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AUTOMATISM AND EVOLUTION

'Semper ego auditor tantum? nunquam reponam
Vexatus toties. . . . .'

'Je vois ordinairement que les hommes, aux faicts qu'on leur propose, s'amusent plus volontiers à en chercher la raison, qu'à en chercher la vérité.' MONTAIGNE, liv. iii. chap. xi.

'En voyant la complaisance du public pour les faiseurs de systèmes qui l'entretiennent tous les jours de leurs rêveries, on ne peut s'empêcher d'admirer le singulier penchant des hommes pour tout ce qui est explication. Personne ne s'informe si les explications sont exactes et précises, si elles sont établies sur des faits bien observés, déduites avec rigueur, confirmées par les phénomènes ; on regarde seulement où elles vont ; et plus elles vont loin, plus on les reçoit avidement.'

BIOT, *Mélanges*, vol. ii. p. 110.

WINDS OF DOCTRINE:

BEING

AN EXAMINATION OF THE MODERN THEORIES

OF AUTOMATISM AND EVOLUTION.

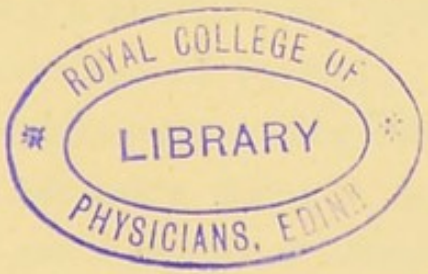
BY

CHARLES ELAM, M.D.

AUTHOR OF

'A PHYSICIAN'S PROBLEMS' 'MEDICINE, DISEASE, AND DEATH' ETC.

'Carried about with every wind of doctrine.'



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1876.

PREFACE.

THE substance of the following pages was written in 1874, shortly after the meeting of the British Association at Belfast. That the publication has been so long deferred, is due to causes in great measure beyond my own control, into any discussion of which it is unnecessary to enter.

The essays are now offered to those interested in these enquiries, with the intention of showing that those purely physical theories of life and mind, that have of late years been promulgated on high authority, and with unhesitating confidence, and have obtained such extensive credence even amongst thoughtful men, are simply untenable and unscientific, and are exercising a mischievous and benumbing influence in every domain of thought.

As these chapters were at first intended for serial publication, it has been thought advisable to preserve, as far as possible, the original plan; notwithstanding that this necessarily entails some want of consecutiveness in certain parts of the argument.

75 HARLEY STREET, W.
November 1876.

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WINDS OF DOCTRINE.

CHAPTER I.

INTRODUCTORY.

THE doctrines of Evolution, as held at the present time, by a large and influential section of the scientific world, logically culminate, as has been forcibly observed by Mr. St. George Mivart,[1] in 'three negations—viz. of God, the soul, and of virtue.'

The idea of a personal Creator of the universe is proved, as an inevitable corollary of these doctrines, not only to be untenable and impossible, but to be so supremely irrational, that it can only have arisen in what represented the minds of men, during those inconceivably dark ages when they were slowly evolving themselves from their ancestral apes, into something resembling humanity.[2]

Until recent times, notwithstanding its absurdity,

[1] *Contemporary Review* for September 1874.

[2] See Haeckel's *Natürliche Schöpfungs-Geschichte*, p. 68.

this belief has been for the most part deemed an innocent one, and not without some favourable influence on the minds of men. It was reserved for Professor Clifford to make the noteworthy discovery that, 'if it is right to call any doctrine immoral, it is right so to call this doctrine,' which recognises a 'destiny or a Providence outside of us, overruling the efforts of men;'[1] or, in fact, any higher power or authority than that of man himself.

What has been considered as the soul is now shown to be merely the mechanical result of the interactions and affinities of carbon, hydrogen, oxygen, and nitrogen; existing only by virtue of the combinations of these elements; ceasing to be when such combinations are resolved.

Virtue, under such conditions, ceases to have any possible meaning. Every action of life and mind being determined and limited absolutely by physical laws, can only be mechanical or automatic in its nature; and its relation to morality, either as virtue or vice, is as unreal as the morality itself.

The demonstration of this Automatism is the latest achievement of a science which is daily becoming more unscientific—a thing of conjecture and assertion, rather than of fact and induction. On the question between Anthropomorphism (or freedom of volition), and Physicism (or Automatism), Professor Huxley says that 'science closely invests the walls; and philo-

[1] *Fortnightly Review*, December 1874, p. 730.

sophers gird themselves for battle upon the last and greatest of all speculative problems—Does human nature possess any free volitional or truly anthropomorphic element, or is it only the cunningest of all nature's clocks?'[1] The answer is finally and definitively given, that man is an automaton, without any fragment of freedom of action.

It might, perhaps, have been a sufficient reply to such a proposition to say that it must of necessity be false, inasmuch as it contradicts a fundamental experience of the intuition of man. Mr. Lewes lays down, as his second rule of philosophising, this position :—[2]

Any contradiction of fundamental experiences of sense or intuition (is) to be taken as evidence of some flaw either in the data or the calculation.

Now, there is no intuition which appears, to the ordinary mind, to be more fundamental than this, that man has, within certain obvious limits, a power of choice, volition, or freedom of selection amongst various possible lines of action. He is in no degree more certain of anything revealed to him by the evidence of his senses than he is of this ; and it is difficult to conceive what order of phenomenon could be included under the definition of a fundamental intuition, if this were not so. It would appear, therefore, that if the doctrine of Automatism opposes this idea of volition, the doctrine itself, and that of Evolution, of

[1] *Lay Sermons*, p. 164.

[2] *Problems of Life and Mind*, vol. i. p. 90.

which it is the logical corollary, must be rejected as obviously false and sophistical.

