem the distinction between animal and vegetable in the lowest appearances of the former.

The distinction of creation is again most emphatically marked in the wide gap interposed between man and all other animals. He holds life—and the same kind of life too,—in common with them. But mark the enormous difference: he became a living *soul*, not only living like the rest of the animal

kingdom, but receiving, by direct agency, the breath of the Immortal, constituting him, also, thereby immortal. This distinction was not bestowed upon the inferior animals. Of course the same argument applies here, as between plant and animal, with the additional force of the highest conceivable dignity—that of not only claiming to be, but of being, immortal—the crowning gift of the Eternal, to the master of earth.

The separation of plant and animal appears, then, so prominently marked that, however closely they may externally approximate, the line of separation is as completely impassable as if the one were of earth and the other of the planet Neptune. So, likewise, between man and the rest of the animal creation. The natural impossibility of intermixture between the leading divisions of animate nature, must denounce all theories based on an unknown, or unacknowledged, or speculative source of life, either as mere ingenious hypothetical schemes or premeditated infidel teachings.

Some of our comparative anatomists, however, struggle hard against these marked distinctions. Anything like an impassable barrier is abhorrent to them. Unity of organization is their hope. Even then—is the question of life solved? And the chemist, framing organic compounds from inorganic mixtures, thence argues for the production of vitality; as if a dead organism were more likely to start into life than a dead electrical spark; as if by mixing, and moulding, and transferring forces (always ignoring vitality as a force) this vitality could be generated;—hence, if so produced, subordinate; hence, an inferior power. Life, the inferior power of earth! indeed, not a power at all, but the offspring of involuntary inorganic combinations—the child of blind chance—unmeaning in its lower form, irresponsible in its highest; unmeaning, as an essential quality—irresponsible, as of the unintelligent.

May I venture to beg you to look upon so short a paper as this, on a subject of such extent and deep importance, as only a text for discussion—towards educing some little order from the mass of confusion with which a modern materialistic section of philosophy is overlaying the origin of life on the globe?

On the motion of the Chairman, the thanks of the meeting were voted to Mr. Wheatley for his paper; and a paper ON THE TRIUNITY OF LIFE, by Dr. Edward Haughton, of Great Malvern, was afterwards partially read by the Secretary, and the thanks of the meeting were voted to the author.

[Dr. Haughton's paper is not here printed, as it was not completely read,

and the discussion that follows was confined to the paper of Mr. Wheatley. Dr. Haughton's paper will, however, be published separately by himself. —J. R., Ed.]

Dr. Protheroe Smith.—The subject of the first paper is one that has interested me very much; but, not being aware what form Mr. Wheatley's views would take, I came here rather to gather a few ideas on the subject than to offer any observations of my own. As the President, however, has done me the honour to call upon me for some remarks, I may say that I find one observation in the paper with which I most fully agree—viz., that but for revelation we should be utterly in the dark on the subject of the origin of life. As by one grand *coup*, all the rubbish which infidels have heaped together is removed by it, as well as some of the views broached by geologists. We must, in order to form a correct idea of the question before us, go at once to revelation; and there only we get the true answer to the inquiry, "What is life?"—a question, I think, one of the utmost importance, because it involves to some extent our conceptions of the Creator. In appealing to those who are ignorant of God it is often said, "Why do you not go to God? Why are you not more godly?" &c.; and it might as well be asked in an unknown tongue, since it is impossible to form a notion of anything of the nature of which one is ignorant. It strikes me, therefore, as a precaution that we should in some way answer the inquiries, "What is God, and how and where is He to be found?" In endeavouring to supply this definition, I would first say that if there be one thing above another—one great peculiarity or attribute—one grand distinctive mark which expresses God, it is Life. We find Him revealing Himself to His creatures by the simple declaration, "I am." He is the self-existent one, who not only possesses life in Himself, but has the power of imparting that life to others. But, when I say "God is life," it is but offering an abstract idea which the natural man cannot grasp. We often find, however, that what is at first unintelligible to finite comprehension is made clear by attendant circumstances. Thus things visible to the naked eye are so simply by virtue of light. For instance, put out the light in this room, and I should be ignorant of your existence so far as sight is concerned. We therefore arrive at another principle, that light is essential to reveal the nature of existing things. Now, God dwells in light, but "He dwelleth in light whereunto no man can approach." Then how can we get a knowledge of Him who is life, though dwelling in that light by which He is revealed, since man cannot get to that light? But God is a God of mercy, and, seeing that His creatures were separated from Him by sin, and living in darkness, He who is the light of the world—the light of life—came down from the bosom of the Father to shine in this dark world. Now, as the Father has life in Himself, so has He given to the Son to have life in Himself; and this was the credential of His Godhead. Thus "in Him was life, and the life was the light of men;" and though the darkness comprehended it not, "as many as received Him, to them gave He power to become the sons of God;" saying, "I am the light of the world; he that followeth Me shall not walk in darkness, but have the

