

# GERARD JOHN

THE OLD RIDDLE AND  
THE NEWEST ANSWER

John Gerard

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the Newest Answer**

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# John Gerard

## The Old Riddle and the Newest Answer

### PREFACE

THE enemies of Science are not the philistines alone – if any still remain – who would muzzle or stifle her. More numerous and dangerous are those – professedly of her own household – who ascribe to her pretensions of which she herself knows nothing, and strive to make her responsible for a philosophy entirely beyond her scope. With this object efforts are assiduously made to popularize the idea that nothing in heaven or earth is beyond her ken, and that she has rendered all such beliefs impossible as alone can satisfy the deeper cravings of humanity. At the same time the very brilliance of her achievements is apt to dazzle our eyes, blinding them to the extremely narrow limits of the field in which she can operate, and making us rush to the conclusion that she has solved the riddle which from the beginning of time Nature has offered to every thinking mind, – or at least that what her search-light cannot illumine must for ever remain unknowable.

How far such assumptions are rational, it is the object of the present enquiry to examine by means of the evidence furnished by Science herself in her own regard.

I have to thank Mr. W. E. Darwin for permission to use the illustration of feathers of the Argus Pheasant from his illustrious father's *Descent of Man*, and for the loan of blocks for the purpose. Through the courtesy of Messrs. Macmillan I am allowed to copy a portion of the plate in the late Professor Huxley's *Lectures on Evolution*, illustrating his pedigree of the Horse. If I forbear to mention others who have kindly supplied me with information, it is only lest it might be supposed that they are anywise responsible for the use I have made of it. The design on the cover of the present volume I owe to my friend Mr. Paul Woodroffe.

*J. G.*

*March 10, 1904.*

## **PREFACE TO THE SECOND EDITION**

IN this edition, which has been thoroughly revised throughout, a few corrections have had to be made, especially in the Index, and in one or two instances alterations or additions have appeared advisable for the sake of clearness or accuracy of expression. Nothing has, however, as yet been brought to the author's notice which affects any substantial point in what he has written.

*July 28, 1904.*

## **PREFACE TO THE THIRD EDITION**

THIS edition has again been thoroughly revised, and some new matter appended which bears on various points raised in the original volume, especially the establishment of the important group of the *Cycado-filices*, as affecting the succession of plant life on the earth, and recent evidence concerning the pedigree of the horse.

*December 21, 1906.*

# I

## TO BEGIN AT THE BEGINNING

THAT the world as we know it had a beginning is a truth which there is no denying. Not only have philosophers always argued that it must be so: the researches of physical science assure us that it has been so in fact. Astronomy, says Professor Huxley,<sup>1</sup> "leads us to contemplate phenomena the very nature of which demonstrates that they must have had a beginning." The hypothesis that phenomena of Nature similar to those exhibited by the present world have always existed, the same authority assures us,<sup>2</sup> "is absolutely incompatible with such evidence as we have, which is of so plain and so simple a character that it is impossible in any way to escape from the conclusions which it forces upon us." This conclusion, physicists tell us, is inevitable when we study the laws by which the operations of Nature are governed, and as Professor Balfour Stewart writes,<sup>3</sup> we thus become "absolutely certain" that these operations cannot have existed for ever, and that a time will come when they must cease. In like manner, a recent and competent witness to the conclusions of contemporary Science, lays down,<sup>4</sup> as one of the truths which her latest discoveries compel us to accept, that the world is not eternal, that the earth is cooling from a state of heat rendering life impossible, to one of physical exhaustion equally fatal to it. Accordingly "Life must have had a beginning and must come to an end," – and our whole Solar System (he adds) must similarly have had a commencement, at a period not infinitely remote.

But, if the world had a beginning, what was there before it began? Something there must have been, and something which had the power of producing it. Had there ever been nothing, there could never have been anything, for, *Ex nihilo nihil fit*. That nothing should turn into something is an idea which the mind refuses to entertain. Nor is the case any better even if we suppose that matter had no beginning, that it has existed for ever as we know it now, and that at first there was nothing else. For if so, whence have all these things arisen which, according to all observation and experiment, matter cannot produce, as, organic life, sensitive life, consciousness, reason, moral goodness? Had matter been always what it now is, and had there been no source beyond matter whence the power of producing all these things could be derived, they could never have been produced at all, or else they would have come into being without a cause. It would be like a milestone growing into an apple-tree, or a mountain spontaneously giving birth to a mouse.

We are therefore compelled by common-sense to ask when we consider Nature, What is the force or power at the back of her, which first set her going, and whence she draws the capability of performing the operations which we find her performing every day; that force or power which must be the ultimate origin of everything that is in the world? This is the great fundamental problem which the student of Nature has to face, and beside it all others fade into insignificance. It is with this that we are now engaged. We have to ask how our reason bids us answer it, and the first question which arises naturally is, What light is thrown on the subject by modern Science, of whose achievements we are all so justly proud?

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<sup>1</sup> *Collected Essays*, i. 35.

<sup>2</sup> *Lectures on Evolution*, Cheap Edition, p. 16.

<sup>3</sup> *Conservation of Energy*, § 210, p. 153.

<sup>4</sup> F. W. Hutton, F.R.S., *The Lesson of Evolution* (1902), pp. 9-11.

## II REASON AND SCIENCE

IN studying a question such as this, we must commence by being determined, on the one hand to accept nothing as true but what our reason warrants us in believing, and on the other hand to follow the guidance of reason as far as, rightly used, it will lead us. The principle formulated<sup>5</sup> by Professor Huxley, as the foundation-stone of what he termed "Agnosticism," is that which must needs be adopted, and as a matter of fact has ever been adopted, by rational men.

Positively – in matters of the intellect follow your reason as far as it will take you, without regard to any other consideration. And negatively – in matters of the intellect do not pretend that conclusions are certain which are not demonstrated or demonstrable.

But to justify the confidence which we thus repose in it we must obviously be careful to use our reason aright, and not to attribute to it any conclusions which it does not really sanction. It is this right use of reason that is specially claimed for modern "Science,"<sup>6</sup> which, as we are again assured by Professor Huxley, is only another name for sound reasoning – "*Science*," he declares,<sup>7</sup> "*is, I believe, nothing but trained and organized common-sense.*"<sup>8</sup> ... The man of science, in fact, simply uses with scrupulous exactness, the methods which we all, habitually and at every moment, use carelessly."

There can be no sort of question that so long as men of science really act thus, and confine themselves to the treatment of matters in regard of which they can claim special knowledge, common sense bids us listen to them with respect, and even with submission. But the same common sense requires that we should satisfy ourselves that they truly deserve the character assigned them, and pretend to no knowledge on the score of Science but what their scientific methods are competent to acquire. When they step beyond this their own proper domain, whatever weight may be given to their opinions upon other grounds, they cease to speak in the name of Science.

What then, we must ask, is the province of Science, and what are her methods?

"Science," always understood by the term physical or experimental Science, deals with the universe so far as it is known to us through our senses. The universe known thus we call "Nature," and the whole stock in trade of Science is the examination and verification of natural phenomena, with such inferences therefrom as ascertained facts legitimately suggest. From careful and trustworthy observation she can learn what are called the "Laws of Nature," that is to say the manner in which

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<sup>5</sup> *Nineteenth Century*, February, 1889, p. 173.

<sup>6</sup> This term is now applied almost exclusively to *physical science*, or that whose province is the observation of phenomena and inferences directly deducible from them. To avoid confusion, this sense of the word "Science" will be here adopted: it is nevertheless objectionable inasmuch as it implies that – as Professor Huxley following Hume would have it – sound knowledge is restricted, outside the field of mathematics, to "experimental reasoning concerning matter of fact and existence." But although all premisses or data of inference come to us first through the gates of sense, there is much, beyond the limits within which sensible experience is confined, to a knowledge of which inference can lead us, and of which we become certain before experience can verify what we have thus learnt. Thus a chipped flint or a fragment of pottery is universally recognized as evidencing the work of man: a single page of Virgil would suffice – apart from all other information – to prove its author to have been both a poet and a scholar: the shipwrecked mariner cast on an unknown shore argued soundly from the sight of a gibbet that he had reached a civilized land ruled by law. But more than this, Science herself proceeds on this principle to the recognition not only of forces, the character of which is known by previous experience, but of others concerning which she knows nothing at all, except through the very effects from which she argues. Thus, as all bodies left free are found to draw towards one another in a certain mode, it is concluded with absolute confidence that there is a force making them do so, although this is in itself utterly imperceptible, and is known only by the way in which bodies behave under what must be its influence. Yet, who questions the existence of Gravitation? In like manner, the phenomena of light force us to admit the existence of the Ether, as the medium through which its waves are transmitted. Yet, we are compelled to attribute to this medium qualities apparently so incompatible that, as the late Lord Salisbury said, Ether remains, "a half discovered entity." But little as we can realize its nature, we have no doubt that such a medium exists.

<sup>7</sup> "Value of the Natural History Sciences" (*Lay Sermons*), p. 75.

<sup>8</sup> Italics his.

the various elements and forces of the universe are found constantly to act, in given circumstances; she can, to some extent, discover the chain of causes and effects, or more properly of conditions and consequences, through which natural operations are carried on. She can even construct hypotheses as to what she cannot directly observe, namely, the nature of substances and forces; and such hypotheses are justified in proportion as they are found to tally with facts. If constantly thus justified, they are styled theories, and come to be practically assumed as established truths. But it must ever be remembered that Science can take no step in advance which is not based on fact, and that when facts are not forthcoming for its support an hypothesis or a theory has no scientific value.

Bearing this in mind, we will proceed to enquire what Science has to tell us regarding the origin of the world, and the manner in which it has come to be what it is.

### III "EVOLUTION"

WE are constantly assured that Science compels us to believe in "Evolution," and that in this doctrine is to be found the explanation of the universe whereof we are in quest. We must however in the first place make sure that we understand what "Evolution" means, and if we look into the question, it speedily appears that the term is very differently understood by those who use it.

Some who style themselves "Evolutionists" mean only that, as a matter of established fact, the organic world, the world of life, whether animal or vegetable, has been brought to its present condition by *genetic* development of one species from another, in the natural course of descent and through the operation of natural laws; and that as we see plants and animals of the same kind propagated one from another at the present day, so in the course of long ages the lower and simpler forms of life have given birth to the higher and more complex.

Others again do not limit this process to organic creatures, and believe that from first to last, the whole world, inorganic and organic alike, has resulted from the action of forces such as those with which Science deals; and that life has thus arisen in purely natural course out of non-living matter, the universe in its original condition having been constituted as a vast machine which was bound to produce all that has since arisen.

In either of the above senses – of which the second obviously includes the first, – "Evolution" is understood as no more than a *process* which is said to have occurred. But there is a more extreme school which takes "Evolution" for much more, namely for a power, principle, or "law," which both governs and accounts for everything, and requires no further cause beyond itself.

If this paramount "Law of Evolution" can be established, there is clearly an end of our enquiry, for here is the ultimate explanation of everything which we are seeking. But what has Science to say concerning it?

## IV "THE LAW OF EVOLUTION"

THAT there is a self-existing and self-sufficing "Law of Evolution" to which everything in the world must be ascribed, is the doctrine of those Evolutionists who are most active in propagating their creed and who most loudly proclaim that it alone is scientific. The great leader and prophet of this school, Professor Ernst Haeckel, assures us<sup>9</sup> that he gives expression,

to that rational view of the world which is being forced upon us with such logical rigour by the modern advancements in our knowledge of nature as a unity, a view in reality held by almost all unprejudiced and thinking men of science, although but few have the courage (or the need) to declare it openly.