But this, which would be conclusive in any other science, is unavailing in that of Evolution, which, it is agreed, is not to be tested by the ordinary methods. Evolution is not to be doubted; with or without support, or in the face of evidence to the contrary, it must be accepted. We, the 'profane or uninitiated,' are authoritatively assured by the hierophants of these mysteries, that what we have been accustomed ignorantly to consider as our volition 'is not the *cause* of a voluntary act, but the symbol of that state of the brain which is the immediate cause of that act;'[1] and that therefore our sensation of volition is not a fundamental intuition at all, but only a delusion and a snare.

In support of these doctrines the most astounding statements have been made from the high places of philosophy of late years—statements which possess little of science except the language in which they are clothed; yet, being so clothed, and proceeding from high authority, they have been accepted as science by a considerable section of even the educated world. These statements have chiefly been directed towards the position that life is only a mechanical phenomenon, due to the affinities of ordinary matter. It will be instructive very briefly to notice some few of these assertions.

[1] Professor Huxley, in *Fortnightly Review*, November 1874.

Haeckel states that organic and inorganic substances are 'equally living'[1] (*gleichmässig belebt*).

Prof. Fiske announces that 'the difference between a living and a not-living body is . . . a difference of degree, not of kind;'[2] and that the formation of an organism differs only in complexity from that of a crystal.

Many writers, including Professor Tyndall and Mr. Herbert Spencer, state that the lowest forms of living matter approximate very closely to non-living matter.

All these and a thousand similar fallacies, to which science gives not the slightest even apparent support, have been shattered to pieces over and over again. They are all so manifestly false, that no attempt at proof is ever made; but the assertions are repeated again and again, with the most monotonous iteration. Dr. Lionel Beale, in his 'Lumleian Lectures,' in 1875, and in his 'Life Theories,' in 1871, gave all such doctrines their death-blow, from a microscopic demonstration. But all this is in vain; each successive writer makes the same statements, with as much confidence as if they were founded on any fact.

Mr. Lewes devotes one hundred and nine pages in his 'Problems of Life and Mind' to insisting, with every variety of iteration, on the application of the

[1] *Op. cit.*, p. 66.

[2] *Cosmic Philosophy*, vol. i. p. 422.

strictly '*scientific method*' to all questions of life and mind. On the hundred and tenth we meet with this most marvellous illustration of the 'method':—

> To speak of vitality as a substance would shock all our ideas; but many speak of it as a force. *They might with equal propriety hold mortality to be a force!!*

To apply this 'method' to the investigation of any branch of physical science would lead to results anything but scientific. For suppose we are told that the phenomena of light depend upon the undulations of a substance called ether; and we reply, 'This is shocking to all our ideas. You might as well say that *darkness* is due to the undulations of ether.' We should certainly be deemed unworthy of any serious answer. Yet this is a strictly parallel instance.

In like manner, the illustrious German philosopher, Fritz Müller, says that 'we may with equal propriety speak of the *creation* of cholera, of a conflagration, or of a railway collision, as of the creation of man.' Haeckel quotes this[1] as the most crushing of arguments, and one which cuts the ground completely away from all the unbelievers in Evolution! Surely confusion of thought, or perversity of misapprehension, can go no further than this.

These are but a few specimens of the utterly baseless assertions which are made constantly in the interests of the Evolution hypothesis; and of the bald and jejune arguments which are adduced in their sup-

[1] *Op. cit.*, p. 66.

port. It is further said that 'all living creatures, even the highest organisms, including man himself, have been gradually developed from one primary simple form (the *Monera*), or a very few such forms, which were not *created*, but evolved from inorganic matter, by the influence of the ordinary physical forces:'[1] and that, in particular, man is a lineal descendant of the anthropoid apes—'*without any doubt*'—in accordance with the doctrine of natural selection.

When Mr. Mivart sums up his estimate of this doctrine by designating it as a 'puerile hypothesis,'[2] he certainly neither transgresses the bounds of reason nor courtesy. It appears to me 'strange, monstrous, unnatural, and portentous,' that a doctrine which is not supported directly by any one single fact in the whole domain of nature, which is wildly improbable in its principles, and absolutely impossible in its application to details, should occupy the attention of the scientific world, to the exclusion of all others.

It has been justly said that 'there is but one effective mode of displacing an error, and that is to replace it by a conception which, while readily adjusting itself to conceptions firmly held on other points, is seen to explain the facts more completely. The one permanent victory over a false method is by philosophising better.'[3] This is undoubtedly correct as regards science and philosophy in general; but

[1] *Op. cit.*, p. 68. [2] *Lessons from Nature*, p. 300.
[3] *Problems of Life and Mind*, vol. i. p. 7.

it is scarcely applicable to the doctrines in question, inasmuch as they do not deal with facts and phenomena as they do exist, but with such as might possibly exist under undefined and impossible conditions. They constitute mere forms of thought or expression, which have no correlatives in fact or nature; nevertheless, from prestige, and various other adventitious circumstances, they have obtained so firm a hold on the popular scientific mind, that there appears to be no hope for the reception of a truer system of philosophy, and especially of biology, until the modern conjectural 'method' is shown to have no scientific foundation, and to lead to no practical result.

The object of the following chapters is to inquire what support the well-known facts and principles of physical science give to the modern theories of Evolution and Automatism.

CHAPTER II.

THE DOCTRINES STATED.

The 'Belfast Addresses'—Their meaning—Necessary limitations—Outline of the doctrine of Evolution.