light of life." Thus "He hath abolished death, and hath brought life and immortality to light through the gospel." We therefore gain another step in the attainment of the definite answer to the question, "What is life?" for God is not only life, but God is light also. But how can we apprehend light, since, like life, it is also an abstract thing, and known commonly only as antithetical to darkness? No, to comprehend it, we must know it in the concrete—in a form which is intelligible to us. Thus we find the true light became a man like ourselves; and so God, who is life and light, manifests in man what life is. I see life not only in God in the abstract, but also in the Son of God,—in a being like unto myself. I can take Him, so to speak, by the hand, and follow Him through His life on earth; and I can understand what that life is in operation; and life in operation, revealed by the true light, is love. I discern, then, that God is Life, and Light, and Love; and so I have the three great attributes of God presented to me at last in a form which I can understand, and also make intelligible to others. Thus light makes manifest to me the life, and the life becomes intelligible to me through love. Now, these peculiar attributes or properties of God must, to a certain extent, impress themselves upon what passes through His hands in creation, since we know from revelation that "by Him, and through Him, and to Him are all things." Through Him, therefore, it is that all created things pass, taking, to a certain extent, an impress from His form and peculiarities. Therefore when God says, "Let us make man in our image," I expect to find in that creature some sign or peculiarity derived from the Creator. But do I now see in the thing formed that life or being, light or intelligence, and love or charity, which characterizes Him who formed it? When turned out of hand, God certainly pronounced His creature "very good," or perfect; but man was unable to sustain that perfection, as he had not life in himself, but merely the breath of life, constituting him a living creature; otherwise the Almighty would have created gods instead of men. The creature, however, had to learn his insufficiency and instability when left to himself. So this good God submitted him to the simplest possible test. With the most profuse liberality of the gifts of nature at his disposal, he was to be subject to but one law—viz., that he should not eat an apple; but as soon as the trial came he yielded to temptation and fell. Now, what was that fall but from a state of perfection or holiness to one of imperfection and failure? So the imperfect became disunited from the Perfect, and man was consequently separated from God. But do I not see still in that fallen creature, the natural man, even though thus remote from his Creator, some resemblance to God adhering to him? Yes, I recognize some life, light, and love in him, but it is only in a fragmentary form. By aid of revelation, I know our natural life is but death, our light darkness; and our love is imperfect or insane, often degenerating into hatred. But it may be urged that we are, nevertheless, still living. Yes, but wait for the threescore years and ten, and then what are we?—"even as a shadow;" "as the grass of the field, so we perish." And what is life, if it be not like that from which it originates—persistent, eternal? I lately listened to a very interesting lecture at the

Royal Institution, by Sir Samuel Baker, giving an account of his discoveries of the sources of the Nile. Now, suppose that by some giant force that river was severed from its Nyanza source, and that a telegram was sent down to Egypt stating that the Nile was no more—was dead. The Egyptian would rush to ascertain if it were so, and he would, of course, disbelieve the report, for he would see those mighty waters flowing on, giving beauty, fertility, and prosperity to his country ; the ships would be still sailing on its bosom, and the crocodile basking on its sunny banks ; in short, all would appear as usual, till its empty bed should declare that its existence had ceased,—that it was no more. And so it is with us in our unregenerate state. We have the principle of life, but it is cut off from its eternal source ; and it is only by regeneration that we can be reunited to that source again, and be at one with Him "whom to know is life eternal." (Cheers.)

Rev. S. WAINWRIGHT.—I agree very much with what has fallen from the last speaker ; and I should not have risen were it not that I decidedly disagree with one thing he said. I understood him to say he did not think man, as originally formed, was perfect ; and that if we were prepared to allow that the Almighty made man perfect, we must admit that he had created not men, but gods. But we are told expressly on the authority of the Bible that the first human being was absolutely created in God's own image, and that it was man's own fault that the race did not afterwards retain that image. We have a sort of general dictum laid down in Genesis as to all the works of God. After every act of creation it is said that "God saw that it was good :" and His work could not have been so described unless it were without flaw. I think it is important in these days that we should, in discussing these subjects, endeavour to show how irrefragable are our arguments drawn from other sources than scriptural authority and inspiration, though at the same time we affect no such independence of these as is maintained by some men, and are not above referring to that book which we believe to be an inspired record. Dr. Smith has asked, What is life ? We might, indeed, ask, What is anything ? What do we know of anything but by its effects ? Now, just think of that for a moment. Take a handful of coarse blasting-powder. A rustic might say it was merely a handful of onion seed ; and how are you to know the difference ? But scatter it upon the fire, and then you will be able to tell what it is in a moment. Professor Huxley has told us that historically we know nothing of the origin of life. Now, I am ready to affirm that Professor Huxley is fundamentally wrong, and to maintain that historically we do know something of the origin of life. The Immutable and Eternal is unseen and unknown : He is surrounded by clouds and darkness ; but it is the darkness which proceeds from excess of light. That light is so dazzling and blinding that, as Bishop Hall well says, those who gaze long at the sun will have specks in their eyes. Men neglect to search out what may be known of the invisible nature and character of God, so far as it may be furnished by the things that are seen. The heavens declare His glory ; the vast firmament, the mighty ocean, and even every tiny flower and blade of grass, all declare His wisdom, His goodness, and His power.

And as I gaze upon the works of His hand, I am furnished with evidence that, though He has not made Himself visible, He has scattered around us proofs of what He is and does, and thus gives us impressions of Him which He wishes us to seize and to retain. Then He shows us in another way that which He cannot show us in that way. What are those moral principles by which all His mighty energies are guided and controlled? I take it to be one of the grandest things in the revelation of the Bible that it represents Him as bringing the human mind into contact with the divine energies in such a way as that he who has seen the Son has seen the Father; and we know on authority that in the working of that life we see the hidden life.