The plain and rational conclusion thus exhibited is, he tells us,<sup>10</sup> the special glory of modern research.

It is true [he writes] that there were philosophers who spoke of the evolution of things a thousand years ago; but the recognition that such a law dominates the entire universe, and that the world is nothing else than an eternal "evolution of substance," is a fruit of the nineteenth century.

So far as concerns the world which we actually inhabit, its first beginning, we must, he tells us, suppose<sup>11</sup> to have been a vast nebula of infinitely attenuated and light material, rotating upon its own axis.<sup>12</sup>

Given this first beginning of the cosmogonic movement, it is easy, on mathematical principles, to deduce and mathematically establish the further phenomena of the foundation of the cosmic bodies, the separation of the planets, and so forth.

Nor are we to suppose that the beginning of this particular process was in any true sense a beginning at all. Evolutionary philosophy such as Professor Haeckel's, necessarily teaches that beginnings and endings succeed one another everlastingly, one world-system arising phoenix-like from the ashes of another.

The nebular hypothesis above described has recently [we are told]<sup>13</sup> been strongly confirmed and enlarged by the theory that this cosmogonic process did not simply take place once, but is periodically repeated. While new cosmic bodies arise and develop, out of rotating masses of nebula in some parts of the universe, in other parts old, extinct, frigid suns come into collision, and are once more reduced by the heat generated to the condition of nebulae.

It appears, in fact, to be assumed that this cyclic process has been actually demonstrated, for we are told<sup>14</sup> that astronomy reveals, in the endless depths of space, "Millions of circling spheres, larger than our earth, and, like it, in an eternal rhythm of life and death."

Moreover, "life" is here to be understood literally, for it is a cardinal article of such evolutionary belief that equally with the foundation of cosmic bodies and the separation of planets, the production of organic life, of plants and animals, has been wrought by forces which the material universe contains within itself,<sup>15</sup> and accordingly,<sup>16</sup>

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<sup>9</sup> *Confession of Faith of a Man of Science*, English translation, 1903, Preface, p. vii.

<sup>10</sup> *Riddle of the Universe*, Cheap English Edition, p. 2.

<sup>11</sup> *ibid.*, p. 85.

<sup>12</sup> And also, it should be added, travelling bodily through space with a movement of "translation."

<sup>13</sup> *Ibid.*

<sup>14</sup> *Ibid.*, p. 2.

<sup>15</sup> The 15th Chapter of Haeckel's *Natural History of Creation* is devoted to this point.

<sup>16</sup> *Confession of Faith of a Man of Science*, p. 32.

We now definitely know that the organic world on our earth has been continuously developed "in accordance with eternal iron laws." ... An unbroken series of natural events, following an orderly course of evolution according to fixed laws, now leads the reflecting human spirit through long aeons from a primeval chaos to the present order of the cosmos.

Finally, at the back of all these processes, we are to recognize the one ultimate reality, the universe itself, which originates and undergoes all these evolutions. In its regard Professor Haeckel tells us<sup>17</sup> that,

The universe, or cosmos, is eternal, infinite, and illimitable. Its substance, with its two attributes (matter and energy) fills infinite space and is in eternal motion. This motion runs on through infinite time as an unbroken development, with a periodic change from life to death, from evolution to devolution...

And again:<sup>18</sup>

The two fundamental forms of substances, ponderable matter and ether, are not dead and moved only by extrinsic force, but they are endowed also with sensation and will (though naturally of the lowest grade); they experience an inclination for condensation, a dislike of strain; they strive after the one and struggle against the other.

Moreover,

Movement<sup>19</sup> is as innate and original a property of substances as is sensation.

Such is the raw material whose metamorphoses produce, or rather constitute, all possible worlds, while paramount over every thing dominates the "Law of Substance," under which title Professor Haeckel unites the scientific principles of the indestructibility of matter, and the conservation of energy. Thus is the conclusion reached,<sup>20</sup>

Towering above all the achievements and discoveries of the century we have the great comprehensive "law of substance," the fundamental law of the constancy of matter and force. The fact that substance is everywhere subject to eternal movement and transformation gives it the character also of the universal law of evolution. As this supreme law has been firmly established and all others are subordinate to it, we arrive at a conviction of the universal unity of nature and the eternal validity of its laws.

Accordingly we are to conclude with Goethe that all proceeds by iron law to the fulfilling of inevitable destiny; or as an ardent disciple proclaims, who undertakes to expound the new creed to the people,<sup>21</sup>

We rest in sure and certain hope that no force and no combination of forces can stop the process of Evolution, which from a speck of jelly has developed such living forms as Charles Darwin and Herbert Spencer, and which has produced the beauty of the earth and the heavens from formless ether.

This outline of the Evolutionary system in its widest and fullest sense will enable us to judge upon what grounds it can claim the sanction of Science. Various points here present themselves for consideration, which demand separate treatment.

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<sup>17</sup> *Riddle of the Universe*, p. 5.

<sup>18</sup> *Ibid.*, p. 78.

<sup>19</sup> *Ibid.*, p. 86.

<sup>20</sup> *Ibid.*, 134.

<sup>21</sup> *An Easy Outline of Evolution*, by Dennis Hird, M.A., Principal of Ruskin Hall, Oxford, p. 230.

## V

# WHAT IS A "LAW OF NATURE"?

AS we have seen, the doctrine of Evolution is presented by its advocates as being based upon the existence of a "Law of Evolution," or "Law of Substance," which both brings about evolutionary processes, and certifies us of their occurrence, so that we may appeal to it as an authority for our belief in the facts of evolution themselves. Thus as Professor Milnes Marshall told the British Association,<sup>22</sup>

The doctrine of descent, or of evolution, teaches us that as individual animals arise, not spontaneously, but by direct descent from pre-existing animals, so also is it with species, with families, and with larger groups of animals, and so also has it been for all time.

It is not said, be it observed, that the establishment of such facts teaches us the doctrine of evolution, but that the doctrine assures us of the facts; and the utterances constantly met with, of which the above is a fair sample, have no signification if they do not mean this. In the same way Professor Haeckel declares<sup>23</sup> that his fundamental cosmic law "establishes" the eternal persistence of matter and force, and their unvarying constancy throughout the entire universe, becoming thus "the pole-star that guides our Philosophy through the mighty labyrinth to a solution of the world problem," and the key to this supreme problem, he further tells us,<sup>24</sup> is found in one magic word – Evolution.

It would certainly appear from all this, that by "Evolution" we are to understand some sort of entity at the back of the world, with power at its disposal capable of effecting all its operations, – something in fact remarkably like the First Cause of which we are in search, – and that by its "Laws" are signified some definite forces, the practical action of which has been ascertained by us, so that we can foretell the course of events under them, as we can that of the planets or the tides under the influence of gravitation.

But is it scientific, or even intelligible, to use words thus, and to assign any such significance to such terms as "Law of Evolution," "Law of Substance," or any other "Law of Nature"? We are repeatedly warned to the contrary by so high an authority as Professor Huxley. Once, for instance, he discovered in a sermon of Canon Liddon's this "fallacious employment of the name of a scientific conception," for which it was however added, the preacher "could find only too many scientific precedents."<sup>25</sup> This fallacious use of terms, which nowise differs from that under consideration, Professor Huxley thus denounces:

It is the use of the word "law" as if it denoted a thing – as if a "law of nature," as science understands it, were a being endowed with certain powers, in virtue of which the phenomena expressed by that law are brought about... All I wish to remark is that such a conception of the nature of "laws" has nothing to do with modern science... A law of nature, in the scientific sense, is the product of a mental operation upon the facts of nature which come under our observation, and has no more existence outside the mind than colour has. The law of gravitation is a statement of the manner in which experience shows that bodies, which are free to move, do, in fact, move towards one another... The tenacity of the wonderful fallacy that the laws of nature are agents, instead of being, as they really are, a mere record of experience, upon which we base our interpretations of that which does happen, and our anticipation of that which will happen, is an interesting psychological fact: and would be unintelligible if the tendency of the human mind towards realism were less strong.

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<sup>22</sup> *Presidential Address, Section D, Zoology, Leeds, 1890.*

<sup>23</sup> *Riddle of the Universe, p. 2.*

<sup>24</sup> *Ibid., p. 83.*

<sup>25</sup> "Pseudo-Scientific Realism," *Collected Essays, i, 68, 74-78.*

A law, accordingly, "is not a cause but a fact,"<sup>26</sup> and we must learn laws from facts, not facts from laws. It is indeed evident on a moment's thought, that to speak of the Law of Evolution as causing things to be evolved, is like saying that the law of growth makes things grow. Till we know what happens, there is nothing of which Science can take account.

True scientific teaching, I cannot too often repeat [says Professor Tait]<sup>27</sup> requires that the facts, and their *necessary* consequences alone, should be stated, as simply as possible.

In like manner Professor Huxley,<sup>28</sup> undertaking to vindicate full scientific value for his own favourite Biology, does so by pointing out that biological methods are similar to those of every other branch of Science, since they begin with the observation of facts, and from this proceed to various applications of the knowledge so acquired. And Professor Haeckel himself tells us regarding his own mode of procedure:<sup>29</sup>

The means and methods we have chosen for attaining the solution of the great enigma do not differ, on the whole, from those of all purely scientific investigation: firstly, experience; secondly, inference.

Therefore, although the phrases we have already heard from him, are found when scrutinized to be only phrases, which explain nothing, it may be supposed that he elsewhere produces such proofs of his doctrine as will place it on a scientific basis. For these we will now seek.

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<sup>26</sup> Newman, *Grammar of Assent*, p. 72. A "Law of Nature," as has already been said, is simply a statement of what *de facto* has always been found to occur under certain conditions, and may consequently be expected again. It is obvious however that such expectation is implicitly based on the existence of some cause capable of ensuring the result.

<sup>27</sup> "The Teaching of Natural Philosophy," *Contemporary Review*, Jan., 1878.

<sup>28</sup> *Lay Sermons*, p. 83.

<sup>29</sup> *Riddle of the Universe*, p. 6.

## VI

# "THE LAW OF SUBSTANCE"

WE have just been told by Professor Haeckel, that the means and methods which he has chosen for the establishment of his philosophy are, on the whole, identical with those employed in all purely scientific investigation, namely, first experience, and secondly inference.

But here a grave difficulty at once presents itself. How, either by experience or by inference, can we learn anything about the commencements of the universe, as to which we have heard so much? How the first bodies, whether organic or inorganic, actually arose, neither philosophy nor science can definitely say, for the latter was not there to see, and the former has no facts on which to argue.<sup>30</sup> But if neither by observation, nor by clear inference, can the account that has been given be substantiated, that account cannot pretend to be scientific, for it rests not upon knowledge but upon speculation, – and as Professor Tait warns us,<sup>31</sup> "That of which there is no knowledge is not yet part of Science."

This plain consideration seems to account for a fact which is undoubtedly highly significant. Professor Huxley had certainly no prejudices against evolutionary systems, could they but be satisfactorily established. He knew all that Professor Haeckel has urged on behalf of his own theory, and showed how much he was in sympathy with it by naming after his friend the ill-starred *Bathypus Haeckelii*, the deep-sea slime which was at first supposed to bridge the gulf between the organic and the inorganic worlds, and to be living stuff in process of spontaneous manufacture. Nothing, in fact, as he himself admitted, in his controversy with Dr. Bastian, could have suited him better than a demonstration that Nature possesses all the powers necessary for her own processes, and that the explanation of all is within the scope of Science. But, at the same time, he revered scientific truth beyond anything else, and he was keenly sensible of the danger attending the use of hypothetical explanations, leading to conclusions which cannot be experimentally tested, which danger he carefully shunned.<sup>32</sup> Accordingly, not only did he never lend his countenance to what Professor Haeckel represents as the inevitable conclusions of Science, but he even plainly intimated that those who advanced such views were going much farther than Science warrants. The doctrine of Evolution, he declared,<sup>33</sup> is not only attacked on false grounds by its enemies, but is made by some of its friends to cover so much which is disputable, as to force him in self-defence to make his own position clear in its regard. And the first point of his explanation is to repudiate the idea that we have any such knowledge as Professor Haeckel assumes. "I have nothing to say," he writes, "to any 'Philosophy of Evolution.'"