THE eloquent and learned address delivered by Professor Tyndall at Belfast, in the autumn of 1874, followed by what was termed the 'brilliant vindication' of Professor Huxley, may be considered to mark an epoch in philosophical thought, as being a full, formal, and public recognition of the doctrine of EVOLUTION carried out to its logical conclusion. This conclusion is precise and intelligible, and may be summed up in two short propositions, the second being the natural and inevitable corollary of the first—

1. MATTER IS ALL-POWERFUL AND ALL-SUFFICIENT.
2. MAN IS ONLY A SENTIENT AUTOMATON.

The enunciation of doctrines such as these, on such authority, and before such an assembly, could not fail to cause great excitement, both amongst the few who think for themselves, and the many who allow others to think for them, and to form their

opinions. And whilst they were received at the time with 'whirlwinds of applause,' and have since been upheld with enthusiasm, as being the 'death-knell of superstition,' and the signal for the 'emancipation of thought,' there have not been wanting earnest and enlightened seekers after truth, wherever it was to be found, who have not only refused to accept this *teaching* and its 'logical consequences,' but have been unable to see in it anything more than a flimsy framework of hypothesis, constructed upon imaginary or irrelevant facts, with a complete departure from every established canon of scientific investigation.

The enthusiasm on the one hand, and the opposition on the other, are sufficiently comprehensible. It is less easy to understand the indignation, the dislike, and the apprehension with which these utterances have been received. Nothing can be more certain than that every man has a perfect right, moral and social, as well as legal, to express before a scientific assembly any opinion that he may hold in science or philosophy. It is, therefore, worse than unmeaning to complain, as certain critics have done, that Professor Tyndall has 'abused his position, as President of the Association,' in enunciating views 'subversive of religion and morality,' as understood by them.

Still more misplaced and illogical is the alarm that has been felt, and expressed in no measured terms, as to the consequences of these doctrines. Two simple reflections might at once set at rest

all these apprehensions. The first is the self-evident consideration that *one truth can never contradict or be opposed to another*, to whatever department of knowledge or belief they may respectively belong. The second is, that statements made, and opinions expressed, on the personal authority only of men of great scientific eminence, are not necessarily scientific truths. The first duty of all thinking men, before expressing adhesion, attempting compromise, or manifesting alarm, is to inquire, 'Are these doctrines *true?*' If they prove after proper investigation to be so, we may certainly leave the consequences to take care of themselves, feeling well assured that they will disturb no other truth in any domain of thought. But in this investigation no amount of mere assertion or authority must be allowed to rank as demonstration or proof.

Professor Huxley, in concluding his very able address, dwells some little time upon the 'logical consequences' of this doctrine, but suggests that any inquiry into these matters should be carried out, irrespective of these. He says:—

> The logical consequences are very important, but in the course of my experience I have found that they were the scarecrows of fools, and the beacons of wise men. Logical consequences can take care of themselves.

Perhaps they can; although the experience is exceptionally fortunate that finds this to be the case. But, however this may be, it is very desirable not

entirely to lose sight of these 'consequences,' seeing that they serve as an incentive to investigation, and also as a preventive to feeble attempts at compromise, and at harmonising views between which there is and must ever be an unresolvable discord—attempts which work nothing but evil to the cause they are intended to serve. The following quotations from Dr. Büchner's 'Force and Matter' (*Kraft und Stoff*) will indicate the tendency of what is to-day called 'philosophical thought':—

That the world is not *governed*, as frequently expressed, but that the changes and motions of matter obey a necessity inherent in it, which admits of *no exception*, cannot be denied by any person who is but superficially acquainted with the natural sciences. (P. 5.)

Matter is the origin of all that exists; all natural and mental forces are inherent in it. (P. 32.)

What this or that man may understand by a governing reason, an absolute power, a universal soul, a personal God, &c., is his own affair. The theologians, with their articles of faith, must be left to themselves. (P. 43.)

Nature, the all-engendering and all-devouring, is its own beginning and end, birth and death. She produced man by her own power, and takes him again. (P. 88.)

There exists a phrase, repeated *ad nauseam*, of 'mortal body and immortal spirit.' A closer examination causes us with more truth to reverse the sentence. The body is certainly mortal in its own individual form, but not in its constituents. It changes not merely in death, but also . . . . during life; however, in a higher sense it is immortal, since the smallest particle of which it is composed cannot be destroyed. On the contrary, that which we call '*spirit*' disappears with the dissolution of the individual material

combination; and it must appear to any unprejudiced intellect as if the concurrent action of many particles of matter had produced an effect which ceases *with* the cause. 'Though' (says Fechner) 'we are not *annihilated* by death, we cannot save from death our previous mode of existence. We return visibly to the earth from which we were taken.' (P. 13.)[1]

Leaving the consequences to take care of themselves, Professor Huxley then proceeds:—

> The only question for any man to ask is this: 'Is this doctrine true or is it false?' No other question can be taken into consideration until that is settled. And, as I have said, the logical consequences of doctrines can only serve as a warning to wise men to ponder well whether the doctrine be true or not, and to test it in every possible direction.

This is a fair challenge, and the issue is simple and direct. *Is this doctrine true?* Not who has said it, or what great authorities have upheld it, or under what overwhelming prestige it has been advanced, or what adventitious support it has received from personal or other sources. Nor, on the other hand, is it the question, 'Is *any other* doctrine, theory, or tradition true or false?' Every other question it is proposed to set aside for the time being, and to inquire solely, 'Is the doctrine of Evolution (of which Human Automatism is the logical outcome) true?'

Perhaps, however, there may be an inquiry worth pursuing for a brief space even before this which concerns the *truth* of the doctrines. We may ask,

[1] English translation, by Mr. J. F. Collingwood.