Mr. REDDIE.—Greatly as I have sympathized with some of the remarks of Dr. Protheroe Smith and Mr. Wainwright, I cannot help saying that I think both those gentlemen have been led away from the precise subject before us; and I feel it is of the greatest importance that we should observe some sort of precision in our discussions. I am sure that great interest was felt in the remarks made by both those gentlemen; and it was only on that account that I did not rise to order very early after Dr. Protheroe Smith began to speak. Mr. Wheatley in his paper has not been discussing that highest life of all—the spiritual life—which proceeds especially and as it were afresh from the Creator to the soul of man, but ordinary and common life as once communicated to all the organic creatures of God's creation. The discussion, therefore, is not one which can be based upon metaphysical considerations, or a spiritual philosophy, but upon natural physical science. But with regard to one remark which fell from Dr. Smith: he said that a person who might enter this room could only be conscious of the presence of the rest through seeing us, and that he would only be conscious of the *nature* of existent things through the same means. Now, I venture to differ emphatically from Dr. Smith as to this. I venture to say that if a blind man had been present and heard the papers read to-night, and the remarks which have since been made, he would have been much more conscious of the presence of intelligent beings around him, from his hearing and intelligence, than others could possibly be from eyesight alone. Hearing would thus afford a better proof of the existence of intelligent man than seeing, and so the argument from sight falls to the ground. With regard to the paper itself, I will point out what appears to be a misapprehension on the part of the author, where he introduces a quotation from Dr. Odling. Mr. Wheatley observes, "Speaking of vital force, Dr. Odling says, 'So far as I can make out, it seems to be a sort of internal, intransferable, immeasurable, self-originating power.'—I believe it to be internal, not intransferable; immeasurable, not self-originating." I have not had the advantage of reading Dr. Odling's book, but, judging merely from that short quotation, I should be inclined to think that Dr. Odling means not that life is self-originat*ed*, but self-originat*ing*, in the sense that life is a power that develops and so originates growth, for instance, which is a power that you do not find existing in the inorganic world. The most nearly analogous thing to this in the inorganic world would, perhaps, be found in the case of certain crystals with regard to

which I dare say you, sir, will favour us with some observations bye and bye. In the organic world, however, there is this remarkable fact, that even in the smallest seed there is an enormous power of vitality and of growth, from which the building up of the solid wood of the strongest trees may result. It is a pity to force the language of any writer beyond the point to which he himself meant to go. Dr. Odling is talking of physical science,—his book is on chemistry,—and I do not see that in the words quoted he at all denies, or intends to deny, the divine origin of life. If, however, he or any other philosophers do venture, as some of them have no doubt done, to argue seriously that the inorganic processes of nature have a sort of life-originating power attached to them, then I say that this is very much like attempting to prove that two and two might make five. If they first deny that there was any life at all on the earth at one time, and assert that life was afterwards produced by some fortuitous combination of material atoms, or some extraordinary power in the elements themselves, then I cannot conceive anything more opposed to all their own principles as to force and matter than this. They tell us that force and matter are both indestructible, that neither could have had a beginning, and that they are both eternal; and yet their whole notion of producing life out of organic combinations is that something in time should begin to be. Now, that is just what we hold who believe in creation—namely, that there was once "a beginning to be;" but then we hold also that this proceeded from the Great Invisible First Cause, the existence of which is clearly manifested to us by the visible things around us, whether to the eye or through any of the other senses of man. Another argument may also be used if our opponents will admit that life is a thing at all,—if they do not deny an actual existence to that most potent power in nature. You are aware that the dogma of the immortality of the soul has been a question of continual discussion and debate; but I do not think that any of the religious philosophers—if I may use such a term—who have been anxious to prove the immortality of the soul have ever ventured upon such a strange argument as that which these mechanical philosophers have ventured upon with reference to the existence of force. For if force be indestructible—I do not grant it, mind—but if you grant that, and grant that life is a reality, and something analogous to force, then why should not life be also considered indestructible? Those philosophers who maintain the eternity of matter and force cannot consistently, when they come to that force which of all others is the most powerful in the world, argue that it may have come into existence by accident, and vanishes into nothing the moment dissolution takes place in an organic structure. And yet they really profess to believe that that most potent thing called life,—by the power of which, indeed, I now speak to you, and you are enabled to hear and understand,—they argue that that, the most potent force in nature, is destructible, and after a time vanishes into non-existence. (Hear, hear.)

Mr. WADDY.—I have been very much delighted with the first paper which has been read to-night. It is not, indeed, an exhaustive paper, but it is very suggestive. There is one part which appears to me a little weak in its

language, and I rather fancy that some mistake has been made by the author. Mr. Wheatley says, "To my mind, the experiments of M. Pasteur most conclusively negatived those of Mr. Crosse and Mr. Weeks, who found a species of acarus appear in solutions of nitrate of copper, silicate of potash, and ferro-cyanate of potassium—on which a powerful battery was brought to bear. A pretence of creative power was thereupon sought to be established. May there not be an attempt to prove rather too much here? Three distinct solutions, acted upon by electricity, each disengaged the same form of life. If the forces employed, the solutions used, and the surrounding conditions are all precisely the same, to the greatest possible exactitude, it is quite comprehensible how the same creature should appear, supposing that any could. But it is surely incredible that by the employment of various media the same animal appeared, unless on the supposition of the introduction of germs from outside." So far as my memory serves me, it never was suggested, either by Mr. Crosse or Mr. Weeks, that the acarus formed in one case was the same as that formed in the other. That it was a similar kind of animal life is true, but it never was said that it was exactly the same. The argument appears to me to be useless, unless we can insert another word or two, and read it that Mr. Weeks found the same species of acarus in solutions of nitrate of copper which he found in the other solutions, which I do not think was the case. And now with regard to the main argument of the paper, so far as the Darwinian theory is concerned, and the line of thought laid down here, it follows that if there be a series, or if Mr. Darwin supposed that there was a series, by means of which man has been produced from the lowest forms of animal life, then the series which has produced him is not simply a "sport," as it is called, but a regular link in what I might almost call a system of scientific gradation that may be in existence still on the earth; and wherever there are links wanting we might hope to be able to trace the whole series complete. But I never met any one who was prepared to say that the series could be traced, distinct and complete, in any manner. You may get one or two very remarkable similarities here and there, by means of which you leap a very long way in the dark. Beyond that, if the argument just hinted at is good, which I think there can be no doubt about, then we have a right to suppose that the "sport" should perfect itself in such a form as that we should find a whole series perfectly complete from the lowest form up to man. If we follow out the same thought in a divergent direction, we should find also an immense number of series rising from the lowest form up to the highest, but in very different positions. We do not find all molluscs the same, for instance. If I find my parentage in an oyster, it follows that I do not claim my origin from an anemone. If I come through the oyster, I should like to see some fresh series derived through the anemone, and that series completely carried on from the beginning, so that I may have the whole chain with all its divergences rising from the lowest up to the highest form, in all the dignity, beauty, and perfection of life. I think Mr. Wheatley has been a little troubled with this, which it was almost impossible for him to escape from,—I mean the two different lives of plants

