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Joseph Cook

Excerpt

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# BIOLOGY.

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## I.

### HUXLEY AND TYNDALL ON EVOLUTION.<sup>1</sup>

“None of the processes of Nature, since the time when Nature began, have produced the slightest difference in the properties of any molecule. We are, therefore, unable to ascribe either the existence of the molecules, or the identity of their properties, to the operation of any of the causes which we call *natural*. The quality of each molecule gives it the essential character of a manufactured article, and precludes the idea of its being eternal and self-existent.”—Professor CLERK MAXWELL, “Lecture delivered before the British Association at Bradford,” in *Nature*, vol. viii. p. 441.

“There is a wider teleology which is not touched by the doctrine of evolution, but is actually based upon the fundamental proposition of evolution. The teleological and the mechanical views of Nature are not necessarily mutually exclusive. The teleologist can always defy the evolutionist to disprove that the primordial molecular arrangement was *not intended* to evolve the phenomena of the universe.”—Professor T. H. HUXLEY in *The Academy* for October 1869, No. 1, p. 13.

IN 1868 Professor Huxley, in an elaborate paper in the “*Microscopical Journal*,” announced his belief that the gelatinous substance found in the ooze of the beds of the deep seas is a sheet of living matter extending around the globe. The stickiness of the deep-sea mud, he maintained, is due to innumerable lumps of a transparent, jelly-like substance, each lump consisting of granules, coccoliths, and foreign bodies, embedded in a transparent, colourless, and structureless matrix. It was his serious claim that these granule-heaps, *and* the transparent gelatinous matter in which they are embedded, represent masses of protoplasm.

1. To this amazingly strategic and haughtily-trumpeted substance found at the lowest bottoms of the oceans Huxley gave the scientific name *Bathybius*, from two Greek words meaning *deep* and *life*, and assumed that it was in the past, and would be in the future, the progenitor of all the life on the planet. “*Bathybius*,” was his language, “is a vast sheet of living matter enveloping the whole earth beneath the seas.”

<sup>1</sup> The forty-sixth lecture in the Boston Monday Lectureship, delivered in the Meionaon, Oct. 2, 1876,

2. No less a man than David Friedrich Strauss, who, in 1872, wrote "The Old Faith and New," his last work, used Bathybius as a presumably triumphant keystone of the physiological portion of his argument against the belief in the supernatural.<sup>1</sup> This deep-sea ooze he made the bridge between the inorganic and the organic. "At least two miracles or revelations," wrote Jean Paul Richter, face to face with the French Revolution, "remain for you uncontested in this age, which deadens sound with unreverberating materials. They resemble an Old and a New Testament, and are these,—the birth of finite being and the birth of life within the hard wood of matter. In one inexplicable every other is involved, and one miracle annihilates a whole philosophy."<sup>2</sup> It is very noteworthy, that, according to Strauss's own final admission in 1872, miracle must be confessed to have occurred once at least at the introduction of life, unless some method of filling up the chasm between the dead and the living forms of matter can be found. Bathybius was to occupy this gap. "Huxley," wrote Strauss, "has discovered the Bathybius, a shining heap of jelly on the sea-bottom; Hackel, what he has called the Moneres, structureless clots of an albuminous carbon, which, although inorganic in their constitution, yet are all capable of nutrition and accretion. By these the chasm may be said to be bridged, and the transition effected from the inorganic to the organic. *As long as the contrast between inorganic and organic, lifeless and living nature, was understood as an absolute one, as long as the conception of a special vital force was retained, there was no possibility of spanning the chasm without the aid of a miracle.*"<sup>3</sup> As devout believers in Bathybius, educated men—Strauss affirmed in the name of what he mistook for German culture—could no longer be Christians. Bathybius had expelled miracle. Thus in 1868 and 1873 Bathybius was the watchword of the acutest anti-supernaturalistic discussions, and was adopted as a victorious weapon by Strauss, when, with his dying hand, he was using his last opportunity to equip his philosophy with armour. Men have trembled before Strauss's negation of the supernatural. Bathybius was his chief support of that denial. Huxley called his discovery *Bathybius Hackelii*. Ernst Hackel, well knowing what stupendous issues were at stake, elaborately applauded the discovery.