'Do the sponsors for these statements really mean what their words seem to imply? or are they like children playing in the dark, of whom the bolder and more adventurous take pleasure in practising upon the fears of their weaker companions?'

Professor Tyndall discerns in matter 'the promise and potency of all terrestrial life.' But does he really mean this? It would not have been very surprising if, with his devotion to, and perhaps unrivalled facility for, physical investigation, he had lost sight of another order of phenomena, which cannot be interpreted in terms of matter. But this is not the case. In his essay on 'Scientific Materialism'[1] he distinctly recognises in the facts of consciousness *another* class of phenomena, the connection of which with physics is *unthinkable*, and speaks in set terms of '*two classes* of phenomena' the 'chasm between' which must ever 'remain intellectually impassable.' This reduces the omnipotence of matter to a very innocent cry of 'Wolf.'

It is, doubtless, possible to *assert* that the 'two classes of phenomena' are equally due to matter, although the causative connection between them cannot be traced, or even *thought*; but such assertion must necessarily lack all scientific value. And, indeed, if made, it would be answered by the author himself, far more completely than I could hope to answer it. No longer ago than November 1875 (see

[1] *Fragments of Science*, p. 121.

Fortnightly Review, p. 585), Professor Tyndall quotes and *adopts* the words of Du Bois Raymond, to the effect that 'it is *absolutely and for ever inconceivable that* a number of carbon, hydrogen, nitrogen, and oxygen atoms should be otherwise than indifferent as to their own position and motion, past, present, or future;' and adds, in his own words, that 'the continuity between molecular processes and the phenomena of consciousness . . . is a rock on which materialism must inevitably split, whenever it pretends to be a complete philosophy of the human mind.'

In the same essay (p. 595) the author intimates that if our 'capacities' were 'indefinitely multiplied,' he could *imagine* that we should observe 'not only the vegetable, but the mineral world, responsive to the proper irritants;' in other words, we should find that mere elementary matter is endowed with the attribute of consciousness or sensation. Referring to this, it was recently well and tersely observed by Mr. Martineau, that 'you will get out of your atoms by Evolution exactly so much, and no more, as you have put into them by hypothesis.' I may add that on the same principle we might make any number of baseless assertions on any scientific subject whatever, and defend their obvious inaccuracy on the grounds of the imperfection of our senses or of our instruments of research.

Professor Tyndall again refers (see 'Scientific Materialism,' p. 419) to 'the relation of physics to

consciousness' as being 'invariable.' I have no doubt the writer firmly believes in this assumption; and its assertion on such high authority will weigh powerfully with many; yet it needs no profound acquaintance with modern physiology and pathology to convince us that no such 'invariable relation' can be verified; that, in fact, it does not exist.

Comparing these various utterances, we cannot but see that 'the promise and potency' of life and mind which Professor Tyndall discerns in matter must be understood with many limitations; and that he himself most carefully guards us against attaching to these words a literal significance.

It has, however, been asserted, as supporting this proposition, that 'naturalists *prove* that there are no other forces in nature beside the physical, chemical, and mechanical,'[1] and that therefore all the phenomena of life and mind must be due to them; although, 'as to the *how*, it must be confessed that our knowledge is but scanty.' The latter clause of the sentence is perfectly true; the former stands closely related to most of the assertions on which the modern doctrine of Evolution is built. That some naturalists and (so-called) philosophers *assert* this, with marvellous monotony and perseverance, is true enough; that they *prove* it, that they even make the most distant approach to proving it, is altogether opposed to the truth. I hope at some future time to

[1] Büchner's *Force and Matter*. Preface, p. xxvii.

enter more fully into this subject; at present I content myself with affirming it to be demonstrable that, whatever evidence we may be able to adduce for the existence of matter and physical forces, there is corresponding evidence, at least as strong (I think *much* stronger), for the existence of something, *certainly not material*, in any ordinary or legitimate acceptation of the term, which is antagonistic to matter in its activities, and which we are accustomed to call mind.

Professor Huxley defines man as being 'a conscious automaton;' but, perhaps, lest the assertion should be too strong food for his weaker brethren, he qualifies it immediately by saying that the automaton is 'endowed with free will, in the only intelligible sense of that much-abused term; inasmuch as in many respects we are able to do as we like.' [1]

An 'automaton endowed with free will' is certainly a pleasing and interesting novelty in physical science; and Mr. Huxley deserves great credit for his ingenious invention. It would have been an intellectual treat to listen to him replying to any unfortunate opponent who had committed himself so profoundly. Meanwhile his proposition, taken as a whole, is simply suicidal; for as no one, to my knowledge, ever considered *free will* to signify anything else but the power *to do as we like*, the definition of man as being 'an automaton endowed with free will' leaves him

[1] *Fortnightly Review*, Nov. 1874, p. 577.

exactly where it found him; that is, as an intelligent free agent.

In entering formally upon the proposed inquiry, Are these doctrines true? it will clear the way to ask first, what support they receive (1) from comparative analogies, and (2) from what has been called 'the aggregate common sense' of mankind?

1. It is not easy to find any satisfactory illustration or analogy from comparative anatomy or physiology. Professor Huxley adduces the case of the frog, which can stand, balance itself, jump, avoid obstacles, and perform a variety of acts simulating volition, when all connection between the brain, (the centre of volition) and the limbs, is severed. The facts are interesting; they are also well known, and indisputable; but the inferences from them are hasty and altogether unwarranted. It can by no means follow, that because *certain* acts of some animals *may be* automatic, *all* their acts *are* so.