Being thus necessarily destitute of support either directly from observation or by inference from observed facts, it would seem that only in one way can Professor Haeckel's system of cosmogony, or world-production, obtain any support from Science. If amongst the operations now in progress in the universe, is to be found evidence of an exhaustless and self-renewing energy, a mainspring capable of keeping the machine going everlastingly, then undoubtedly there will be an explanation forthcoming, which, whatever difficulties may still remain on other grounds, will at least furnish a complete mechanical account of things within the ken of Science. May we not suppose that this is what is claimed as being supplied by the "Law of Substance," which is represented as the cornerstone of the whole edifice, the supreme triumph of scientific discovery, and, in fine, "the universal law of evolution"? Let us see how far such a notion can be styled scientific.

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<sup>30</sup> See Wasmann "Gedanken zur Entwicklungslehre," *Stimmen aus Maria-Laach*, vol. 63, p. 298.

<sup>31</sup> *Contemporary Review*, ut sup., p. 301.

<sup>32</sup> Professor Weldon, F.R.S., in the *Dictionary of National Biography*.

<sup>33</sup> *Collected Essays*, v. 41.

As has been shown, a "Law" is nothing but a statement that a certain kind of fact is found to occur in certain circumstances. Professor Haeckel has told us that the "Law of Substance" is a blend of two such statements, namely, "the Law of the persistency or indestructibility of matter," which signifies that in no instance within our knowledge is any particle of matter destroyed, and "the Law of the persistence of force, or conservation of energy," which signifies that the sum of force, at work in the world, and producing all phenomena, is similarly found to be unalterable.<sup>34</sup>

It must here first be observed that the term "Conservation of Energy," is more correct and intelligible than "Conservation of Force"; by "Energy" being understood the power of doing "work," that is to say, of overcoming resistance.<sup>35</sup>

It is in this form alone that Force becomes subject to observation and can be measured by Science, and the Law of Conservation which observation reveals is thus stated: The sum of all the various energies in the universe is a constant quantity, which can be neither increased nor diminished, though it may be changed from one form to another;<sup>36</sup> such forms being motion, heat, chemical action, electricity, magnetism.

But another point is of far greater importance. The mode in which Professor Haeckel states this fundamental Law is altogether deceptive. He tells his readers only half the truth, and when the other half is told, not only is his whole doctrine found to receive no support from the Laws of Energy, but it is these very Laws which appear most incompatible with it.

For, along with the Law of the Conservation, there is another, of the Dissipation of Energy. It is perfectly true, as Professor Haeckel often repeats, that the sum of Energy existing in the universe remains ever the same: but it is no less certain, as he unfortunately fails to remind his readers, that the stock of Energy *available for the work of the universe* is growing less every day. Though none is ever destroyed, much is constantly *lost*, being dissipated, or radiated into space, in the form of heat which can never be recaptured or translated into any form which can be of any practical avail. "It is lost for ever as far as we are concerned."<sup>37</sup>

From what we have heard concerning the Law of Substance it might naturally be supposed that it certified us of the continued existence of the power required to carry on the operations of Nature, and that, accordingly, reason bids us to suppose these operations to be everlasting. But this neglected element of the reckoning, or *Entropy* as it is styled, leads scientific men to an entirely different estimate. Thus Professor Balfour Stewart writes:<sup>38</sup>

Although, therefore, in a strictly mechanical sense, there is a conservation of energy, yet, as regards usefulness or fitness for living beings, the energy of the universe is in process of deterioration. Universally diffused heat forms what we may call the great waste-heap of the universe, and this is growing larger year by year.

We have [he continues] regarded the universe, not as a collection of matter, but rather as an energetic agent – in fact, as a lamp. Now it has been well pointed out by Thomson,<sup>39</sup> that looked at in this light, the universe is a system that had a beginning and must have an end; for a process of degradation cannot be eternal. If we could view the universe as a candle not lit, then it is perhaps conceivable to regard it as having been always in existence; but if we regard it rather as a candle that has been lit, we become absolutely certain that it cannot have been burning from eternity, and that a

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<sup>34</sup> *Riddle of the Universe*, p. 75.

<sup>35</sup> Professor Garnett in the *Encyclopaedia Britannica*. By "Force" is understood "any cause which tends to alter a body's natural state of rest, or of uniform motion in a straight line." Of the nature of such causes science professes to know very little, and as Clerk-Maxwell, who knew as much as most men, sang apropos of a lecture of Professor Tait's:... Tait writes in lucid symbols clear one small equation; And Force becomes of Energy a mere space-variation.

<sup>36</sup> Balfour Stewart, *Conservation of Energy*, § 115; by Clerk-Maxwell, *apud* Garnett, *ut sup.*

<sup>37</sup> Tyndall, *Fragments of Science*, 5th Edition, p. 23.

<sup>38</sup> *Conservation of Energy*, § 209.

<sup>39</sup> Sir William Thomson, now Lord Kelvin.

time will come when it will cease to burn. We are led to look to a beginning in which the particles of matter were in a diffuse chaotic state, but endowed with the power of gravitation, and we are led to look to an end in which the whole universe will be one equally heated inert mass, from which everything like life or motion or beauty will have utterly gone away.

It is doubtless true that attempts have been made to show that this conclusion is not final, and that there may be resources whereby Nature is able to recoup herself, and to draw upon some bank unknown to us for her missing store. As we have seen, Professor Haeckel simply takes for granted that some such means of recuperation exist and operate, and he is not wholly without countenance from others. Thus, no less an authority than Sir William Crookes addressing the Chemical Society as its president, thus expressed himself:<sup>40</sup>

If we may hazard any conjectures ... we may I think premise that the heat radiations propagated outwards, ... by some process of nature unknown to us, are transformed at the confines of the universe into the primary – the essential – motion of chemical atoms, which the instant they are formed, gravitate inwards, and thus restore to the universe the energy which would be lost to it through radiant heat. Hence Sir William Thomson's startling prediction falls to the ground.

But it need not be pointed out that if an advocate so eminent as Sir William Crookes is reduced to pleas like this on its behalf, the case for Renovation of Energy must be singularly destitute of anything resembling scientific support. Suppositions which are avowedly hazarded as conjectures, and which must appeal to processes of Nature of which we know nothing, whatever authorship they may boast, have nothing to do with Science, and possess no sort of value for our purpose.<sup>41</sup> It must of course be allowed that we may still be utterly in the dark as to the whole of this question, and that further discoveries may one day completely upset all our present notions. But we are concerned with the evidence which Science has now before her, and with the assertion so confidently advanced that this makes the Law of ceaseless Evolution an indisputable truth. We find, on the contrary, that this Law runs directly counter to the facts as they are at present known to us, and to the conclusions drawn from them by the most authoritative representatives of science.

Nor is it only our own globe and solar system that appear to be thus bound towards an inevitable doom. The eternal rhythm of life and death, of which we have been told as pervading the endless depths of space, has no better title to scientific sanction. Like the minor province which we inhabit, the whole universe, we are assured, – so far as we have means of calculating, – must ultimately arrive at a condition of eternal stagnation, – its component parts being drawn close together by their mutual attractions, – so that motion ceases; while the heat replacing it being equally diffused, becomes as incapable of doing work as water between two pools on the same level is of turning a mill. As the writer lately quoted sums up the matter:<sup>42</sup>

Slow as the process of condensation is, it is not endless. In time all the meteoric dust will be collected into stars or planets; and in time the law of dissipation of energy will bring all these bodies to a uniform temperature. So at last the movements due to the original unequal distribution of matter will cease, and the life of the universe will come to an end. We know of no process of rejuvenescence, by means of which dissipation of energy and the force of gravitation might be counteracted. Several attempts have been made to refute the theory of the dissipation of energy, but all have failed.

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<sup>40</sup> March 29, 1888.

<sup>41</sup> So of another effort in the same direction Capt. Hutton tells us: "The last champion in the field is Professor A. W. Bickerton, who thinks he has found a way in which this dismal conclusion, as he considers it, may be averted. But he is not very sure about it, and has to assume: first, that space contains now and always will contain, a large quantity of cosmic dust scattered through it with some approach to uniformity; and secondly, that the Universe consists of an infinite number of what he calls 'cosmic systems,' travelling through space, constantly throwing off dust in all directions and occasionally colliding. As all this is pure assumption and highly improbable, I cannot think that Professor Bickerton has brought forward any serious objection to the theory of the dissipation of energy, and his hypothesis must be added to the list of failures." (*Lesson of Evolution*, p. 14, n.)

<sup>42</sup> *Lesson of Evolution*, p. 14.

This, however, is but the first of many difficulties which must be disposed of ere the account of the world's genesis which we are considering can pretend to our acceptance on the ground that reason and science proclaim its truth.

## VII "THE SEVEN ENIGMAS"

THE doctrine that the universe is an automatic machine, – self-originated and self-sustained – undoubtedly rests upon a principle formally recognized by some evolutionists, as the "Law of Continuity," and taken for granted by many who do not put it into words. This principle is, – that everything must always have happened according to the same laws of Nature which operate now; that there can never have been a "miracle," understanding by this term whatever is beyond the scope of natural forces; and that, accordingly, the whole of the world's history, – one stage as much as another, – falls within the province of Science. By no one has this position been more clearly stated than by the late Professor Romanes.

All minds [he tells us]<sup>43</sup> with any instincts of science in their composition have grown to distrust, on merely antecedent grounds, any explanation which embodies a miraculous element. Such minds have grown to regard all these explanations as mere expressions of our own ignorance of natural causation; or, in other words, they have come to regard it as an *à priori* truth that nature is always uniform in respect of method or causation; that the reign of law is universal; the principle of continuity ubiquitous.

He goes on to declare that "The fact of evolution – or, which is the same thing, the fact of continuity in natural causation – has now been undoubtedly proved in many departments of nature," and that, in particular, "throughout the range of inorganic nature" it is "a demonstrated fact."

If this be so, it must necessarily follow that the Laws of Nature, as Science finds them operating, sufficiently explain not only all that happens in our present world, but also all that must have happened while this world was being produced. According to what has already been said, by "The Law of Continuity" no more can be signified than that Continuity is a fact, that the world has actually come to be what it is through the continual operation of just the same natural forces as we find at work to-day. That things *did* so happen we have not and cannot have, direct evidence; for no witness was there to report. We can but draw inferences from the present to the past, and argue that what Nature does to-day, she must have been capable of doing yesterday and the day before. Only thus can continuity of natural laws possibly be established. It would obviously be vain to argue that we must suppose no other forces ever to have acted than those we can observe, because, for all we know, other conditions may so have altered as to make their results altogether different from any of which we have experience.

It is likewise manifest that if we are to speak of demonstrated facts, and of conclusions placed beyond rational possibility of doubt, proofs must be forthcoming sufficient to compel scientific assent.