and animals. It is impossible for us to connect consistently in the same argument the life of the plant and the life of the animal. The life of the animal is such a different thing in its nature and its results from the life of the plant, that I think there has been some confusion in different parts of the paper, arising from Mr. Wheatley's desire to keep his argument abreast of both those kinds of life. It is impossible to consider the origin of life without considering the end of life. To us, with our belief, death may be taken to be a negation of life—the abstraction of life. When that life which has been given us is taken from us, death ensues. But if I can work out properly the argument which must be worked out, it must follow that death is not a negation of life, but something actually positive, and not by any means a negation. Then what becomes of life in the end? These philosophers say that life is pressed into the body—that it arises in some fashion which we cannot explain. Supposing that this is accepted as satisfactory, I would still ask, What becomes of life when death arrives? Because, though we are told that the physical body is resolved into its elements, and that no atom of it is lost,—that you can trace it all in different forms,—still nobody has undertaken to trace what becomes of the life. It is gone: you cannot trace it, or find it in any shape. If it was born by chance, yet, having once been made, why is it to end any more than the body? Why is life to pass out of existence if the body is not? No philosophical answer has been given to this question. Though very much tempted, I will not, of course, go into the question of what becomes of the soul, because that is another matter altogether. Take an animal or a man dead. I can understand about the body. I know what will become of it. I can understand how it will be separated into its elements, but I cannot understand what will become of the life. I cannot see that it will turn into nitrogen or oxygen, or find what gases it is composed of. That is a question which might have been very aptly argued, and I think Mr. Wheatley would have done well if he had dealt with it in his paper. (Hear, hear.)

Mr. WARINGTON.—Before touching on the question which is before us, I will refer for a moment to that point as to what becomes of life, with regard to which I think I shall be able to explain the difficulty which has arisen. If life in vegetables or animals has originated from the modification of natural forces, it ends by a resolution into that out of which it originated. It goes back to that out of which it sprung. If you allow a quantity of light to fall on a dark surface, all the light which is absorbed is held to have resolved itself into another form of force, that which we call heat. So life passing away would resolve itself into some one or other form of force. I do not say that that is my view; I do not believe this myself; but I think that that would be the explanation given by those who hold the views which have been alluded to as to the origin and destruction of life. I only want to show that the difficulty in this question is not so very great. It would simply be considered as life passing back to that out of which it sprung. As to the paper itself, allow me first to notice what appears to me to be a misapprehension on the part of the

author as to the nature of organic matter. He endeavours to show that there is something intrinsically different in organic matter, as matter, which necessitates the supposition of a different origin. He says in one place, "There are peculiarities of composition in organic substance and structure, marking it off from the rest of creation by a deep and a wide valley, across which no human arm can throw a bridge. There are many elementary substances found in organic matter, the whole of which are not, however, present in all organisms. The four principal do pervade all that is organic, hence commonly called organic elements; — they are oxygen, hydrogen, nitrogen, and carbon. The presence of those in the organic is universal. They are also of the inorganic: and thus far, being common to both, why may not the one produce the other?—the lifeless, elaborate life? The peculiarities of their distribution forbid it. The elements generally form a binary combination in minerals; but in the organic world, at least three—usually four—of the elementary principles enter into combination to form the proximate principle—to educe each simplest substance."—I would deny *in toto* that mineral substances are generally, or scarcely even at all, binary compounds. Binary compounds, on the contrary, are rare. There are many cases of three, and plenty of four: so far like organic compounds. The difference Mr. Wheatley had in his mind was, no doubt, this, that in the mineral world you can trace the way in which the more complex compound has been built up, and show that it is binary in its complex form. But the whole tendency of chemistry shows us that this is true of the organic world. You can group your elements into radicals and connect them with other radicals. Take the whole theory of types in chemistry. Chemistry tells us of the water type, the muriatic acid type, and the ammonia type—all inorganic types,—and the tendency is to reduce organisms to these three inorganic types. Chemists are able now, by means of such simple natural processes by which they build up inorganic substances, to build up organic substances. They can, at any rate, build up the same compounds which are originated by means of life, but that does not mean that they can form life. It does not follow that in plants or animals they are formed in the same manner. The long roundabout method adopted by the chemists is very different from the "short cut" action of life. Chemists can make organic matter; but when they have got that they have not got organic life. It is only to point out what is irrelevant that I have gone into this criticism about organic matter. When you come to the life itself—the power which directs the natural forces of the plant or animal—no physical science will explain that. But let us be careful to see where the essential point lies, in order that we may not expose ourselves to a retort, for having misstated our argument. We find that a plant not only requires a certain amount of material to form its structure, but a certain amount of force to employ in its work. A seed put into the ground will not germinate unless it obtains sufficient heat to be used up by the plant in doing its work. You can connect the amount of work done with the amount of force employed in doing it. A later stage of its existence requires a certain amount of light, the employment of which is seen