But even supposing, for the sake of the argument, that this had been proved, that all the motions of a frog in the normal state were automatic, and might, in fact, be performed as well without as with a brain, the question would naturally arise, How far will these experiments and conclusions apply to the higher animals? And on trying the same mode of investigation upon any of the warm-blooded quadrupeds, we should arrive at the absolute certainty that no such results could be obtained. A dog or cat, for instance, will

not live for one moment after division of the spinal cord at its junction with the brain; much less will it perform any quasi-voluntary acts. In these, as in man, under certain diseases or injuries, some simple reflex motions may be elicited; but nothing that resembles complex voluntary action in any way. It has never occurred to any physiologist to doubt that *certain* motions and actions in man are automatic; nor that a much greater proportion of the actions of the lower animals must be considered so; but it would require many intermediate steps of argument to enable us from this to conclude that man is an automaton.

2. What has the 'aggregate common sense' of mankind to say to this question? Does any man's personal experience lead him to the conclusion that he is an automaton? I think not. It is only as a sequel to reasoning, or pseudo-reasoning, that he arrives at this stage of confusion. On the contrary, every sane man knows that, within certain limits, physical, social, legal, and the like, he can exercise a definite power of *choice* as to what he will do, and what he will leave undone. And that this kind or appearance of choice is not delusive, is admitted by Mr. Huxley himself, candidly, even if reluctantly. In his essay on 'The Physical Basis of Life' he confesses that '*our volition counts for something as a condition of the course of events*;' and that this 'can be verified experimentally as often as we like to

try'[1]—so recognising our personal consciousness as authoritative and trustworthy, to this extent;—and, as quoted above, in his latest essay, he allows that 'we are in many respects able to do as we like.'

In what sense, then, are we supposed to be automata? Mr. Huxley seems to be playing a little game of bo-peep with the idea: first, we are automata pure and simple; that we are *conscious* automata is granted, but apparently rather by way of concession to prejudice. Then we find ourselves endowed with free will and power 'to do as we like.' And finally it appears that 'there is no proof that any state of consciousness is the cause of change in the motion of the matter of the organism,' and that 'the feeling we call *volition* is not the *cause* of a voluntary act, but the symbol of that state of the brain which is the immediate cause of that act.'[2]

Some special training in mental gyration is certainly required to enable us to follow, without vertigo, these ever-changing phases of opinion. A plain man, attributing only the ordinary and received meanings to words, might well be justified in asking, 'What does it all mean?'

It is highly desirable, in a case like this, where the general conviction and 'aggregate common sense' of mankind are set aside as untrustworthy, to ascertain in what the *truth* of a doctrine consists, and on what

[1] *Lay Sermons*, p. 145.
[2] *Fortnightly Review*, Nov. 1874, p. 577.

it depends. If assertion and reiteration, on high authority, constitute truth, then are these doctrines very true indeed ; but perhaps that will not be contended. On the other hand, they are not *necessarily* untrue, *because* opposed to the general conviction and consciousness of men. I *think*, for instance, that in any given act, A, I exercise my volition V, to change my place by locomotion, to escape sensation S. But if I am assured that S directly excites in my nervous system the change which effects A, and that my sensation V, which I erroneously suppose to be volition, is only 'a symbol' of the state of brain so produced, I have no absolute and incontestable answer to the allegation, except such as arises from the *dicta* of my own consciousness, and from the testimony of all other men.

In the same way, a person who is generally called 'colour-blind' may tell me that all ripe cherries are of the same colour as the leaves of the tree. I can but reply that I see them differently, and that, with very few exceptions, all men do the same. Should he reply that he and the few exceptions alone see rightly, and that I and all the world are subject to diseased vision, I do not know that the argument could be profitably prolonged. The truth is, that in all such questions as these our ultimate appeal must and will be to the evidences of our own consciousness. It may be proved to us again and again that this evidence is unreliable—that consciousness is liable

to this, that, and the other error, physiologically and pathologically. We know, when we come to reflect, that this much-despised consciousness is at the root of *all* our knowledge and *all* our belief; and that if we propose to reject its testimony, we *pro tanto* close our *only* source of information. A distinguished and learned writer, whom for the present I forbear to name, lately urged the necessity of studying the operations of the mind by investigating the structure and functions of the brain; because, from the unreliableness of our consciousness, no other course offered any hope of success. The idea is amusing, but would have been more practical, had it been further shown how we were to dispense with this unreliable auxiliary. We may for a moment be startled by being told, gravely and authoritatively, that we are only conscious automata, as we should be if assured with equal solemnity that some marvellous change had suddenly occurred in the colour of our skin or hair. But as in the latter case we should look in the glass, and trust implicitly to its evidence as revealed through our consciousness, so in the former, when told that we can neither think, act, nor move, except automatically, we arise and walk, if we so wish it, and our consciousness says, '*Solvitur ambulando.*'

If a speaker in an assembly, or a piece of music in a concert, displease me, I *think* I balance in my own mind the advantages and disadvantages of leav-

ing the room, and *feel* that I act accordingly. If this idea of mine is deceptive, and I am only obeying a state of brain of which my 'supposed volition is a symbol,' I am certainly acting automatically; but in that case it is not true that *my volition counts for anything in the course of events*, which Mr. Huxley asserts to be the case. In regard to any individual act or motion, it is no doubt impossible, except by personal consciousness, to *prove* that it is not automatic; but in that case the suggestion of free will in any form is out of place. On the other hand, if the said act be the result of any intelligible form of volition, it certainly is not the act of an automaton. One or the other view we must adopt; there is no compromise or alternative possible.