And here lies the difficulty. Very much must unquestionably have happened in the course of the world's making for which the Laws of Nature as we find them now acting cannot account, and which, therefore, Science cannot attempt to explain. So we are assured by eminent scientific men, – men, too, who desire nothing more than to find an explanation, but are driven, in search of one, as we have already seen Sir W. Crookes, to plead the limitation of our knowledge, and that there may be capabilities in Nature of which we are ignorant. But it remains always true, that what we do not know is not yet part of Science, and that if our scientific information, so far as it goes, is adverse to the Law of Continuity, it is quite unscientific to bring arguments for the law not from our knowledge, but from our lack of it. Still more unscientific is it to proclaim that Science has pronounced judgment in a sense contrary to that of all the evidence hitherto presented to her.

Amongst the men of Science who testify as above, we may begin with Herr Du Bois-Reymond, an avowed Evolutionist and Materialist, whom Professor Haeckel styles, "the all-powerful secretary

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<sup>43</sup> *Darwin and after Darwin*, p. 17.

and dictator of the Berlin Academy of Sciences."<sup>44</sup> He can be suspected of no prejudices which would prevent him from accepting Professor Haeckel's cosmogony, if only he found the evidence satisfactory. Far from this, however, he declares,<sup>45</sup> that the history of the universe confronts us with no less than seven problems, for which Science has no solution to offer, and some of which he holds to be for ever insoluble. These he styles "Enigmas," and they are:

- (1) The nature of Matter and of Force.
- (2) The origin of Motion.
- (3) The origin of Life.
- (4) The apparently designed order of Nature.
- (5) The origin of sensation and consciousness.
- (6) The origin of rational thought and speech.
- (7) Free-will.

The first, second, and fifth of these are in the opinion of Du Bois-Reymond "transcendental," or beyond possibility of solution. The others, in his judgment, have certainly not yet been solved, but *perhaps* may be solved some day. As to the last, he much doubts whether it should not also be classed as "transcendental."

It thus appears that in the judgment of a competent witness, and one no-wise biassed by preconception or prejudice, so far from it being true that Professor Haeckel's story of the universe is imperiously imposed on us by the results of Science, not one but several great gulfs in the course of that history must have been bridged over somehow, which Science confesses she cannot bridge, so far as her present knowledge goes, that is to say, so far as she is Science at all.

Professor Haeckel, it is true, loudly pronounces Du Bois-Reymond's declaration to be mere "dogmatism"<sup>46</sup> of a "shallow and illogical character," and he undertakes to show that with the help of his own philosophy the enigmas cease to be enigmatical.

In my opinion [he writes] the three transcendental problems (1, 2 and 5) are settled by our conception of substance; the three which he [Du Bois-Reymond] considers difficult, though soluble<sup>47</sup> (3, 4 and 6) are decisively answered by our modern theory of evolution; the seventh and last, the freedom of the will, is not an object for critical scientific inquiry at all, for it is a pure dogma, based on an illusion, and has no real existence.

How far such a mode of rebuking dogmatism appears convincing, must of course depend on what the reader understands by an argument. Some points already considered may help us to a right estimate of proofs which are based upon "Our conception of substance," or "Our modern theory of evolution," and we shall presently inspect more closely the nature of the difficulties which we are invited so summarily to dismiss. Meanwhile, even though not final or conclusive, the testimony of such a man as Du Bois-Reymond serves at least to prove that it is possible to be thoroughly familiar with Science and her teaching, and yet to believe that as yet she knows nothing at all concerning questions which, as we have been assured, she has conclusively answered. And, as we shall presently see, if Professor Haeckel's account of things be the true one, there are many more scientific men of the first rank who are equally in the dark.

In a word, while according to Professor Haeckel there is in the universe but one Riddle, which he tells us he has solved, – in the opinion of another who is certainly no less entitled to speak in the name of Science, there yet remain seven to which no answer has yet been given, and to three, at least, of which none will ever be found.

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<sup>44</sup> *Riddle of the Universe*, p. 64.

<sup>45</sup> *Über die Grenzen der Naturerkennens: Die Sieben Welträthsel*, Leipzig, 1882.

<sup>46</sup> *Riddle of the Universe*, p. 64.

<sup>47</sup> Du Bois-Reymond does not say that they are soluble, but only that he cannot pronounce them "transcendental."

## VIII MATTER AND MOTION

IN the forefront of the problems which have been pronounced to be not only unsolved but insoluble, are the nature and origin of the ultimate factors arrived at by Science in her study of the constitution of the universe, – Matter, Force, and Motion.

With the first and last of these alone need we at present concern ourselves, for "Force," as Science knows it, is always associated with Matter, and signifies no more in her terminology than that which produces, or tends to produce Motion. On the other hand, we are told,<sup>48</sup> that "The contents of the material universe may be expressed in terms of Matter and Motion."

By "Matter" is understood "Sensible Substance," the stuff composing all of which our senses tell us, and which forms the object of Scientific investigation. What do we know concerning this raw material whereof worlds are made?

As we have seen, Professor Haeckel and his school are ready to tell us. Matter, we are assured,<sup>49</sup> is self-existent and imperishable, "it has no beginning and no end; it is eternity." Together with Ether, it occupies infinite and boundless space. It is in ceaseless motion; and its interminable modifications produce everything that ever was or ever will be. Movement<sup>50</sup> is one of the "innate and original properties" of Matter. So are Sensation and Will,<sup>51</sup> but these, we are warned,<sup>52</sup> are "unconscious."

Obviously, however, it is not enough that these things should be said, they require likewise to be proved; and the question must immediately suggest itself, Whence is proof to come? Not, by any possibility, from observation and experiment. For who can speak, of his own knowledge, to eternity or infinity? The only conceivable supposition is that Science has so thoroughly mastered the nature and properties of Matter here and now, as to be furnished with evidence unmistakably pointing to the above conclusions. Thus alone can she be quoted on their behalf; and it must always be remembered that the philosophy which we are examining is nothing if not scientific.

But, in the first place, is it quite clear of what our philosophers are speaking? They use the term "Matter" as though it represented some one definite thing: but this is very far from being the case.

We must remember [says Lord Grimthorpe]<sup>53</sup> that matter is not an unit, as a creator is, and that talking of it so is merely a rhetorical artifice when used in philosophical inquiries... Matter is nothing but the sum of all the ultimate particles or atoms contained in the universe, or in any particular mass that we are dealing with... A very large proportion of the atoms of the universe have never been within millions and billions of miles of each other.

Therefore, he goes on to urge, the doctrine of the self-existence of Matter, must mean that each several atom is self-existent, or "every atom its own god." How comes it then that they all obey the same "Laws"? How have their various provinces been allotted? Above all, how are they not all the same, but – so far as we know – divided into classes widely different from one another? For, according to our present knowledge, – and we cannot too frequently remind ourselves that upon this alone can any sound conclusion be based, – there are, in round numbers, some seventy different species of atoms, whose diverse qualities are absolutely necessary for the production of the world. Had all atoms been of one kind, we could have had none even of what used to be called the Four Elements, – neither Earth, Air, Fire, nor Water.

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<sup>48</sup> Samuel Laing, *Modern Science and Modern Thought*, Cheap Edition, p. 19.

<sup>49</sup> *Riddle of the Universe*, p. 86.

<sup>50</sup> *Ibid.*

<sup>51</sup> P. 78.

<sup>52</sup> P. 64.

<sup>53</sup> *Origin of the Laws of Nature*, p. 23.

But, – apart from this, – What is known concerning this same "Matter"? Has Science so thoroughly fathomed its constitution as to be able to declare that it possesses all the properties we have heard assigned to it, – Sensation and Will, even of the unconscious kind, whatever that may be, – locomotive power, – eternity, – and, in its collective capacity, immensity?

So far from this being the case, scientific men who were most willing, and even anxious, to assign to Matter a foremost, if not *the* foremost, place in Nature, have done so precisely upon the ground, not of our knowledge, but of our ignorance. No better examples need be sought than Professor Huxley, and Professor Tyndall, who alike agreed, in the words of the latter,<sup>54</sup> "to discern in Matter the promise and potency of every form and quality of life." But Huxley took his stand on the declaration, that we know so little about Matter as to make it impossible to say of what it may not be capable, for we cannot so much as be certain of its existence, and use the term only "for the unknown and hypothetical causes of our own states of consciousness,"<sup>55</sup> while Tyndall described the process, whereby the promise and potency are realized, as "the manifestation of a Power absolutely inscrutable to the intellect of man."

Speculations thus founded upon the absence of evidence, whatever else they may be, are certainly no part of Science; and when we turn to what, being established by scientific methods, is a possible basis of scientific argument, we find that in every instance it contradicts instead of supporting the assertions we have heard.

To begin with the question of Motion, as being both of supreme importance, and one more open than some others to observation and experiment. According to Professor Haeckel's teaching, "movement is an innate and original property of substance," that is to say of Matter, and in consequence, "Substance is everywhere and always in uninterrupted movement and transformation." It is by thus attributing to matter an inherent determination to move that he meets Du Bois-Reymond's difficulty as to the origin of motion.

But this is in direct opposition to the first of Newton's Laws, which are universally recognized as the most firmly established and unquestionable of all scientific conclusions. This law tells us that a body at rest will continue at rest for ever, unless compelled by some force to move; just as a body in motion will continue to move at the same rate and in the same direction, unless compelled by force to arrest or alter its course. Upon the universal certainty of this law the whole of our Natural Philosophy depends: but it absolutely blocks the way for the idea that Matter has an innate tendency to move itself, which is thus quite unscientific. Not self-movement but *Inertia* is the property which Science ascribes to Matter.<sup>56</sup> It may further be observed that the idea of inherent motion is absurd and unintelligible; for movement cannot be in more than one direction at a time: so that a mass, or an atom, of Matter could tend to move only by having an intrinsic impulse in a straight line towards some one particular point. If it should tend to move indifferently, in all directions at once, it would remain motionless, each such tendency being neutralized by its opposite.

As to the further claim made on behalf of Matter to be endowed with Sensation and Will, of any description, it must be enough to say that no one has ever pretended to find any evidence whatever to this effect, or to detect the faintest trace of such properties; – and that on the contrary, all experience shows inorganic Matter, (that is, Matter not incorporated in living animals or plants,) to be utterly lifeless and inert. It is a mere abuse and perversion of terms to speak of Science as countenancing any conclusion but that to which such experience points. The attempt to invest Matter with these attributes Professor Tait stigmatizes as "non-science," or "pseudo-science."<sup>57</sup>

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<sup>54</sup> *Belfast Address*, 1874.

<sup>55</sup> *Lay Sermons*. "On the Physical Basis of Life," p. 143.

<sup>56</sup> Professor Tait, *Properties of Matter*, § 108.

<sup>57</sup> *Contemporary Review*, January, 1878, p. 301.

The Pygmalions of modern days [he writes] do not require to beseech Aphrodité to animate the ivory for them. Like the savage with his *Totem*, they have themselves already attributed life to it... The latest phase of this peculiar non-science tells us that all Matter is *alive*; or at least that it contains "the promise and potency" (whatever these may be) "of all terrestrial life." ... So much for the attempts to introduce into Science an element altogether incompatible with the fundamental conditions of its existence.

In fine, to make us realize not merely how extremely narrow are the bounds of our knowledge, but even how much narrower they may be than we suppose, there enters upon the scene Radium, like the golden apple that came to disturb the harmony of the celestials. What lessons this turbulent and unconventional element will ultimately be found to teach, and how far it will revolutionize the laws of Nature as hitherto accepted, remains, of course, to be seen: but this at least is clear. In presence of it, scientific men find that they are sure of nothing they thought most certain, not of the indestructibility of matter itself, on which is based that Law of Substance which we have seen made responsible for so much.