3. Great microscopists and physiologists, like Professor Lionel Beale and Dr. Carpenter, rejected Huxley's testimony on this matter of fact. Dr. Wallich, in 1869, in the "Monthly Microscopical Journal," presented evidence that the deep-sea ooze has nothing in it to confirm Huxley's views. The ship "Challenger," engaged now in deep-sea soundings, has accumulated evidence of the same sort; and at present Bathybius is a scientific myth and a by-word of derision. "Bathybius," says Professor Lionel Beale in his work on "Protoplasm" (London, 1874, pp. 110, 368, 371), which the "North British Review" well calls one of the most remarkable books of the age,

<sup>1</sup> The Old Faith and New, sect. 48.<sup>2</sup> Levana, sect. 38.<sup>3</sup> The Old Faith and New, sect. 48.

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“instead of being a widely-extending sheet of living protoplasm, which grows at the expense of inorganic elements, is rather to be regarded as a complex mass of slime, with many foreign bodies and the *debris* of living organisms which have passed away. Numerous minute living forms are, however, still found upon it.” At the meeting of the German Naturalists' Association at Hamburg, in September 1876, Bathybius was publicly interred. It was my fortune to converse for a while, lately, with Professor Dana of Yale College, when I put to him the question, “Does Bathybius bear the microscope?” He replied, “You know that, in a late number of ‘The American Journal of Science and Arts,’ Huxley has withdrawn his adhesion to his theory about Bathybius.” Thus the ship “Challenger” has challenged the assertion with which Strauss challenged the world; and Huxley himself has left Bathybius to take its place with other ghosts of not blessed memory in the history of hasty speculation.

4. *Nevertheless*, in his New York definition of the doctrine of evolution, Professor Huxley speaks of a “gelatinous mass, which, so far as our present knowledge goes, is the common foundation of all life.” As, by his own confession, no such gelatinous mass has ever been observed, his popular assertion that our “knowledge” goes “so far” as to establish that this gelatinous mass not only exists, but is the foundation of all life, is contradictory of his published retraction of his theory before scholars. The observed Bathybius having turned out to be a myth, its place is now occupied by an inferential Bathybius. The chasm between the inorganic and the organic was not bridged by the results of actual observation; but it must yet be bridged, even if only with a guess and a recanted theory. This substitution of the inferential for the observed is unscientific. A primary fault of Professor Huxley's latest definition of the basis of evolution is self-contradiction.

Huxley persists in his forced recantation in spite of all the alleged discoveries in the Bay of Biscay and the Adriatic. But the gelatinous mass, which, according to Huxley's New York Lectures, is the common foundation of all life, he defined. His words permit no doubt that he meant Bathybius and its associated forms of life, as Hæckel does in similar language, and not protoplasm in the minute forms in which it exists in the living tissues of to-day. Huxley affirmed in New York, that, “if we traced back the animal and vegetable world, we should find, preceding what now exists, animals and plants not identical with them, but like them, only increasing their differences as we go back in time, and at the same time becoming simpler and simpler, until finally *we should arrive* at the gelatinous mass, which, so far as our present *knowledge* goes, is the common foundation of all life. The tendency of science is to justify the speculation that that also could be traced farther back, perhaps to the general nebulous condition of matter.”<sup>1</sup>

Very plainly, by *this* gelatinous mass, at which we should “arrive”

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<sup>1</sup> Tribune Pamphlet Report, p. 16.

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by a process of investigation carried backward to the first living organisms and to the nebulous condition of matter, Huxley does *not* mean protoplasm in minute forms in the veins of the nettle, and in the other living tissues of to-day, and in them constituting what his famous lecture of a few years ago called "the physical basis of life." But he affirmed that our "knowledge," and not merely our theory, goes "so far" as to show that *this* gelatinous mass is "the foundation of all life."

In view of his recantation as to this sheet of living matter beneath the seas, this assertion is self-contradictory. Since no such gelatinous mass has ever been seen, the substitution of an inferential for an observed sheet of living slime enveloping the world is unscientific. With the argument of Huxley, that of Strauss takes its place among exploded and ludicrous errors.

5. It follows, also, from the facts now stated, that *Professor Huxley's New York Lectures are defective in omitting the most essential part of their subject; that is, in failing to explain how evolution bridges the chasm between the inorganic and the organic, or the lifeless and the living forms of matter.*

6. There have been and are at least three schools of evolutionists, —those who deny the Divine existence, those who ignore it, and those who affirm it; or the atheistic, the agnostic, and the theistic. Carl Vogt, Büchner, and Moleschott belong to the atheistic school of evolutionists; Huxley and Tyndall and Spencer, to the agnostic; Dana, Gray, Owen, Dawson, Carpenter, Sir J. Herschell, Sir W. Thomson, and, in the judgment of Professor Gray, Darwin himself, to the theistic.