The assertion, however, that 'man is but a conscious automaton' does not profess to be based on the results of experience or consciousness, but upon considerations connected with his nature and origin. It is, as stated in the outset, the logical and inevitable corollary of the doctrine of Evolution. If this doctrine, as now held by a large and powerful section of the scientific world, does indeed, as it professes, afford the only possible solution of the various problems of ontology, then it follows naturally and of necessity that matter *is* all-sufficient, and that man *is* an automaton, 'without spirit or spontaneity.' Then is our immortality a dream; volition, choice, and responsibility are mere delusions; virtue, vice, right,

and wrong are sounds without possible meaning; and education, government, rewards, and punishments, are illogical and mischievous absurdities. Let us eat and drink, for to-morrow we shall be carbonic acid, water, and ammonia.

It cannot be too clearly understood that the *consequences* of a doctrine, if true, afford no argument whatever against its acceptance. My reason for briefly enumerating some of them here is, that I have met with many earnest and even educated men who have accepted these doctrines without investigation, *because* propounded on high authority, without reasoning or reflecting what these consequences were, or what is their logical sequel.

It is evident, however, that the importance of these results renders it absolutely necessary to inquire, What is this doctrine? and what is its scientific value? For this inquiry the time is fully ripe. Evolution, which not long ago was modestly, even somewhat timidly, advanced as offering a rational solution of certain natural phenomena, is now boldly set forth, with unlimited pretension, as affording the only possible or thinkable system of nature. The last edition of the gospel of Evolution, the 'Constructive Philosophy' of Mr. Herbert Spencer, is announced as 'stereotyped,' conveying a significant intimation that the system is now complete, and that no further advance in that direction is probable or required; and those who do not accept it are described as only

'those who have not kept pace with the recent advances in natural history,' or 'who have lagged behind in science,' and as generally unworthy of consideration. Evolution, in one word, is the Shibboleth of modern progress.

The question of questions for mankind,[1] (says Professor Huxley) the problem which underlies all others, and is more deeply interesting than any other, is the ascertainment of the place which man occupies in nature, and of his relations to the universe of things. Whence our race has come; what are the limits of our power over nature, and of nature's power over us; to what goal we are tending? are the problems which present themselves anew, and with undiminished interest, to every man born into the world.

By the conclusions of Evolution these problems would appear to be definitively solved. As to man's origin, it is now *known* that he is the last term in a long but uninterrupted series of developments, beginning with 'cosmic gas,' and effected without 'the intervention of any but what are termed secondary causes.'[2] As to his present relations to the universe of things, and his power over nature, he is an automaton, and nothing more than a 'part of that great series of causes and effects which, in unbroken continuity, composes that which is, and has been, and shall be, the sum of existence.'[3] To what goal *the race* is tending is not yet satisfactorily known, but, individually, the man resolves into carbonic acid, water, and ammonia,

[1] *Man's Place in Nature*, p. 57. [2] *Ibid.* p. 108.
[3] *Fortnightly Review*, Nov. 1874, p. 577.

and has no more personal future existence than a consumed candle.

The earliest condition of our world (or universe) presents itself to the 'eye of the imagination' as a vast expanse of 'cosmic gas,' in which it is to be inferred that there exists but one form of matter, and probably only one form of force or motion.

After this we catch glimpses of a 'fiery cloud,' in which 'not alone the more ignoble forms of life, not alone the exquisite and wonderful mechanism of the human body, but the human mind itself—emotion, intellect, will, and all their phenomena . . . all our philosophy, all our poetry, all our science, and all our art—Plato, Shakespeare, Newton, Raphael'—all are supposed to be 'latent' and 'potential.'[1]

Then follows a long period of cooling and contraction, by means of which the crust of the earth is formed, and the once homogeneous matter becomes differentiated by a process to be alluded to hereafter. Watery vapours are condensed; seas, rivers, and lakes are formed; and thus the earth is prepared for the appearance of Life, which is first recognised under the form of sea-slime, or mucus (Oken).

Opinions are not quite in unison as to the mode in which this living mucus or '*protoplasm*' arises; but all are agreed that it is a product of inorganic matter and force without any creative intervention.

[1] Professor Tyndall on the *Scientific Use of the Imagination.*

Oken's account is direct and unhesitating—'*Light shines upon the water, and it is salted. Light shines upon the salted sea, and it lives.*'[1] Perhaps this would scarcely be considered sufficiently explicit as a scientific statement. Mr. Herbert Spencer, the 'Apostle of the Understanding,' as he is termed by Professor Tyndall, is much more circumstantial. Thanks to him, we now know that organisms are 'highly differentiated' portions of the matter forming the earth's crust and its gaseous envelope; and that organisation consists principally in 'the formation of an aggregate by the continued incorporation of matter previously spread through a wider space;'[2] and also that this formation depends upon 'an integration of matter and concomitant dissipation of motion; during which the matter passes from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity; and during which the retained motion undergoes a parallel transformation.'[3]

Professor Fiske finds the development of life to be due to the cooling of our planet, as follows:—[4]

As soon as it became cool enough for oxygen and hydrogen to unite into a stable compound, they did unite to form vapour of water. As soon as it became cool enough for double salts to exist, then the mutual affinities of simple binary compounds and single salts, variously brought into

[1] *Elements of Physiophilosophy*, sec. 905.
[2] *First Principles*, p. 311.
[3] *Ibid.*, *p.* 396.
[4] *Cosmic Philosophy*, vol. i. p. 433.

juxtaposition, sufficed to produce double salts. And so on, throughout the inorganic world.

Here we obtain a hint as to the origin of organic life upon the earth's surface. In accordance with the modern dynamic theory of life, we are bound to admit that the higher and less stable aggregations of molecules which constitute protoplasm, were built up in just the same way in which the lower and more stable aggregations of molecules which constitute a single or a double salt, were built up. Dynamically, the only difference between carbonate of ammonia and protoplasm, which can be called fundamental, is the greater molecular complexity and consequent instability of the latter. We are bound to admit, then, that as carbonic acid and ammonia, when brought into juxtaposition, united by virtue of their inherent properties as soon as the diminishing temperature would let them ; so also carbon, nitrogen, hydrogen, and oxygen, when brought into juxtaposition, united by virtue of their inherent properties, into higher and higher multiples, as fast as the diminishing temperature would let them, until at last living protoplasm was the result of the long-continued process.