It had been thought that whatever else might change or perish the atoms of which we have heard, as the ultimate constituents of Matter, were beyond the reach of any vicissitude. "No man," said Dalton, their discoverer, "can split an atom." Thus too Mr. Clodd, while acknowledging that the constitution even of atoms may some day be found to be liable to disorder and decay, clearly teaches that, as a practical certainty, we have in them got to something final. Taking one particular kind, an oxygen atom, as a text, he thus discourses:<sup>58</sup>

It matters not into how many myriad substances – animal, plant, or mineral – an atom of oxygen may have entered, nor what isolation it has undergone: bond or free, it retains its own qualities. It matters not how many millions of years have elapsed during these changes, age cannot wither or weaken it; amidst all the fierce play of the mighty agencies to which it has been subjected it remains unbroken and unworn; to it we may apply the ancient words, "the things which are not seen are eternal."

But now, with the recognition of radio-activity, and the disintegration of atoms into their constituent "electrons" which this is held to evidence, we have changed all that. Such disintegration, it is affirmed, must imply dissolution and death, alike of the atoms themselves and of the universe which they compose. As Sir William Crookes told the physicists assembled at Berlin, June, 1903:

This fatal quality of atomic dissociation appears to be universal, and operates whenever we brush a piece of glass with silk; it works in the sunshine and raindrops, in lightnings and flame; it prevails in the waterfall and the stormy sea.

Matter he consequently regards as doomed to destruction.<sup>59</sup> Sooner or later, it will have dissolved into the "formless mist" of "prothyle"<sup>60</sup> and "the hour-hand of eternity will have completed one revolution."

Consequently, we are told,<sup>61</sup>

The "dissipation of energy" has found its correlative in the "dissolution of matter." We are confronted with an appalling sense of desolation – of quasi-annihilation.

It is no doubt true, here again, that such judgments cannot be called final, and that not all scientific men will accept them as they stand. But all alike are forced to agree that our previous notions are completely upset, and that we are compelled to recognize the fact that of these fundamental questions we know far less than the little we seemed to know. What, then, is to be thought of Professor Haeckel's confident utterances, which could be justified only on the supposition that we

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<sup>58</sup> *Story of Creation*, p. 11.

<sup>59</sup> *Edinburgh Review*, October, 1903, p. 399.

<sup>60</sup> Or "primal stuff." This looks remarkably like the old *Materia Prima* of the Schoolmen translated into Greek.

<sup>61</sup> *Ibid.* *The Revelations of Radium*.

know everything? And what becomes of the famous Law of Substance, if both its parts are found thus to contradict the conclusion he would draw from it?

The case is thus summed up by the writer of the article just cited:

The discovery of radio-activity is one of the most momentous in the history of science. "There has been a vivid new start" (we again borrow Sir William Crookes' expression). "Our physicists have remodelled their views as to the constitution of matter." The remodelling indeed has hardly commenced... What is undeniable is that the Daltonian atom has, within a century of its acceptance as a fundamental reality, suffered disruption. Its proper place in nature is not that formerly assigned to it, ... its reputation for inviolability and indestructibility is gone for ever. Each of these supposed "ultimates" is now known to be the scene of indescribable activities, a complex piece of mechanism composed of thousands of parts, a star-cluster in miniature, subject to all kinds of dynamical vicissitudes, to perturbation, acceleration, internal friction, total or partial disruption. And to each is appointed a fixed term of existence. Sooner or later, the balance of equilibrium is tilted, disturbance eventuates in overthrow; the tiny exquisite system finally breaks up. Of atoms, as of men, it may be said with truth, "*Quisque suos patitur manes.*"

"Here," in fact, "we meet the impenetrable secret of creative agency."<sup>62</sup>

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<sup>62</sup> *Ibid.*, p. 398. {*Note.*— It is often assumed that the composite character of the atom – if fully established – must upset the Atomic Theory. This is not so; all that the new hypothesis does is to go further back in accounting for the Atomic Theory, and for all practical purposes things remain exactly as they were; except, indeed, that the dissolution of matter does away with what was held as one of the most assured conclusions of science.}

## IX THE PROBLEM OF LIFE

THE question concerning the origin and nature of Life is of supreme and vital importance not only for those who speak of Evolution as a force or principle by which everything is guided and governed, but also for such as understand by the term no more than a process which they say has actually occurred. Evolutionists of this second class disclaim, with Huxley, any "philosophy of Evolution." They are content to take the world as a going concern, at the farthest point in the past to which, even speculatively, Science can trace it, as that vast primordial nebula of which we have heard.<sup>63</sup> Given this, – assuming the existence of such a nebula, constituted as they suppose, – they believe that the whole subsequent history of the world is fully explained by the uniform action of the same laws of matter which we find in operation to-day. Not only is the establishment of our Solar System, of sun and planets, to be thus accounted for, but likewise the production of life, of the organic world of plants and animals.

Hence it necessarily follows that life must originally have been evolved naturally from lifeless matter, for all are agreed that not only in the nebula, but on the earth when it first started its independent career, life did not, and could not, exist.

There has been [says Virchow]<sup>64</sup> a beginning of life, since geology points to epochs in the formation of the earth when life was impossible, and when no vestige of it is to be found.

If the evolution hypothesis is true, [says Huxley]<sup>65</sup> living matter must have arisen from not-living matter; for by the hypothesis the condition of the globe was at one time such that living matter could not have existed in it, life being entirely incompatible with the gaseous state.

There was a time [says Tyndall]<sup>66</sup> when the earth was a red-hot molten globe, on which no life could exist.

Accordingly, as Professor Huxley acknowledges, spontaneous generation is an evolutionary necessity. Unless such generation can be shown to have taken place, or at the very least unless it can be shown to be naturally possible, the theory which requires it cannot be an established truth. But it is precisely as a scientifically established truth that the doctrine of Evolution is presented to us, so firmly established indeed that we are warned "to doubt it is to doubt science."<sup>67</sup> It presents itself, moreover, as the most precious result of modern research, the appearance of which is as a sunrise illuminating the field of knowledge.<sup>68</sup>

This being so, and it being the first principle of Science that we should take nothing on faith and accept only what can be proved, it is our plain duty to satisfy ourselves, as scientific methods alone can rightly satisfy us, that a doctrine of such paramount importance is entitled to demand our acceptance.

What methods can claim to be scientific, all are agreed. Advances in science, Professor Tait warns us,<sup>69</sup>

come or not, as we remember or forget that our Science is to be based entirely upon experiment, or mathematical deduction from experiment.

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<sup>63</sup> The Nebular Hypothesis itself is, of course, far from being an established certainty, and is not devoid of grave difficulties. Into these, however, it is not necessary now to enter.

<sup>64</sup> *Apud* Gaynor, *The New Materialism*, p. 83.

<sup>65</sup> *Encyclopaedia Britannica*, "Biology."

<sup>66</sup> *Apud* Gaynor, p. 84.

<sup>67</sup> Professor Marsh.

<sup>68</sup> Professor Dewar at Belfast, 1902.

<sup>69</sup> *Recent Advances in Physical Science*, 3rd Edition, p. 6.

Men of science [says Tyndall] prolong the method of nature from the present into the past. The observed uniformity of nature is their only guide.<sup>70</sup>

The man of science [says Huxley] has learned to believe in justification, not by faith, but by verification.<sup>71</sup>

In this manner must we test the Evolution theory, and spontaneous generation as an essential element thereof. We will begin with Professor Huxley's statement of what he styles "the fundamental proposition of Evolution."<sup>72</sup>

That proposition is [he writes] that the whole world, living and not-living, is the result of the mutual interaction, according to definite laws, of the forces possessed by the molecules of which the primitive nebulousness of the universe was composed. If this be true, it is no less certain that the existing world lay, potentially, in the cosmic vapour; and that a sufficient intelligence could, from a knowledge of that vapour, have predicted, say the state of the Fauna of Britain in 1869<sup>73</sup> with as much certainty as one can say what will happen to the breath in a cold winter's day.

That is to say, the supposed nebula was a vast piece of mechanism, of unimaginable complexity, the component parts of which under the influence of such forces as gravitation, heat, chemical affinity, electricity and magnetism, have produced everything that has since appeared on earth, vegetable and animal life amongst the rest. How are we to assure ourselves that such was really the case?

Professor Tyndall has told us that the only scientific method is to prolong the method of nature from the present into the past, taking her observed uniformity for our only guide, and in like manner we have heard it laid down by Professor Romanes, that we must assume as a first principle that the laws of nature are always and everywhere the same, and that by their uniform operation everything is done. It is therefore quite clear that as no man was present when life first made its appearance, to observe and record whence it came, the only way in which we can possibly proceed, without violating every scientific canon, is to argue from what happens now, to what must have happened then, – to show that inorganic matter can in fact generate organic life, and to conclude that the same laws must have worked the same results in the past as they do in the present.

But this is precisely what cannot be done, for one of the most conclusive results of modern research has been to show that in the present world spontaneous generation never occurs, that living things come only from living parents, and that from organic matter alone can the smallest particle of organic matter be derived. *Omne vivum e vivo, omnis cellula e cellula, omnis nucleus e nucleo*. Upon this point there is now complete agreement amongst scientific authorities, and what is most remarkable, none are more strenuous in upholding the doctrine of *Biogenesis*,<sup>74</sup> than some of those who with equal vehemence proclaim the doctrine of Evolution for which the occurrence of spontaneous generation is a necessity.

Never, for example, were there Evolutionists more pronounced than Professors Huxley and Tyndall, and they both saw clearly that without spontaneous generation there could not have been evolution such as they maintained. Yet when the occurrence of spontaneous generation, here and now, was asserted by Bastian and Burdon Sanderson, they, following in the wake of Pasteur, repudiated the notion, and Tyndall in particular conclusively disproved the experiments by which it was supported.<sup>75</sup> As Huxley wrote to Charles Kingsley:<sup>76</sup>

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<sup>70</sup> Gaynor, p. 102.

<sup>71</sup> *Lay Sermons*, p. 18.

<sup>72</sup> *Critiques and Addresses*, p. 305.

<sup>73</sup> Being the year in which this passage was written.

<sup>74</sup> Viz. that of the derivation of life from life alone, as opposed to *Abiogenesis*, or its production from lifeless matter.

<sup>75</sup> See *Fragments of Science*, "Spontaneous Generation," for a full account.

<sup>76</sup> March 18, 1863. *Life and Letters*, i. 352.

I am glad you appreciate the rich absurdities of spontogenesis. Against the doctrine of spontaneous generation in the abstract I have nothing to say. Indeed it is a necessary corollary from Darwin's views if legitimately carried out.

A few years later, writing to Dr. Dohrn<sup>77</sup> upon the same subject, he made use of a phrase – which in his mouth expressed the uttermost limit of disbelief: "Transubstantiation will be nothing to this if it turns out true."

In the same year as President of the British Association he chose for the subject of his inaugural address, "Biogenesis and Abiogenesis," and, after a careful examination of the case for each, pronounced the former "to be victorious all along the line."

In spite of all this, however, he assured himself as an Evolutionist that spontaneous generation must once have been not only a possibility but a fact. In the same Presidential address, after piling up evidence against it – he thus continued:<sup>78</sup>

But though I cannot express this conviction of mine too strongly, I must carefully guard myself against the supposition that I intend to suggest that no such thing as Abiogenesis has ever taken place in the past, or ever will take place in the future. With organic chemistry, molecular physics and physiology yet in their infancy, and every day making prodigious strides, I think it would be the height of presumption for any man to say that the conditions under which matter assumes the properties we call "vital" may not, some day, be artificially brought together. All I feel justified in affirming is that I see no reason for affirming that the feat has been performed yet.