7. Of the theistic form of the doctrine of evolution, there are theoretically three varieties: (1) That which limits the supernatural action in the origination of species to the creation of a few primordial cells; (2) That which makes Divine action in the origination of species chiefly indirect, or through the agency of natural causes, and yet sometimes direct, or through special creation; (3) That which makes God immanent in all natural law, and regards every result of cosmic forces as the outcome of present Divine action.

8. In the history of the discussion of evolution, the origin of species among plants and animals has been explained by at least seven distinct hypotheses:—

(1.) Self-elevation by appetency, or use and effort. That is the theory of Monboddo; Lamarck, and Cope.

(2.) Modification by the surrounding condition of the medium. That is Geoffrey St. Hillaire, Quatrefages, Draper, and Spencer.

(3.) Natural selection under the struggle for existence, with spontaneous variability, causing the survival of the fittest. That is Darwin and Hæckel.

(4.) Derivation by pre-ordained succession of organic forms under an innate tendency or internal force. That is Owen and Mivart.

(5.) Evolution by unconscious intelligence. That is Morell, Laycock, and Murphy.

(6.) Immanent action and direction of Divine power, working by

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the purposive collocation and adjustment of natural forces, acting without breaks ; or the theory of *creative evolution*. That is Asa Gray, Baden Powell, and the Duke of Argyll.

(7.) The same immanent Divine power collocating and adjusting natural forces, but with breaks of special intervention, and this notably in the case of man. That is Dana, and Darwin's great co-discoverer of evolution, Alfred Wallace.<sup>1</sup>

What Huxley calls the Miltonic theory of creation, he did well not to call the biblical ; for it is generally admitted by specialists in exegetical science, that the writings of Moses neither fix the date, nor definitely describe the mode, of creation. Professor Dana, in the closing chapter of his celebrated "Geology," exhibits the first chapter of Genesis as thoroughly harmonious with geology, and as both true and divine. Many theologians combine their distinctive positions with some theistic view of evolution, especially with that held by Professor Dana. Owenism seems at least as sure of a future as unmodified Darwinism. Dana and Häckel represent respectively, I should say, the use and the abuse of the theory of evolution.

9. It is thus evident, from the history of recent speculation alone, that there are, or well may be, at least thirty different views as to the past history of nature ; but Professor Huxley affirms, that, so far as he knows, "there have been, and well can be, only three." That nature has existed from eternity, and that it arose, according to the Miltonic hypothesis, in six natural days, and that it originated by evolution, of which latter he gives a definition,—these are his three theories ; and they are a curiously incomplete statement of facts in the case. It does not follow, that, if the first two be overthrown, only the theory represented by *his definition* is left to be chosen ; but this is the implicit and explicit assumption of the New York Lectures.

10. It is the theistic, and not the agnostic or the atheistic, school of evolution which is increasing in influence among the higher authorities of science.

Some agnostics are proud of exhibiting under almost atheistic phraseology a really theistic philosophical tendency. Spencer's negations in natural theology amount to the assertion that our knowledge of the Divine existence is like our knowledge of the back-side of the moon,—we know that it is, not what it is. But I assuredly know that there is not a ripple on any sedgy shore, or in the open sea of the whole gleaming watery zone, from here to Japan, which is not influenced by that unknown side as much as by the known. So, in the far-flashing spiritual zones of the universe of worlds, there is not a ripple which does not owe glad allegiance to that law of moral gravitation which proceeds from the whole Divine nature, known and unknown. God is knowable, but unfathomable. The agnostics call God unknowable ; but that He is unfathomable is all that they prove, and often all that they mean.

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<sup>1</sup> See arts. on "Evolution," by Professor Youmans and President Seelye, in Johnson's *Cyclopædia*, and Johnson's *Natural History*.

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11. As Professor Huxley does not notice the different schools of evolutionists, his New York definition of the doctrine is defective through vagueness.