If this passage adds little to our knowledge of the origin of life, it certainly illustrates how great an amount of unscientific misrepresentation, and inconsequence of reasoning, can be compressed into a brief space. It is difficult to know or conjecture what meaning the author intends to convey ; for there is certainly no resemblance, either chemically or 'dynamically,' between protoplasm and carbonate of ammonia, except that of their ultimate elements.

Having, however, arrived by this simple and lucid process at the sea-slime, mucus, or protoplasm, there

seems to be no further difficulty or doubt. The *monera* is the first form of individual life, and this 'was formed from inorganic matter' (Haeckel). Then by successive evolutions we pass through amœboids, worms, polyzoa, and ascidians, 'which last produced the two remaining stirpes of the vertebrata and the mollusca.' Amongst the vertebrata are found sundry families of apes, from one of which, the Catarhini, man is directly and lineally descended.

Those who wish to verify this abstract are referred to Dr. Haeckel's 'Natural History of Man,' or to what is more readily accessible to the many, Professor Huxley's excellent review of the same, entitled the 'Genealogy of Animals,' as also to Mr. Darwin's 'Descent of Man.' I have not attempted here to give more than the barest outline of the general idea of the doctrine of Evolution.

From the gravity with which these statements are enunciated, from the vast number and weight of the books written in support of them, and from the enormous amount of learning and research of which they *seem* to be the result, it might well appear as though this were a system founded on knowledge and observation. It is somewhat difficult to realise the idea that all this is but a figment of the imagination; and that at the best it is but a hypothesis, in direct support of which not one single fact in the whole range of natural history or palæontology can be adduced.

It is in this doctrine that is illustrated what Pro-

fessor Huxley calls 'Nature's great progression, from the formless to the formed, from the inorganic to the organic, from blind force to conscious intellect and will.' [1] We find man set forth as a natural and inevitable product of the inorganic world, without 'the intervention of any but what are termed secondary causes,' [2] and necessarily with only such attributes as attach to this material origin. He is an automaton and nothing more.

This is a conclusion summary enough, but the end is not yet. The tendency of Evolution is to reduce all force to one expression or formula, and *that* the mechanical. Mental phenomena are but higher expressions of the ordinary vital and nutritive changes; *these* are but the chemistry of quaternary compounds; and chemical force in its turn is not to be distinguished from mechanical, except under the penalty of sacrificing all claim to enlightened views. In the 'Fortnightly Review' for February 1869 Professor Tyndall says: 'I do not think that any really scientific mind at the present day, will be disposed to draw a substantial distinction between chemical and mechanical phenomena.' And thus the modern school

[1] Professor Huxley makes much grave fun of another well-known formula concerning the 'ordained becoming of organic forms,' which he calls a 'qua-qua-versal proposition,' and remarks thereupon that 'it is the first duty of a hypothesis to be intelligible.' It may perhaps be questioned whether he himself always acts upon this wise maxim, and whether a 'great progression' of this kind is much more intelligible than a 'continuous becoming.' (See *Man's Place in Nature*, p. 106.)

[2] *Ibid.* p. 108.

of philosophy recognises but *one force*; all nature, whether living or dead (if, indeed, there is any difference between the two), is but mechanical.

It appears further, according to this system of philosophy, that not only is there but one force in nature, but there is only 'one ultimate form of matter, out of which the successively more complex forms of matter are built up.'[1] And finally it would seem that matter itself, as generally conceived, does not necessarily exist, but may be only a 'phenomenal centre of energy' or force;[2] and thus we arrive at Cimmerian darkness, where 'naught is everything, and everything is naught.'

This, although a meagre and bare, is, I believe, a tolerably faithful, outline of a system, which is now '*known*' to afford the only possible solution of the mystery of the universe—a conclusion the grounds of which 'will never be shaken,'[3] a doctrine not founded 'on the basis of vague conjecture, but of *positive knowledge*.'[4] It is contrasted with the doctrine of 'special creation,' by Mr. Herbert Spencer, much to the disadvantage of the latter; and the comparison concludes thus:—

The belief which we find thus questionable, both as being a primitive belief and as being a belief belonging to

[1] Herbert Spencer's *Principles of Psychology*, vol. i. p. 155.

[2] Matter is only a '*hypothetical* cause of states of our own consciousness.'—*Physical Basis of Life*, p. 143.

[3] Darwin's *Descent of Man*, vol. ii. p. 385.

[4] Professor Tyndall's *Belfast Address*, p. 5.

an almost extinct family, is a belief that is not countenanced by a single fact. No one ever saw a special creation; no one ever found proof of an indirect kind that a special creation had taken place. It is significant, as Dr. Hooker remarks, that naturalists, who suppose new species to be miraculously originated, habitually suppose the origination to occur in some region remote from human observation.'[1]

If this be intended for argument, it is certainly double-edged. Did any one ever see an organic Evolution? or did anyone ever see *proof* of such an Evolution having taken place? The answer must be No! however circuitous and veiled it may be. In the remaining allegation there is an unconscious and childlike innocence that almost disarms criticism. The system that demands 'ten or a hundred thousand generations' for the development of the distinguishing characters of a single species, and a world so different from its present state that not even a trace of its existence remains, can scarcely object logically or consistently to the relegation of certain phenomena to a 'region remote,' whether in time or in space.[2] And with all this, those who do not or cannot accept this Evolution doctrine, are denied the possession of the very faculties of thought or belief. To anyone who says that he *thinks* the universe was created, Mr. Spencer

[1] *Principles of Biology*, vol. i. p. 336.