And looking back through the prodigious vista of the past, I find no record of the commencement of life, and therefore I am devoid of any means of forming a definite conclusion as to the conditions of its appearance. Belief, in the scientific sense of the word, is a serious matter, and needs strong foundations. To say, therefore, in the admitted absence of evidence, that I have any belief as to the mode in which the existing forms of life have originated, would be using words in a wrong sense. But expectation is permissible where belief is not; and if it were given me to look beyond the abyss of geologically recorded time to the still more remote period when the earth was passing through physical and dynamical conditions, which it can no more see again than a man can recall his infancy, I should expect to be a witness of the evolution of living protoplasm from not living matter... That is the expectation to which analogical reasoning leads me; but I beg you once more to recollect that I have no right to call my opinion anything but an act of philosophical faith.

Here we have the whole state of the case put for us in a nutshell. On the one hand, all known facts are against the idea of spontaneous generation, and therefore, so far as she can at present go, the verdict of Science must condemn that supposition. But, on the other hand, the fundamental principle of Evolution cannot be justified unless spontaneous generation has taken place, and accordingly, although Evolution is the very thing which we should be engaged in establishing by the evidence of facts, it is held to be reasonable and scientific to infer that facts which we cannot verify must exist because they are wanted. It is admitted that the requisite evidence is lacking, and therefore we must not go so far as to express belief in the facts: but we may indulge in expectations, – which seem, however, to imply belief in the thing expected, – and meanwhile we may go on believing firmly in the Evolution theory itself, which includes belief in the missing facts. This, we are told, is "philosophical faith." But, to say nothing of what we have heard from others, Professor Huxley elsewhere<sup>79</sup> warns us against faith as the one unpardonable sin: and as we have heard him declare the man of science has learned to believe in justification, not by faith, but by verification.

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<sup>77</sup> April 30, 1870. *Ibid.* ii. 17.

<sup>78</sup> *Critiques and Addresses*, p. 238.

<sup>79</sup> *Lay Sermons*, p. 18.

And as to the expectation which he avowed, there appears to be no slight force in the response of his adversary Dr. Bastian:<sup>80</sup>

What reason [he asks] does Professor Huxley give in explanation of his supposition?.. The only reason distinctly implied is because the physical and chemical conditions of the earth's surface were different in the past from what they are now. And yet, concerning the exact nature of their differences, or the degree in which the different sets of conditions would respectively favour the occurrence or arrest of an evolution of living matter, Professor Huxley cannot possess even the vaguest knowledge. He chooses to assume that the unknown conditions existing in the past were more favourable to *Archebiosis* (life-evolution) than those now in operation. This, however, is an assumption which may be entirely opposed to the facts.

It is thus hard to understand how Professor Huxley could profess to justify his expectations by verification, for that the above account of the matter is no-wise overstated we have his own acknowledgment:<sup>81</sup>

Of the causes which have led to the origination of living matter, it may be said that we know absolutely nothing... Science has no means to form an opinion on the commencement of life; we can only make conjectures without any scientific value.

Such a witness as Huxley might well suffice, but the question is so important as to make it advisable to call some others, though only a few amongst many who testify to the same effect.

Like his friend and ally Huxley, Professor Tyndall believed that spontaneous generation had once occurred, and denied that it occurs now. As to the former article of his creed he was even more pronounced in his materialism. We have already heard him proclaim that in matter is to be discerned the promise and potency of all terrestrial life. He likewise inclined to believe that not only life but consciousness is immanent everywhere, in the vegetable and mineral no less than in the animal world,<sup>82</sup> and that not merely life and consciousness, but:

All our philosophy, all our poetry, all our science, and all our art – Plato, Shakespeare, Newton, and Raphael – are potential in the fires of the sun.<sup>83</sup>

Beliefs such as these might be thought to imply that the genesis of life is a simple affair, but Tyndall was no less convinced than Huxley that, as things are, it cannot be obtained without antecedent life on which to draw. Having described the experiments devised to test the matter, he thus concludes:<sup>84</sup>

Here, as in all other cases, the evidence in favour of spontaneous generation crumbles in the grasp of the competent enquirer.

At the same time, he was equally certain that life must have had an inorganic origin and that Science bids us so to believe. His various utterances are not, it is true, very easily reconciled. On the one hand he lays it down that "Without verification a theoretic conception is a mere figment of the intellect." On the other hand in his Belfast Address he thus expressed himself:

Believing, as I do, in the continuity of nature, I cannot stop abruptly where our microscopes cease to be of use. Here the vision of the mind authoritatively supplements the vision of the eye. By a necessity engendered and justified by Science I cross the boundary of the experimental evidence... If you ask me whether there exists the least evidence to prove that any form of life can be developed out of matter, without demonstrable antecedent life... [men of science] will frankly admit their inability to point to any satisfactory experimental proof that life can be developed, save from demonstrable antecedent life.

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<sup>80</sup> *Evolution and the Origin of Life*, 1874, p. 23.

<sup>81</sup> *Encyclopaedia Britannica*, "Biology."

<sup>82</sup> *Fragments of Science*. "Rev. James Martineau and Belfast Address."

<sup>83</sup> *Ibid.* "Scientific use of the imagination."

<sup>84</sup> *Fragments of Science*, "Spontaneous Generation."

Far, however, from being a mere figment, his mental vision is represented as the most unalloyed product of reason. He writes:<sup>85</sup>

Were not man's origin implicated, we should accept without a murmur the derivation of animal and vegetable life from what we call inorganic nature. The conclusion of pure intellect points this way and no other.

The conclusion of pure intellect, however, having nothing to show for itself in the way of evidence, we are again referred to a condition of things concerning which we know, and can know, nothing.

Supposing [writes the Professor]<sup>86</sup> a planet carved from the sun, set spinning round an axis, and revolving round the sun at a distance from him equal to that of our earth, would one of the consequences of its refrigeration be the development of organic forms? I lean to the affirmative.

It is no doubt interesting to know to what opinion the Professor inclined, but is this sort of thing Science?

In the same manner Mr. Herbert Spencer, the philosopher of evolution *par excellence*, thus reports:<sup>87</sup>

Biologists in general agree that in the present state of the world no such thing happens as the rise of a living creature out of non-living matter. They do not deny, however, that at a remote period in the past, when the temperature of the surface of the earth was much higher than at present, and other physical conditions were *unlike those we know*,<sup>88</sup> inorganic matter, through successive complications, gave origin to organic matter.<sup>89</sup>

Mr. Darwin himself, who is constantly supposed to have upheld, or even to have demonstrated, the fact of spontaneous generation, is amongst the strongest witnesses against it. He was indeed disposed to believe that the living will some day be found to be producible from the lifeless, the ground of his expectation being the "Law of Continuity,"<sup>90</sup> or the assumption that from the beginning of nature to the end one only kind of law uniformly operates, namely the same as we now experience. But this is to assume the whole question at issue, for unless it can be shewn that there has been spontaneous generation, we cannot be assured that there is such a Law of Continuity. And despite his expectation Darwin always denied that the origin of life has been – sometimes even that it can be – explained. Thus he wrote on various occasions:

It is mere rubbish thinking at present of the origin of life; one might as well think of the origin of matter.<sup>91</sup>

As for myself I cannot believe in spontaneous generation, and though I expect that at some future time the principle of life will be rendered intelligible, at present it seems to me beyond the confines of Science.<sup>92</sup>

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<sup>85</sup> *Ibid.* "Rev. James Martineau and Belfast Address."

<sup>86</sup> *Ibid.* "Vitality."

<sup>87</sup> *Nineteenth Century*, May, 1886, p. 769.

<sup>88</sup> Italics mine.

<sup>89</sup> It has been established by Pasteur and others that the highest temperature at which organic life is possible is 45° *Centigrade* (113° *Fahrenheit*). When the globe had cooled to this point from its primitive molten condition, the epoch of terrestrial life commenced. According to what is perhaps the latest theory, that of M. Quinon, the temperature immediately below this, 44° *Centigrade*, remains always the best for living things, and those creatures are highest in the scale of life, and consequently the most developed, which have contrived means of keeping their internal heat at, or about, this level, despite the refrigeration of their surroundings. In their blood-heat M. Quinon therefore finds an absolute rule for fixing the relative rank of organic forms, and the date of their appearance; those whose blood is warmest being the most recently evolved. The results of this new system are sufficiently startling. Birds are to be classed as the highest and newest of all; while man, with the other *Primates*, has to take a much lower place, the ungulates, including the horse and donkey, and the carnivora, as dogs and cats, being his superiors. (*La Revue des Idées*, January 15, 1904, pp. 29 seq.)

<sup>90</sup> To D. Mackintosh, February 28, 1882.

<sup>91</sup> To Sir J. D. Hooker, March 29, 1863.

<sup>92</sup> To V. Carus, November 21, 1866.

No evidence worth anything has as yet, in my opinion, been advanced in favour of a living being, being developed from inorganic matter.<sup>93</sup>

Here we may conveniently pause and take stock of our results. On the one hand, we are bidden in the name of Science to learn the past from the present, and the present from observation and experiment alone. On the other, we are invited to believe in an occurrence which observation and experiment negative in the present, on the ground that the circumstances must once have been entirely different from any with which we are acquainted. Obviously, the real motive of belief is that naïvely expressed by Professor Haeckel, who tells us that spontaneous generation is proved by the doctrine of Evolution;<sup>94</sup> which then in its turn is proved by spontaneous generation.

Two points must however be noticed in which it is attempted to find present evidence in favour of spontaneous generation.

First, there is Protoplasm – the "Physical Basis of Life," or Living Matter, being that form of matter by which life is always accompanied. In this no chemical element unknown elsewhere, is to be found; the cells of which it consists are compounded of Oxygen, Hydrogen, Nitrogen, and Carbon; and it has been argued, especially by Huxley, that it is therefore not different in kind from other compounds; that as Oxygen and Hydrogen form water, Oxygen and Carbon, Carbonic Acid, Hydrogen and Nitrogen, Ammonia, – so the four combined, in proper circumstances and proportions, make Living Matter, without the aid of any vital force or principle. And Haeckel with his habitual audacity foretells the artificial production of Protoplasm for purposes of commerce. But, as Mr. Stirling observes,<sup>95</sup> man has always known that he is made of dust, and that the only part of him perceptible to sense is substantially the same as the earth beneath his feet. All that he now learns in addition is that when such matter is wedded to life it undergoes marvellous transformations which in part at least we are able to recognize, but are wholly unable to comprehend. This Professor Huxley himself admits:

The properties of living matter [he writes]<sup>96</sup> distinguish it absolutely from all other kinds of things, and the present state of knowledge furnishes us with no link between the living and the not-living.

Not only that: the subject is full of complexities of which Professor Huxley gives no hint, and which it would even seem he did not himself perceive. In his celebrated lecture on the Physical Basis of Life<sup>97</sup> he gives his hearers to understand that all Protoplasm is the same, that its particles are as the bricks with which any sort of edifice may be constructed, a cathedral or a gin-shop, a palace or a hovel. The protoplasm of a mushroom, for instance, he declares to be essentially identical with that of him who eats it, into which it is most readily convertible. He also speaks of the effect of eating mutton being to "transubstantiate sheep into man." But, positive as are these statements, they are far from representing scientific truths, and we are told by Sir William Thiselton-Dyer that he himself would not know what to do with a candidate who should advance such views in an examination.<sup>98</sup> As to the mushroom and the mutton, Sir William adds, that except the definition of a crab, as a red fish that runs backwards, attributed to the French Academy, he can call to mind no statement "so compact of error."