12. For the same reason, it is defective by a suppressed statement of hypotheses which are rivals of his own.

13. It is evident, from the nature of the case, that the question of chief interest to religious science is, whether the new philosophy is to be established in its atheistic, its agnostic, or its theistic form. But Professor Huxley regards the order of the appearance of species as a matter to be studied with all zeal: the causes of their appearance, he thinks, are a matter of subordinate importance. At Buffalo he said, "All that now remains to be asked is, How development was effected? and that is a subordinate question." He thus makes the merely initial question, What? more important than the commanding and final question, Why? The clashing looms in Machinery Hall at the World's Exhibition are of supreme moment; the Corliss Engine, which drives them, is of subordinate and inferior interest. Religious science, therefore, finds Professor Huxley curiously wanting in the sense of logical proportion.

14. The New York Lectures insist on resemblances, and not on differences, in related animal forms.

15. They exaggerate resemblances by broadly inaccurate pictorial representation. The Eocene horse of Wyoming, of the genus *Orohippus*, Dana says, is not larger than a fox.<sup>1</sup> The bones of its leg and foot were represented in the New York reported illustrations as quite as large as those of the horse.

16. The New York Lectures prove the existence, not of connected links, but of links with many gaps between them. They prove the existence of steps with many and long and unexplained breaks, and should prove the existence of an inclined plane.

17. They fail to reply to the great, and as yet unanswered objections to Darwinism,—the absence of discovered links between man and the highest apes, the sterility of hybrids, the mental and moral superiority of man, and the existence, in many animals, of organs of no use to the possessors under the laws of either natural or sexual selection.

18. In asserting that this self-contradictory, vague, and historically inexact account of evolution is a demonstration of the truth of his definition, and places evolution, thus defined, on "exactly as secure a foundation" as the Copernican theory, which is verified by all experiment, and has in its favour the unanimity of experts, Professor Huxley's conclusions include more than his premises.

The New York Lectures disagree in their conclusions with those of higher geological authorities, equally well or better acquainted with the American facts, and notably with the conclusions of Dana and Verrill. According to these professors of the university where the relics are preserved, the bones explain, in part, the variations of one style, but do not account for gaps between groups of animals, and least of all do they account for man.<sup>2</sup>

<sup>1</sup> Manual of Geology, ed. of 1875, p. 505.

<sup>2</sup> Dana, Manual of Geology, pp. 590-604.

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Professor Gray calls himself, in his latest work, a "convinced theist, and religiously an acceptor of the creed commonly called the Nicene."<sup>1</sup> Is there yet any occasion for the disquietude of a free mind holding these views? If the demonstrative evidence in favour of the materialistic form of the theory of evolution is unsatisfactory as presented by Huxley in New York, what shall be said of the subtler procedures of Tyndall's Belfast Address?

Sitting on the Matterhorn on a July day in 1868, Tyndall meditates on the period when the granite was a part of the molten world; thinks then of the nebula from which the molten world originated; and asks next whether the primordial formless fog contained potentially the sadness with which he regarded the Matterhorn.<sup>2</sup> In 1874 he answers, Yes, and concludes that we must recast our definitions of matter and force, since life and thought are the flower of both.

Accordingly, Tyndall's effort is to change the definition of matter. Of the many forms of materialism, his coincides nearest with a tendency which has been gathering strength among physicists for the last hundred years,—to deny that there are two substances in the universe, matter and mind, with opposite qualities, and to affirm that there is but one substance, matter, itself possessed of two sets of properties, or of a physical side and a spiritual side, making up a double-faced unity.<sup>3</sup> This is precisely the materialism of Professor Bain of Aberdeen, and of Professor Huxley; and its numerous supporters in England, Scotland, and Germany, are fond of proclaiming that among metaphysicians, as well as among physiologists, it is the growing opinion; and that the arguments to prove the existence of two substances have now entirely lost their validity, and are no longer compatible with ascertained science and clear thinking.

Tyndall's speculations as to matter are simply an extension of the hypothesis of evolution, according to the scientific doctrine of uniformity, from the known to the unknown. Back to a primordial germ Darwin is supposed by Tyndall to have traced all organisation: back to the properties of unorganised matter in a primordial nebula Tyndall now traces that germ. Evolution explains everything since the germ. Evolution must be applied to explain as much as possible before the germ. So far as we can test her processes by observation and experiment, Nature is known to proceed by the method of evolution: where we cannot test her processes, analogy requires that we should suppose that she proceeds by the same method. As all the organisations now or in past time on the earth were potentially in the primordial germ, so that germ was potentially in the unorganised particles of the primordial star-dust: in other words, there was latent in matter from the first the power to evolve organisation, thought, emotion, and will. Where matter obtained this power, or whether matter is self-existent, physical science has no means of determining. In the evolution of the universe from a primor-

<sup>1</sup> *Darwiniana*, 1876, p. vi.