in its results. So with animals. They require not only materials, but force stored up in their food with the materials, and they have to employ that in order to work out their ends. But, besides that, in the growth both of plants and animals, there is the vital power, the office of that vital power being to direct and control the physical power that it uses, and if it were not for that directing force the physical power would be ineffectual. We may take for example the cells of a plant, perfect in structure and chemical constituents. We may expose them to sunshine, give them carbonic acid and water, but still we fail to produce the slightest change in them. Yet we know that sunshine produces a change in the living plant, but then there must be some faculty in the plant itself to enable it to use that sunshine. That is the vital power. The directive power which uses all these things, and brings out the results, is the vital force. That vital force is in its character essentially different from any physical force that we have any knowledge of. Physical force, so far as we know it, is measurable—that is to say, a certain amount of force is required to do a certain amount of work, and if you want more done you must get more force. Vital force, on the other hand, is immeasurable, so far as we can see. It is immeasurable, not simply in the sense that we cannot set limits to it, but it does not appear to work by measure at all. We take a single seed, and we have vital power enough in that to produce millions and millions of fresh plants. No vitality comes to that seed from matter or physical force, yet it has power to spread life to an illimitable extent. We know of no physical power that can do that; and so no physical researches can help us to understand the rule of life. If we examine matter ever so closely, we never get nearer the origin of life. We may know more of its nature, but nothing of its origin. Physical science never has been and never will be able to tell us anything about it. The knowledge must come from somewhere else. I should like now to make one or two remarks on the latter part of the paper, concerning the development of life. How life has developed itself is a question entirely different from its nature and origin. Mr. Wheatley has used an argument with regard to new creations which I confess I am utterly unable to see the force of. He says, if we can show that some few creations have existed from the very beginning up to the present time unchanged, all necessity for a new creation is therefore done away with. How does it follow, because a certain number of species have been able to subsist through an infinite variety of circumstances unchanged, that all others should have done so too? I should think the argument would be rather the other way. The fact that only a few of existing species can be traced to the beginning is to my mind a proof that there have been fresh creations. How does he account for the extinction of certain animals? Because, he says, circumstances have altered. But on the same evidence we are bound to believe that others have come in. We find that animals which existed previously do not exist now, and we find that animals and plants exist now which did not exist ages ago. The argument cuts both ways, and we must believe that at certain periods fresh animals and plants have come into existence, but whether by fresh creation or not is another question. We are

bound to believe that new ones have made their appearance in this world in some way or other since the first beginning of creation, and that some old ones have passed away. No one who knew geology practically would deny that.

Mr. REDDIE.—Professor Huxley attributes these apparently new creations to migration.

Mr. WARINGTON.—And now may I notice another point of Mr. Wheatley's paper with reference to tropical plants and animals to be found in old strata, and which required a tropical climate and a vertical sun? Mr. Wheatley says,—

"They are the forms of a tropical land. How then came they into these climates? for sure it is they neither do nor could flourish here now. What is there wanting wherewith we cannot supply them? There must be something. So there is,—a vertical sun. According to the distribution of the sun's glorious rays, so is vegetation, so is animal.

"It has been customary to account for climatal changes chiefly by atmospheric alterations, brought about by the great currents of the ocean taking a new course, by sea usurping the place of land, or land that of sea. But with our northern sun, alterations could never account for the lion and tiger in our forests, nor the palms and tree-ferns of the tropics on our uncongenial soil. Hitherto, every change of surface on the globe has been attributed to upheavals and subsidences—an upward and downward movement in the same spot—even to the reversing large tracts of country. And the geological mind has been satisfied with it—has given its best attention to it—has become saturated with it—has assumed hypotheses, and drawn inferences, very much to its own satisfaction;—children of imagination, bright and delusive.

"We can understand the sudden coming on of an icy period. Let the gulf stream be deflected from our shores, and a raising of the land take place—a climate might be produced wherein life must give way under its intensely glacial aspect. Ice and snow which no summer's sun could melt—or whose rigour could be even mitigated—would reign undisputed. But so long as our latitude is unchanged, how can we have the heat of Bengal, the burning plains, the steaming jungles? How enjoy the pleasures and pay the penalties of those districts where lurk beast and reptile of surpassing beauty, and where vegetation rises in all its grandeur? Where else is this to be found? Where else? here, under our very feet are buried races of the tropics. We see it in multitudes of shells; we see it in vast numbers of animals; we see it in trees, having at this hour their roots in the very soil in which they grew luxuriantly under warmer skies, showing the impossibility of their having arrived where we find them by any accidental occurrence—any convulsion of nature. Long is it since the beams of a sun which did this have ceased to visit our land."

The whole argument proceeds on the assumption that those tropical plants are the same as those which now flourish in tropical lands. I believe that is not so——

Captain FISHBOURNE.—Surely that is not Mr. Wheatley's argument.

The CHAIRMAN.—I think it is scarcely Mr. Wheatley's view. What I understand him to mean is that those plants could not have flourished except under a vertical sun.