In reality, instead of all Protoplasm being the same, the differences are infinite. Particles from different sources may be indistinguishable by the microscope or by any test that chemistry can apply, but this only increases the mystery of their nature, for each has its own functions and will perform

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<sup>93</sup> To D. Mackintosh, February 28, 1882.

<sup>94</sup> *Riddle of the Universe*, p. 6.

<sup>95</sup> *As regards Protoplasm*, p. 21.

<sup>96</sup> *Encyclopaedia Britannica*, "Biology."

<sup>97</sup> Printed in *Lay Sermons*.

<sup>98</sup> *Nature*, June 5, 1902, p. 121.

no others. The Protoplasm of a plant will do what that of an animal, seemingly identical, cannot do. That of a fish will convert the same nutriment into quite a different formation from that of a man.

It is no doubt true that a particle of fungoid differs in no appreciable physical respect from one of human protoplasm, yet the former will never emerge from the fate of the humble mushroom, while the other may be instinct with the thoughts of a Prime Minister.<sup>99</sup>

As Mr. Stirling sums up the matter:<sup>100</sup>

There is nerve-protoplasm, brain-protoplasm, bone-protoplasm, muscle-protoplasm, and protoplasm of all the other tissues, no one of which but produces only its own kind, and is uninterchangeable with the rest. Lastly, we have the overwhelming fact that there is the infinitely different protoplasm of the various infinitely different plants and animals, in each of which its own protoplasm, as in the case of the various tissues, but produces its own kind, and is uninterchangeable with that of the rest.

It thus appears that the character of Protoplasm, far from making it easier to conceive the mechanical production of living things, does but immensely aggravate the difficulty. As Sir William Thiselton-Dyer avows: "I do not see even the beginning of a materialistic theory of protoplasm." And Haeckel's idea that we shall succeed in creating organic life does not commend itself to such an authority as Sir Henry Roscoe:

It is true [he says]<sup>101</sup> that there are those who profess to foresee that the day will arise when the chemist, by a succession of constructive efforts may pass beyond albumen, and gather the elements of lifeless matter into a living structure. Whatever may be said of this from other standpoints, the chemist can only say that at present no such problem lies within his province. Protoplasm, with which the simplest manifestations of life are associated, is not a compound, but a structure built up of compounds. The chemist may successfully synthesize any of its component compounds, but he has no more reason to look forward to the synthetic production of the structure than to imagine that the synthesis of gallic acid leads to the artificial production of gall-nuts.

And M. de Quatrefages thus sums up the conclusions at which he arrives from minute study of the lowest forms of life:<sup>102</sup>

I make bold to affirm that the deeper Science penetrates into the secrets of organization and phenomena, the more does she demonstrate how wide and how profound is the abyss which separates brute matter from living things.

The other point requiring notice is crystallization. Inorganic matter, as we know, can build up crystals, the wonderful structure of which results from the molecular properties of the substance crystallized. Why then, some would ask, may not matter in the same manner produce Protoplasm?

But, in the first place, this, as we have heard, is what it is never found to do. Crystals we can produce at pleasure, in what quantity we will. But all efforts have not yet succeeded in obtaining the most minute speck of living matter. Moreover, nothing can be more widely different from organic structures than crystals. The latter are always mathematical, the former never: the latter grow by outside accretion, of the one kind of particles whereof they consist: the former by absorption and assimilation of various foreign substances: the latter are wholly independent of anything like an ancestor: for the former an ancestor is in our experience indispensable: crystals can be dissolved and recrystallized: living matter once destroyed can never be reconstituted. Above all, the particles incorporated in the crystal are absolutely quiescent, so far as any portion of matter can be said to be so, no more able to change their position without external force than the bricks in a wall, while

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<sup>99</sup> *Id. ibid.*

<sup>100</sup> *Op. cit.* p. 27.

<sup>101</sup> *Presidential Address*, British Association, 1887.

<sup>102</sup> *Les Emules de Darwin*, ii. 66.

those in living tissue at once become subject to "the whirlwind of life," involving constant change the cessation of which is death.

It is inexplicable to me [says M. de Quatrefages]<sup>103</sup> that some men whose merits I otherwise acknowledge, should have compared crystals to the simplest living forms... These forms are the antipodes of the crystal from every point of view.

To the same effect speaks Mr. A. R. Wallace, Mr. Darwin's associate in the discovery of the Darwinian theory. In a work expressly devoted to the vindication of that theory, Mr. Wallace declares that far from the way of evolution being made clear by Science from end to end – "there are at least three stages in the development of the organic world where some new cause or power must necessarily have come into action." And at the head of them he places that which we are now considering, writing thus:<sup>104</sup>

The first stage is the change from inorganic to organic, when the earliest vegetable cell, or the living protoplasm out of which it arose, first appeared... There is in this something quite beyond and apart from chemical changes however complex; and it has been well said that the first vegetable cell was a new thing in the world, possessing altogether new powers...<sup>105</sup>

Such testimonies are sufficient for our present purpose. In face of them it cannot be pretended that Science *knows* anything of spontaneous generation or gives her verdict in its favour. On the contrary, as Professor Tait declares:<sup>106</sup>

To say that even the very lowest form of life, not to speak of its higher forms, still less of volition and consciousness, can be fully *explained* on physical principles alone, ... is simply unscientific. There is absolutely nothing known in physical science which can lend the slightest support to such an idea... To suppose that life, even in its lowest form, is wholly material, involves either a denial of the truth of Newton's laws of motion, or an erroneous use of the term "Matter." Both are alike unscientific.

Yet it is precisely in the name of Science that we have been told to accept the spontaneous origin of life from inorganic matter, as a clearly demonstrated truth, and no riddle at all.

But as Professor Virchow, Evolutionist and Materialist as he was, well said in regard of this very point in the Munich Congress of 1877:

If we would speak frankly, we must admit that naturalists may well have some little sympathy for the *generatio aequivoca* [spontaneous generation]. If it were capable of proof, it would indeed be beautiful! But, we must acknowledge, it has not yet been proved. The proofs of it are still wanting... Whoever recalls to mind the lamentable failure of all the attempts to discover a decided support for the *generatio aequivoca* in the lower forms of transition from the inorganic to the organic world, will feel it doubly serious to demand that this theory, so utterly discredited, should be in any way accepted as the basis of all our views of life.

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<sup>103</sup> *Op. cit.* ii. 63.

<sup>104</sup> *Darwinism*, p. 474.

<sup>105</sup> The other stages presenting similar difficulties are the 5th and 6th of Du Bois-Reymond's Enigmas, viz. the introduction of sensation or consciousness (animal life), and of rational thought and speech.

<sup>106</sup> *Contemporary Review*, January, 1878, p. 298.

## X ANIMAL AND MAN

LEAVING for later consideration the fourth of Du Bois-Reymond's Unsolved Enigmas, namely the seemingly pre-ordained order of the universe, we may conveniently group together the three which follow it, as much resembling that which has just occupied our attention. These problems, it will be remembered, are (a) the origin of simple sensation and consciousness, or, in other words, of the faculties possessed by animals; (b) that of rational thought and speech; (c) Free-will. – Here again we are bound to ask, in the name of right reason and common-sense, what light has really been thrown on such questions by Science, and how far she has changed their aspect, – that so we may guard against the delusion of imagining ourselves to be in possession of more knowledge than we actually possess.

(a) *Simple sensation and consciousness.* As regards the actual origin of the higher form of life which distinguishes the animal from the vegetable, we are obviously no better informed than we have found ourselves to be concerning the first beginnings of life in any form, – no evidence as to the actual facts being available, or even possible, for our enlightenment. Once more we can only argue from the present to the past, and enquire whether the progress of science has made it more reasonable to suppose than it seemed in pre-scientific days that animal life has been spontaneously evolved, either from inanimate matter or from the vegetative life of plants. This enquiry so much resembles that which we have just concluded as to make it unnecessary to pursue it at any length.

We find, in fact, that men of Science who have no prepossessions whatever against Evolution, and would willingly accept the Law of Continuity at all points, if only evidence were forthcoming, find here not only an unsolved problem, but one even more difficult than the Origin of Life itself. Du Bois-Reymond for example places this amongst his "transcendental" enigmas, to which an answer will never be found, whereas he thinks that the origin of vegetable life, although at present a mystery, may one day be explained. The expression of his opinion, – that by no possibility can we ever understand how consciousness could be evolved from matter – has, he tells us<sup>107</sup> been vehemently contradicted, but, he adds, nothing in the way of argument, or beyond mere assumptions, has been brought against him. Of these assumptions he notices only that of Professor Haeckel, "the Prophet of Jena," who protests against such limitations of our possibilities as treason to the sacred cause of Evolution. The progress we have made in intellect, says Haeckel, beyond our barbarous progenitors, is sufficient to show that we are on the high road of development towards a stage as far in advance of the present, as this is of the past; and when that is attained, our knowledge will be full and will embrace all this. But, asks Du Bois-Reymond in reply, is this mighty progress of ours so very evident within the period concerning which we have any information? Has the mental capacity of our race notably improved since Homer?<sup>108</sup> or its faculty of thinking since Plato and Aristotle? At our present rate of progress, long before the high-water mark prophesied by Haeckel is reached, the earth will have become uninhabitable. And, were it otherwise, the highest point of intellect to which conceivably man could attain, would be that of the "sufficient intelligence" whereof we have been told, which, from an inspection of the cosmic nebula could foretell all that was to issue from it. And, adds Du Bois-Reymond, even could we do this, we should still be unable to understand the origin of consciousness, which would require intelligence of another order than ours, however magnified.

So again Mr. Wallace tells us,<sup>109</sup> after speaking of the beginning of life as we have already heard,

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<sup>107</sup> *Die sieben Welträthsel*, D. 82.

<sup>108</sup> Professor Huxley, it must be remarked, speaks of Homer as a "half savage Greek" (*Lay Sermons*, p. 12), and intimates a mild wonder that such a being could share our feelings in presence of nature to so large an extent as his poems testify. This is undoubtedly a fine example of the good conceit of ourselves which the pursuit of science is rather apt to produce.

<sup>109</sup> *Darwinism*, p. 475.

The next stage is still more marvellous, still more completely beyond all possibility of explanation by matter, its laws and forces. It is the introduction of sensation or consciousness, constituting the fundamental distinction between the animal and vegetable kingdoms. Here all idea of mere complication of structure producing the result is out of the question. We feel it to be altogether preposterous to assume that at a certain stage of complexity of atomic constitution, and as a necessary result of that complexity alone, an *ego* should start into existence, a thing that *feels*, that is conscious of its own existence. Here we have the certainty that something new has arisen, a being whose nascent consciousness has gone on increasing in power and definiteness till it has culminated in the higher animals. No verbal explanation or attempt at explanation – such as the statement that life is the result of the molecular forces of the protoplasm, or that the whole existing organic universe from the amoeba up to man was latent in the fire-mist from which the solar system was developed – can afford any mental satisfaction, or help us in any way to a solution of the mystery.

Unquestionably, there is no lack of speakers and writers who flatly contradict such views, and assert that animal life, equally with vegetable, could be, and must have been, naturally evolved from inorganic nature. The above testimonies, however, amply suffice for our present purpose, and with them we may be satisfied; for at least they make it plain that Science has found no evidence as to the origin of sensation and consciousness conclusive enough to compel belief. And where there is no scientific evidence even alleged, such as might require the training of a specialist for its due appreciation, one man of ordinary intelligence is as competent a judge as another, and scientific experts are on a level with the rest of us.

(b) *Rational thought and speech.* What has just been said applies with equal force to this matter likewise. Unless Science have some positive evidence to bring, demonstrating how the gulf can be bridged which separates the intelligence of the most degraded races of men from the highest of the brutes, and how articulate language can spontaneously have arisen, which is the necessary appanage of reason, we have all equally the means of forming our conclusions on the subject.