<sup>2</sup> *Musings on the Matterhorn*, 27th July 1868. Note at end of Tyndall's Address on Scientific Materialism, 19th August 1868.

<sup>3</sup> Bain (Professor Alexander), *Mind and Body*, 1873, pp. 130, 140, 191, 196.

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dial haze of matter possessing both physical and spiritual properties, there has been no design other than that implied in the original constitution of the molecular particles. Of course, it is utterly futile to oppose these views as self-contradictory in the light of the established definition of matter.

Many of the replies made to Professor Tyndall, however, miss the central point in his scheme of thought, and endeavour to show that it is madness to imagine that matter, as now and for centuries defined by science, can evolve organisation and life. But no one has proclaimed the insanity of such a supposition more vigorously than Tyndall has himself. "These evolution notions," he exclaims, "are absurd, monstrous, and fit only for the intellectual gibbet, in relation to the ideas concerning matter which were drilled into us when young."<sup>1</sup> Most assuredly Professor Tyndall does not propose "to sweep up music with a broom," or "to produce a poem by the explosion of a type foundry." Audacities of that sort are to be left to the La Mettries and Cabanis and Holbachs: they are not attempted even by the Büchners and Carl Vogts and Moleschotts and Du Bois Reymonds, who, with some whom Tyndall too much resembles, are now obsolete or obsolescent in Germany. "If a man is a materialist," said Professor Tholuck to me once, as we walked up and down a celebrated long arbour in his garden at Halle, "we Germans think he is not educated." In the history of speculation, so many forms of the materialistic theory have perished, that a chance of life for a new form can be found in nothing less fundamental than a change in the definition of matter. Tyndall perceives, as every one must who has any eye for the signs of the times in modern research, that if Waterloos are to be fought between opposing schools of science or between science and theology or philosophy, the majestic line of shock and onset must be this one definition. "Either let us open our doors freely to the conception of creative acts," he says in the sentence which best indicates his point of view in his Belfast Address, "or, abandoning them, let us radically change our notions of matter."

Now, it is singular, and yet not singular, that one can find nowhere in Tyndall's writings the changed definition on which everything turns. The following four propositions, all stated in his own language, taken from different parts of his recent discussions, are the best approach to a definition that I have been able to find in examining all he has ever published on materialism:—

1. "Emotion, intellect, will, and all their phenomena, were once latent in a fiery cloud."<sup>2</sup> "I discern in matter the promise and potency of every form and quality of life."<sup>3</sup> "Who will set limits to the possible play of molecules in a cooling planet? Matter is essentially mystical and transcendental."<sup>4</sup>

2. "Supposing that, in youth, we had been impregnated with the notion of the poet Goethe, instead of the notion of the poet Young, looking at matter not as brute matter, but as the living garment of God, is it not probable that our

<sup>1</sup> Address on the Scientific Use of the Imagination, 1870.

<sup>2</sup> Tyndall, *Fragments of Science*, Eng. ed., p. 163.

<sup>3</sup> Belfast Address, 1874.

<sup>4</sup> Tyndall, *Fragments of Science*, Eng. ed., p. 163.



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repugnance to the idea of primeval union between spirit and matter might be considerably abated?"<sup>1</sup>

3. "Granting the nebula and its potential life, the question, Whence come they? would still remain to baffle and bewilder us. The hypothesis does nothing more than transport the conception of life's origin to an indefinitely distant past."<sup>2</sup>

4. "Philosophical defenders of the doctrine of uniformity . . . have as little fellowship with the atheist, who says that there is no God, as with the theist, who professes to know the mind of God. 'Two things,' said Immanuel Kant, 'fill me with awe: the starry heavens, and the sense of moral responsibility in man.' . . . The scientific investigator finds himself overshadowed by the same awe."<sup>3</sup> "I have noticed during years of self-observation that it is not in hours of clearness and vigour that the doctrine (of materialistic atheism) commends itself to my mind, and that, in the presence of stronger and healthier thought, it ever dissolves and disappears, as offering no solution of the mystery in which we dwell, and of which we form a part."<sup>4</sup>

Of the definition of matter implied in these extracts, it must be affirmed,—not that it is new,—for it is simply what the schools call hylozoism, modified by the recent forms of the atomic theory and of the doctrine of evolution, but that *it reverses the best established position of science.*

1. It denies, and the established definition affirms, that inertia, in the strict sense of the word, is a property of matter.