Mr. WARINGTON.—It struck me that he meant they were the same tropical plants. His language is ambiguous, and I suppose I have been mistaken——

The CHAIRMAN.—He goes on then to refer to Mr. Evan Hopkins's idea of the change of surface.

Mr. WARINGTON.—I wish now to notice a misrepresentation of the Darwinian theory towards the close of the paper. I will not discuss the merits of that theory, but simply point out what seems to me to be a great misunderstanding. He says, "A variety thrown off by the parent plant is a species at once, or not at all. It is only a temporary variety; for, when it has grown up and become a perfect plant, it must either die out, revert, or perpetuate *itself*." His argument goes upon this assumption, that if it perpetuates itself it is a species, but if it reverts or dies out it ceases to be a variety. There is no possibility of an intermediate stage. Now, take the simple case of man; a negro perpetuates himself, and a Chinese, and a North American Indian, with all their differences, most exactly; yet we firmly believe that they have all sprung from one original stock——

The CHAIRMAN.—He gives the definition of that. He calls that hybrid, and says that the hybrid cannot be perpetuated. Hybrids, therefore, would not be species, according to him.

Mr. WARINGTON.—I am endeavouring to show that according to his argument they are species, because they are reproducing and perpetuating themselves, with all their characteristic differences, and, therefore, according to his theory they are species; yet, having been formed from varieties——

The CHAIRMAN.—Not according to his definition of species, I think.

Mr. WARINGTON.—There is another serious misunderstanding on the same page. Mr. Wheatley says, "Where man interferes, in the way of improving a species or a variety—such as our culinary vegetables and our florists' flowers—he is obliged to continue by industry what he acquired by skill; else would the size and succulence of his parsnips and his celery, and the glory of his roses and carnations, very soon return to what we consider the insignificance of their originals—neither pleasing his palate nor delighting his eye." Here he is speaking of arbitrary conditions, where the result depends on those conditions being maintained. Mr. Darwin will tell you the same law holds good in nature; if the conditions be maintained, then the variation will remain. It is the same with arbitrary alterations as with natural alterations. I cannot pretend to go into any discussion on this matter; I simply wish to point out an instance in which Mr. Darwin's theory has been unjustly dealt with by Mr. Wheatley. I would especially urge upon every one who deals with the subject to be perfectly clear with regard to this point, that if we could show that life developed itself after the manner of Mr. Darwin's theory, we should have got no nearer to the essential point of life's origin. It would not be much more wonderful if that life should be able to develop itself with variation than that life could develop itself at all. That is a marvel in itself, and if life does not always in developing assume the same form, we are not increasing the marvel, or doing anything to solve the question whence the vital power springs and what it is. (Hear, hear.)

The CHAIRMAN.—Mr. Wheatley has made a slight mistake with regard to crystals, which I should not have referred to had I not been invited to do so. He says, "Crystallography has been appealed to as evidence that

nature does evoke regularity of shapes from the shapeless, and that man can imitate nature with her own materials. It is quite true. Nature's only regular form is the crystal; and though there are several primaries, and a multitude of secondaries, they are all solid bodies, having plane and smooth surfaces." That is not absolutely true. There are a few crystals with curved surfaces—the diamond has curvilinear faces. Why the diamond and one or two others should present that variation is not quite clear, but that is the fact. With regard to the quotation which Mr. Wheatley has given from Dr. Odling, I may say that Dr. Odling's argument has been entirely mistaken; he actually denies the existence of vital force altogether. His language is exceedingly ambiguous; but when you look at the list of the subjects of the various paragraphs of Lecture IV., you will find the words "baseless hypothesis of vital force," and in the text he says that there is no such thing in existence. His view is that you have no right to say that you have any different force acting on the body, in order to combine the materials, but those forces which act in nature upon inorganic bodies,—that because the chemist can imitate some of the results of dead matter, a thing until lately deemed to be impossible, because he can make acetic acid and other things without using any organic matter, you have no reason to believe in vital force. He says that "all the actions of the animal body are traceable to cosmical force; that in living, as in dead matter, there is no creation of force; and that any explanation of the phenomena of life which recognizes the agency of vital force is simply no explanation at all. Applying the word 'force,' as we now do, to certain transferable states of actual or potential activity having quantitative metamorphic correlations, I much question whether the expression 'chemical force' is a correct one, though it is one of which the meaning is perfectly definite and intelligible. By the chemical force of so much oxygen and hydrogen, for instance, we mean the potential energy stored up in them at the moment of their separation, and reproducible from them in the act of their combination. Similarly, we might apply the phrase 'vital force' to the potential energy of so much fat or muscle, capable by oxidation of being manifested in the form of external heat or motion. But what the physiologist means by vital force I have never been able to understand. So far as I can make it out, it seems to be a sort of internal, intransferable, immeasurable, self-originating power, which performs nutritive acts by its absolute will and pleasure, as if it were not abundantly manifest that the growth of a plant and incubation of an egg cannot be performed without a direct supply, and the development of animal organisms without an indirect supply of external force." Further on, speaking of the question of making organic matter by chemical processes, he says, "This question, decided absolutely in the negative, so long as the fiction of vital force tyrannized over men's minds, has of late years received a rapid succession of brilliant affirmative replies. Already hundreds of vegetable compounds, heretofore produced only in living organisms, and, as was supposed, put together and held together by vital force, have been formed by the chemist in his laboratory out of carbonic acid, water, and ammonia; or, in other words, out of charcoal, hydrogen,