That the gulf between man and the lower animals is here immense we have the evidence of Mr. Darwin.

No doubt [he writes]<sup>110</sup> the difference is in this respect enormous, even if we compare the mind of one of the lowest savages, who has no words to express any number higher than four, and who uses no abstract terms for the commonest objects or affections, with that of the most highly organized ape. The difference would, no doubt, still remain immense, even if one of the highest apes had been improved and civilized as much as a dog has been in comparison with its parent form, the wolf or jackal. The Fuegians rank amongst the lowest barbarians; but I was continually struck with surprise how closely the three natives on board H.M.S. *Beagle*, who had lived some years in England and could talk a little English, resembled us in disposition and in most of our mental faculties.

Mr. Darwin goes on to argue, however, that the difference between man and beast is one of degree only and not of kind; that this can be "clearly shewn"; and that there is unquestionably a much wider interval in mental power between one of the lowest fishes, as a lamprey or lancelet, and one of the higher apes, than between an ape and a man; yet this immense interval is filled up by numberless gradations, from which he concludes that by a like series of steps, of which, however, no trace is left, our progenitors have been able to mount from the simian to the human level.

Clear however as Mr. Darwin pronounces the evidence to be, it is very far from being so considered by other eminent naturalists. So convinced an Evolutionist as Mr. Mivart, for example, declared on various occasions that his reason abundantly sufficed to convince him that there was a wider break in nature between man and the highest ape, than between the highest ape and an oyster or even a mushroom.

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<sup>110</sup> *Descent of Man*, c. ii.

It is evident that the evidence which permits judgments so diverse as these cannot be said conclusively to prove the former existence of a bridge every vestige of which has, by the acknowledgment of all parties, entirely disappeared. We are therefore left to determine for ourselves, whether the powers of our own mind, as each knows them in himself, are of a totally different nature from those of dogs and horses, and chimpanzees such as the late lamented "Consul," or whether we are superior only in degree, as a sheep-dog is more intelligent than a sheep, or a fox than a goose.

If in any respect such an enquiry can be made definite and therefore profitable, it is clearly in regard of Language. This, as said above, is an essential adjunct of reason such as ours, and on the other hand it forms the plainest boundary between the domain of the human race and that of the brutes. It is, says Professor Max Müller, our Rubicon on the hither side of which men alone are found. Given reason such as ours, whatever mode of communication might be open to them, we cannot suppose its possessors failing to establish a medium of intercourse. In existing conditions, man can make an alphabet out of the clicks of a needle or the flashes of a mirror, and if his vocal organs were no better than those of a baboon, we cannot imagine him content generation after generation with inarticulate howls and yells. But this is just the case of the animals. They are *never* found to make the smallest progress in the direction of a code of signals. Dogs indeed, as Mr. Darwin says,<sup>111</sup> having developed in captivity the new art of barking, have further learnt to vary this accomplishment according to the circumstances that provoke it, and have distinct tones to express the diversity of their feelings, as when hunting, or angry, or setting out for a walk, or shut up in a kennel or out of a house. Some dogs, he might have added, refine still further, and will betray by their style of bark not only that they are hunting something, but what it is that they have come upon, whether a rabbit, a cat, or a hedgehog. But, as the Chevalier Bunsen observes,<sup>112</sup> and his observation includes such manifestations as the above:

Animal sounds are the echoes of blind instincts within, or of the phenomena of the outward world, uttered by suffering or satisfied animal nature, and in all cases resulting from mere passiveness.

By rational language, on the other hand, is signified, to quote Mr. Mivart:<sup>113</sup>

The external manifestation, whether by sound or gesture, of general conceptions: – not emotional expressions or the manifestations of sensible impressions, but enunciations of distinct judgments as to "the what," "the how," and "the why."

Consequently, as Bunsen declares:

The theories about the origin of language have followed those about the origin of thought, and have shared their fate. The materialists have never been able to show the possibility of the first step. They attempt to veil their inability by the easy but fruitless assumption of an infinite space of time, destined to explain the gradual development of animals into men; as if millions of years could supply the want of the agent necessary for the first movement, for the first step in the line of progress! No numbers can effect a logical impossibility. How indeed could reason spring out of a state which is destitute of reason? How can speech, the expression of thought, develop itself in a year or in millions of years, out of unarticulated sounds which express feelings of pleasure, pain, and appetite? The common-sense of mankind will always shrink from such theories.

Bunsen's words were echoed even more forcibly by professor Max Müller, speaking as President of the Anthropological Section of the British Association at Cardiff in 1889.

What [he asked] does Bunsen consider the real barrier between man and beast? It is language, which is unattainable, or at least unattained, by any animal except man.

You know [he continued] how for a time, and chiefly owing to Darwin's predominating influence, every conceivable effort was made to reduce the distance which language places between

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<sup>111</sup> *Ibid.* 54.

<sup>112</sup> In his paper read before the British Association at Oxford in 1847.

<sup>113</sup> *Lessons from Nature*, p. 89.

man and beast, and to treat language as a vanishing line in the mental evolution of animal and man. It required some courage at times to stand up against the authority of Darwin, but at present all serious thinkers agree, I believe, with Bunsen, that no animal has ever developed what we mean by rational language, as distinct from mere utterances of pleasure or pain, a subject lately treated with great fulness by Professor Romanes. Still, if all true science is based on facts, the fact remains that no animal has ever found what we mean by a language; and we are fully justified, therefore, in holding with Bunsen and Humboldt, as against Darwin and Romanes, that there *is* a specific difference between the human animal and all other animals, and that that difference consists in language as the outward manifestation of what the Greeks meant by *Logos*.

It is moreover evident that, far from speech having generated reason, as some have preposterously maintained, it is reason which generates speech, no less inevitably than sunlight produces the spectrum when it passes through a prism. The seeming paradox of Wilhelm von Humboldt is in fact a sober truth: "Man is man only through speech, but in order to invent it he must already be man." We have plain evidence that before means for the internal expression of it are found, the mental word (*verbum mentale*) is awaiting them, and that without this it would be as impossible for any sort of rational speech to be produced as for an apple to be grown without an apple-tree.

Evidence to this effect is furnished by recorded instances of persons who from early childhood, or even from birth, were deaf, dumb, and blind, and appeared to be cut off from all possibility of human converse, the "gates of Mansoul" being thus almost entirely closed. Such are the well-known cases of Laura Bridgman, Miss Keller, and Martha Obrecht, who had been thus afflicted since their earliest childhood, the two first named from the age of two, and the last from that of three years.<sup>114</sup> Also the more recent instance of Marie Heurtin, who was so born, and consequently could not have even the faintest glimmer of any knowledge these senses could convey.<sup>115</sup> Yet, by the exercise of ingenious and unwearied charity, a means of communication was elaborated through the sense of touch, and the souls which had seemingly been buried alive, shewed themselves responsive to such advances, – often astonishingly so, – and revealed their possession of faculties identical with those of their rescuers. We are told, for example, of Marie Heurtin that her intelligence proved to be quick, that she was even "unusually clever, evidently eager for knowledge, and, as sometimes happens, her faculties being prevented by her infirmity from wasting their powers on external objects, were all the more fresh and vigorous." Even more wonderful is the case of Miss Keller, who attained a degree of culture and accomplishment far beyond the common level of those possessing the use of all their senses.

Somewhat akin to such instances is that of the savages from Tierra del Fuego mentioned above by Mr. Darwin. In their case likewise, when they were brought into communication with people possessed of higher culture than their own degraded race, it was found that the corresponding faculties within them were not dead, or as yet non-existent, but only starved into lethargy; and, the opportunity being given, they speedily caused surprise by unmistakable proofs how closely they resemble ourselves.

Thus we find that in this branch of our enquiry there is one broad fact, which all must recognize and none can deny. No race of men has ever been known which could not speak, nor any race of animals which could, or which had made the first beginnings of intelligent language. Facts being the only groundwork of Science here is undoubtedly something whereon she may build an inference, and this inference will certainly not be that the faculties of men and animals are radically identical. And if we are told, as we constantly are, that it is more truly scientific to admit such identity, should there not be some other facts, still more significant and equally well established, to exhibit on the other side?

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<sup>114</sup> See Mivart, *Origin of Human Reason*, p. 166.

<sup>115</sup> See Louis Arnould, *Une âme en prison*, and article "An imprisoned Soul," by the Ctesse. de Courson, *The Month*, January, 1902, p. 82.

But of what character are the arguments actually adduced? It will be sufficient to quote a few which come with the highest authority.

We may start with the almost classical specimen contributed by Mr. Darwin himself.

It does not [he says]<sup>116</sup> appear altogether incredible that some unusually wise ape-like animal should have thought of imitating the growl of a beast of prey, so as to indicate to his fellow monkeys the nature of the expected danger. And this would have been a first step in the formation of a language.

Similarly Professor Whitney writes of some supposed "pithecoïd"<sup>117</sup> men:

There is no difficulty in supposing them to have possessed forms of speech, more rudimentary and imperfect than ours.<sup>118</sup>

And so again Professor Romanes:<sup>119</sup>

Let us try to imagine a community considerably more intelligent than the existing anthropoid apes, although still considerably below the intellectual level of existing savages. It is certain that in such a community natural signs of voice, gesture, and grimace would be in vogue to a greater or less extent. As their numbers increased ... such signs would require to become more and more conventional, or acquire more and more the character of sentence-words.

Of course, as Mr. Mivart replies,<sup>120</sup> there is no difficulty in supposing anything we choose, or in seeing animals in imagination performing feats which never yet have they been known to achieve in fact. But no amount of such suppositions or imaginations will furnish Science with the scantiest apology for a foothold, nor can the germs of language attributed to pithecoïd communities or the sagest of their patriarchs, be considered as of any greater value than the speeches put into the mouths of the animals by Æsop or "Uncle Remus."

It is also to be noticed that in these accounts of the origin of language, the essential element of reason is always quietly smuggled in as a matter of course. Thus Mr. Darwin's wisest of the pithecoïds was able to "think of" a device for the information of his fellows. There is not the smallest doubt that any creature which had got so far as *that* would find what he wanted. It is but the old case of the man who was sure he could have written Hamlet had he had a mind to do so. Like him, the ape might have made the invention, if he had a mind to make it; – only he had not got the mind. So too, Professor Romanes' missing links use tones and signs which acquire "more and more" the character of true speech: which could not be unless they contained some measure of that character already. But it is just the first step thus ignored which spans the gulf between man and brute.

There is another factor upon which, in conjunction with these suppositions, great stress is wont to be laid, namely that of time; it being apparently taken for granted that if only time enough be given anything whatever may come about. Thus Professor Romanes tells us<sup>121</sup> that his imaginary *Homo alalus*, or speechless man, must probably have lived for an "inconceivably long time," before getting far enough on the road towards speech to give him such an advantage as enabled him to crush out his less accomplished congeners; and that even after this point was reached, another "inconceivable lapse of time" must have been required to turn him into *Homo sapiens*, or man as he actually is. Immense intervals, he further tells us, must have been consumed in the passage through various grades of mental evolution; "The epoch during which sentence-words prevailed was probably immense"; "It was not until æons of ages had elapsed that any pronouns arose."

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<sup>116</sup> *Descent of Man*, i. 57.

<sup>117</sup> i. e. ape-like.

<sup>118</sup> Quoted by Romanes, *Mental Evolution in Man*.

<sup>119</sup> *Ibid.*, p. 371.

<sup>120</sup> *Origin of Human Reason*, p. 385.

<sup>121</sup> *Op. cit.* p. 379.

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