2. It affirms, and the established definition denies, that matter has power to evolve organisation and vitality.

3. It affirms, and the established definition denies, that matter has power to evolve thought, emotion, conscience, and will.

In the conflict between the established definition of matter and Tyndall's definition, I, for one, prefer the established, for the following reasons:

1. If inertia is a property of matter, the power to evolve organisation, life, and thought, cannot be; but that inertia is a property of matter is a proposition susceptible of overwhelming proof from the necessary beliefs of the mind, from common consent, from the agreement of philosophers in all ages, and from all the results of experiment and observation.

Of course, the logical existence of the alternatives implied in this argument is denied by those who attribute both inertia and spiritual properties to matter as a mystic, transcendental, double-faced unity; but, while they used the word "inertia," their definition of it is not the established one, as is that here employed. By force, I mean that which is expended in producing or resisting motion. By inertia, I mean the incapacity to originate force or motion, or that quality which causes matter, if set in motion without other resistance than itself can supply, to keep on moving for ever; or, if left at rest without other force than its own, to remain at rest for ever. Materialism, hylozoism, and Tyndall's definition of matter, cannot justify themselves, unless it be proved that inertia is not a property of matter. Every student of this theme knows, and in this presence it is

<sup>1</sup> Fragments of Science, p. 165.

<sup>2</sup> *Ibid.*, p. 166.

<sup>3</sup> *Ibid.*, p. 167.

<sup>4</sup> Additions to the Belfast Address, in Tyndall's authorised edition.

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unnecessary for me to state, what the proofs are that matter cannot move itself. They are far more superabundant and crucial than even those which support the belief in the existence of gravitation. Newton himself did not regard attraction as an essential property of matter; and it was long a debate whether his great generalisation should be named the theory of attraction, or the theory of propulsion. If the established definition of matter, and the consequent proof of the spiritual origin of all force, or of the Divine immanence in natural law, are not to be disestablished until that late day when the proof that inertia is not a property of matter, that is, that matter can move itself, can be put into the form of a syllogism, then the yoke of Socrates, Aristotle, and Plato,—of which Tyndall complains, that, after twenty centuries, it is yet unbroken,—is likely to continue to be what it now is, one of the best examples in history of the survival of the fittest.

2. The established definition of matter rests on facts verifiable by experience; Tyndall's, confessedly, is demanded and supported only by the tendencies of an improved theory of evolution.

"Those who hold the doctrine of evolution," says Tyndall himself, "are by no means ignorant of the uncertainty of their data, and they yield no more to it than a provisional assent. They regard the nebular hypothesis as probable; and, in the utter absence of any evidence to prove the act illegal, they extend the method of nature from the present into the past, and accept as probable the unbroken sequence of development from the nebula to the present time."<sup>1</sup>

In his Belfast Address, Tyndall says, "The strength of the doctrine of evolution consists not in an experimental demonstration, but in its general harmony with the method of Nature as hitherto known." But *his definition of matter rests only on this theory*, which, as he admits, is not verified by experiment; while the accepted definition of matter is so verified. It is notoriously to experiment, and to ages of experiment, and to necessary belief itself, that the accepted definition appeals; it is to the exigencies of an unverified, and experimentally unverifiable theory, that Tyndall appeals.

3. According to the doctrines of analogy and uniformity, on which Tyndall relies, matter must be supposed to be inert where we cannot experiment on it, since it is where we can.

4. Tyndall admits that the manner of the connection between matter and mind is unthinkable, and that, "if we try to comprehend that connection, we sail in a vacuum." His own definition, therefore, involves propositions which are unthinkable. They must have been reached by sailing through a vacuum, and can be proved only by a similarly adventurous voyage.

Pertinent exceedingly to the criticism of his definition of matter are Tyndall's famous admissions that "molecular groupings and molecular motions explain nothing;" that "the passage from the physics of the brain to the corresponding facts of consciousness is unthinkable;" and that, "if love were known to be associated with a right-

<sup>1</sup> Fragments of Science, p. 166.