oxygen, and nitrogen." You find there that Dr. Odling denies the existence of vital force altogether. I think we are much indebted to Mr. Warington for pointing out so clearly the difference between vital force and physical power. Suppose a chemist can build up so much flesh, or artificially make so much wood or so much quinine, does he get any nearer to an organic body, or to organic life? There is no structure in these things. If he builds up the flesh he does not produce a living body—a something endowed with something else, call it vital force, or power, or anything else, which renders it capable of perpetuating itself. It is marvellous that this something should be capable of taking all the powers of inorganic nature—sunlight and heat and all the other elements—and building them up so as to perpetuate other creatures through all time. You have nothing approaching that—nothing at all like that force anywhere else. No one could have stated that more clearly than Mr. Warington, and it is essentially one of the points in dispute. I was in hope that somebody would have told us more about physiology. Years ago I attended a course of lectures, delivered at the College of Surgeons by Mr. Paget, on the "Life of the Blood." Hunter was not ashamed when he wrote on inflammation to go to one Book, and he took the passage that "the life was in the blood" as the motto for his work, and I do not believe he got beyond it. Mr. Paget stated most lucidly in his lectures that it was impossible to give any scientific definition of life which would hold water—such a definition, for instance, by which we would be enabled to show it differs from everything inorganic. I was somewhat interested in those lectures, and it was through them that I was led to devote my spare time to the investigation of the science of crystallography. Mr. Paget said that the nearest approach you could get to a definition of life was that of a German, whose name I forget, that a living body was that which, when injured, was capable of repairing the injury. But, he continued, according to that, a crystal of alum was a living body, and he exhibited the model of an alum crystal as it was when it had been broken, and another model showing how it had repaired the injury when put again into the solution where it was originally formed. The first model represented the broken crystal, the second showed a perfect octohedron. The crystal, therefore, according to that definition, was a living body. I wanted to know how it was that the crystal could thus repair an injury of itself. He said that the discovery had lately been made by a German, but I afterwards found it was in Mrs. Somerville's *Introduction to the Physical Sciences*, and that it was not a new discovery at all, but an old one revived. Although we cannot define life, there is the widest difference between a living creature of any kind and a dead carcase. In the body without life there is no perpetuation of growth, as there is in the living animal of the lowest or most imperfect type. It was held at first to be a mistake on the part of Liebig and others, who supposed it was possible for the chemist to make the combinations found in living bodies by means of inorganic elements, but it is true. Still it does not bring you one step nearer to making the living body. It was well known before, that phosphate of lime could be procured from bones,

just as acetic acid or alcohol could be obtained from bodies, which had had life, after death. You can get phosphate of lime from bones, and carbonate of lime from shells, but life is beyond all chemical force, and beyond all electrical force, marvellous as that is. How are all the complex organs, with which we are so well acquainted, formed out of the living blood? How do the blood corpuscules perform such subtle chemistry? To say that the chemist can make these organic compounds without life is no nearer the matter than to tell me that because the telescope is made of brass and glass, that, therefore, the structure of the telescope or the microscope is only the result of the action of brass and glass upon one another. I should resent such a thing as an absurdity. But what is that wonderful, subtile thing—call it force, or vitality, or what you will—which is resident in me, and which is possessed of such marvellous powers? How does Dr. Odling, or any other chemist, produce his organic compounds? He first takes organic bodies and pulls them to pieces in order to find out their constituents, and then, in a roundabout way, he gets similar elements combined in a certain form. But my blood corpuscules are constantly doing that for me in the most perfect manner, and in every part of my body. They do not put a crystalline lens in my hand, but in my organs of vision the most perfect lenses are placed in the position and with the surroundings best fitted for their immediate and constant use. Wonderful as it is that my blood corpuscules, having a life of their own, should be able to form such a wonderful and marvellous organ as the eye, it is not more wonderful than the operation of my heart, or than the construction of my veins, with all their beautiful valves placed just where those valves ought to be to prevent the regurgitation of the blood. Where did that marvellous power come from which could make such an organ as the eye, which is mathematically perfect—its perfection being such that no man can imitate it? How are these blood corpuscules endowed with wisdom for doing that? It must have come from some other and higher source, and the very character of the work perfectly manifests the source whence it came. That wisdom could only have come from the Source of all wisdom, and all these results, instead of coming by chance, or being self-originating, are based upon knowledge as sure, as certain, and as mathematically accurate as anything. When I tell you that this is oxygen and this hydrogen, and that both combined will give me water,—if I can say that, as the result of accurate and scientific study, I am forced, by the observation of the organs of my own body, formed there unknown to me, and by the vital action going on in that body,—I am forced to acknowledge, as a scientific fact and truth, that all these things could only have come from the Source of all wisdom, the Almighty Creator of all things. (Cheers.)

Dr. Protheroe Smith.—I wish to correct a misapprehension on the part of Mr. Wainwright as to what I said. I agreed that man was created perfect, but I argued that he was incapable of sustaining that perfection, and therefore fell.

The meeting was then adjourned.

REPLY BY MR. WHEATLEY.

I beg to be allowed the gratification of returning thanks for the kindness with which my paper was received; and I will be as brief as possible in answering such objections as were raised to some of the arguments contained in it.

I can only reply to Mr. Reddie by saying that he is right in not considering Dr. Odling "denies, or intends to deny, the divine origin of life," in the words quoted. I gave them solely to remark that whatever argument he might build upon them would be unreliable, as it seemed to me the definition he gave of vital force was not correct; by which I meant, it was not in accordance with my own ideas as a believer in it; and I think (from what he says he can make out of the physiologists' meaning as to vital force) that he misrepresents the notions any believer has of it.

Mr. Waddy does not think that identically the same acarus was produced by the experiments of Mr. Crosse and Mr. Weeks from diffcrent solutions. My authority for the assertion is not either of those gentlemen, but the author of the *Vestiges of Creation*, who says, "The insects produced by both experimentalists seem to have been the same—a species of acarus, minute and semi-transparent, and furnished with long bristles, which can only be seen by the aid of the microscope." *A* species—each individual described alike. If this be true, the deduction from my argument is true also: and true I presumed it to be from the circumstantial specification of the animals.

Mr. Warington considers I am in error on several occasions. He observes, "Mr. Wheatley has used an argument with regard to new creations which I confess I am utterly unable to see the force of. He says that if we can show some few creations have existed from the very beginning up to the present time unchanged, all necessity for a new creation is therefore done away with." Surely if any genera are proved to exist from the beginning, so far as geology has reached, there can be no necessity for new creations; because, since any *were*, all *could* have been originally created together. What could have been may have been, and subsequent *necessity* ends. Mr. Warington continues: "How does he account for the extinction of certain animals? Because, he says, circumstances have altered. But on the same evidence we are bound to believe that others have come in." It appears to me a very decided *non sequitur* that, because altered circumstances have destroyed one form, another and different form should be built up. I do not see the sequence. "We are bound to believe," again says Mr. Warington, "that new ones have made their appearance in the world in some way or other since the first beginning of creation, and that some old ones have passed away. No one who knew geology practically would deny that." I do know some little of geology,

practically, yet cannot help denying it, and for the following reasons:—The proof is rested on geological evidence. What is that evidence? We are presented with forms of living things which were and are not. Their extinction may not be doubted. But where is the geological proof of successive introductions of other forms of life? Is it because of that class of facts which says the Pleuronectidæ are not found in the earliest strata where fish is discovered, and must therefore have been a subsequent introduction? In dealing, most especially, with geological evidence, three things should be carefully borne in mind—that absence is no proof of non-existence; that presence is no proof of recent introduction; and that so comparatively small an area has been subjected to geological research, inferences should be received with the greatest caution. In seeking after epochs of introduction, the evidence of the rocks is purely negative, and negative witness is no witness at all. A few years since, palæontologists found no bird in any older deposit than the tertiary, affording the loose geological negative evidence of the introduction of birds during that period. The Archæopterix macrurus was afterwards detected in the upper oolite, and part of the skeleton of another gull had been found in the greensand of the cretaceous series. From these and similar facts, I cannot agree with Mr. Warington that the practical geologist must necessarily believe in fresh introductions of life since the first beginning of creation. To fix the date of an event in the tertiary rocks, from negative testimony, and then find it *must* have occurred in the secondary, if not earlier, shows the value of such geological inference; and only those carried away by the fascinations of science can subject their reason to their imagination.

Mr. Warington takes up another part of the subject. He says, "I wish now to notice a misrepresentation of the Darwinian theory"; and he proceeds to observe that my argument goes upon the assumption that, if a variety thrown off by the parent plant perpetuate itself, it is a species; but if it revert or die out, it ceases to be a variety. And he brings this example in refutation: "Now, take the simple case of man. A Negro perpetuates himself, and a Chinese, and a North-American Indian, with all their differences, most exactly; yet we firmly believe they have all sprung from one original stock." If I had intended to have expressed the opinion that a variety could perpetuate itself *so as to set up another species*, how could I have said on the preceding page, "I consider that the perfect and complete forms were those created, from which *varieties cannot be raised into species*"? And again, the two lines immediately before Mr. Warington's extract show the intended meaning of the whole passage:—"If varieties *could* be converted into species, extended time, such as Mr. Darwin requires, seems a most unnecessary step in the process." *If they could*, plainly tells my belief they could *not*. However, I am afraid the sentence on which he comments is ambiguous—no light fault in scientific discussion.

Alluding to the necessity of our culinary vegetables and florists' flowers being continued by constant care in the state to which artificial culture has brought them, Mr. Warington says I have dealt unjustly with Mr. Darwin's

theory ; and adds : "Here he is speaking of arbitrary conditions, and the result depends on those conditions being maintained. Mr. Darwin will tell you the same law holds good in nature ; if the conditions be maintained, then the variation will remain. It is the same with arbitrary alterations as with natural alterations." No doubt. Yet how does this militate against my argument, that varieties cannot be converted into species ? It appears to me that no circumstances whatever can do this. Remit the conditions, whether natural or artificial, and the variety at once fails. But will the species ? I conceive not. Alter the conditions of existence which surround the Negro, and the *Negro* will die out—not the *man*. The perpetuation of the various races of man is no proof as to whether they are either varieties or species. An aggregation of varieties will form a species. Could every variety be extinguished, the species would be at an end. But the subject is too extensive for further discussion here.

I have to thank the Chairman for correcting an assert on I made on crystallography. I said all crystals had plane surfaces. Mr. Mitchell refutes it, and says, "There are a few crystals with curved surfaces : the diamond has curvilinear surfaces. Why the diamond and one or two others should present that variation is not quite clear ; but that is a fact." My knowledge of crystallography is extremely limited ; though directly after having said that all crystals had plane surfaces, I added, "pseudomorphous forms arise ; but the laws of crystallography are, for all practical purposes, irrefragable " ; showing that I was not altogether unaware of occasional deviations, though certainly unaware that the diamond was—more than this—a constant exception.