[2] 'If it were given to me to look beyond the abyss of geologically-recorded time, to the still more remote period when the earth was passing through physical and chemical 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 protoplasm from not-living matter.'—Professor Huxley's *Critiques and Addresses*, p. 239.

replies, 'No! you do not think so, for such a doctrine is not thinkable.' And to those who say they *believe* in a Creator and a creation, Mr. Spencer replies, 'No, you do not believe, you only believe you believe.'[1] Surely this is the very Dundrearyism of philosophy.

But it is far from my present object to discuss or uphold the theory ('if it can be so called') of creation, or of any other system of ontology, in opposition to Evolution. Creation is no more accessible to proof 'from experimental demonstration' than is Evolution. It is not a *scientific* doctrine, and those who believe in it do so on far other than scientific grounds. The question is not whether the doctrine of Creation is tenable or otherwise, but whether that of Evolution is true or not.

It is not altogether easy to approach this question so as to obtain a decisive answer. If we treat it as a scientific inquiry, and ask for some confirmatory evidence, we are told, almost plaintively, that 'the strength of the doctrine of Evolution consists not in an experimental demonstration.'[2] If we further inquire how it is to be approached, and in what its strength *does* consist, we fail to get any definite answer, except some vague statement as to 'its general harmony with scientific thought.' Indeed, the attitude of Evolution is entirely exceptional. It seems to be taken for granted that the doctrine possesses

[1] Vide *Principles of Biology*, vol. i. p. 337.
[2] Professor Tyndall's *Belfast Address*, p. 58.

some esoteric and mysterious principle of vitality and credibility, which makes it independent of any support from science or certain knowledge. We have a right, however, to expect, if it be a true philosophy, that whenever it comes into relation with the results of observation and experience, it shall not be found *opposed* to these. How far this is the case further inquiry will show.

CHAPTER III.

THE PHYSICAL BASIS OF LIFE.

Mr. Herbert Spencer's Philosophy—Professor Huxley's Doctrine of 'Protoplasm.'

THE first question that arises then is this: *Is it true* that there is originally but one form of matter? Mr. Herbert Spencer says that there is 'reason to suppose' so; and that 'by the different grouping of units, and by the combination of the unlike groups each with its own kind, and each with other kinds, it is supposed that there have been produced the kinds of matter we call elementary.'[1] The '*reason* to suppose' all this, and the subsequent *supposing* of it, seem to exist only in Mr. Spencer's own mind; and to have their *raison d'être* in the exigencies of the 'constructive philosophy.' It is known to chemists that a very few of the now supposed simple bodies may be *suspected* to be compound, as one or two of the gases and some less known bodies; but I have never heard of any 'reason to suppose' that iron, phosphorus, iodine, and gold were composed of different arrangements of the

[1] *Principles of Psychology*, vol. i. p. 155.

same units since the time when alchemy gave place to chemistry.[1] A captious person might perhaps be disposed to ask, also, how it happened that with one form of matter and one force any 'different groupings' or 'further combinations' could possibly occur. But this would doubtless be dismissed as a frivolous detail.

An excellent illustration is afforded by this subject of the mode in which the 'constructive philosophy' is built up, and of the gigantic strides that are taken from conjecture to certainty in the interests of the Evolution hypothesis. Mr. Spencer having seen '*reason to suppose*' such and such things, as already quoted, in the very next paragraph, and without adducing any proof whatever, treats these suppositions as ascertained facts, and proceeds to build upon them as if they were solid foundations of scientific truth in this wise: 'If, then, WE SEE (!) that by unlike arrangements of like units all the forms of matter, apparently so diverse in nature, may be produced,' &c., &c. A curiously similar instance of *evolution* of truth occurs in Professor Tyndall's essay on 'Scientific Materialism.' In one sentence ('Fragments of Science,' p. 120), he states that 'we should, on philosophic grounds, *expect to find*' such and such physical conditions; and in the next commences an induc-

[1] Büchner, a most thoroughgoing Evolutionist, affirms on the contrary, that 'nitrogen, carbon, hydrogen, oxygen, sulphur, and phosphorus possess their inherent qualities from eternity'—implying by this that all the elementary bodies are eternally different.

tion from the same, with the phrase, 'The relation of physics to consciousness *being thus* invariable!' —a relation which, as I have above pointed out, does not exist in any demonstrable form, if at all. Such being the received method of evolving science out of personal consciousness at the present day, it ceases to be subject for surprise that so many volumes of such portentous dimensions should have appeared, containing so little absolute addition to our certain knowledge of nature.

Is it *true* that there is but one form of force; that chemical and mechanical forces are fundamentally the same? Generalisation is very pleasant, very attractive, and very philosophical when it is legitimate, and when the resultant formula covers and includes *all* the phenomena treated of; but it is eminently injurious to the advancement of knowledge if these conditions be not fulfilled; when from detached facts a desperate guess is made at analogies and resemblances which do not exist in nature. It may be fairly questioned whether we are not getting on too fast, and whether true science will not rather be hindered than advanced by such rash leaps in the dark. For what advantage is it to us to say that chemical force is mechanical in its operation, if we have at the same time to explain that it is something different? Surely this tends to great confusion of thought as well as of verbiage. If we fasten together two plates of iron with screws or rivets, we *call* the union mechanical. If we dissolve

these iron plates in mineral acids we *call* the process chemical. It is certainly convenient to know by different names processes that differ so much; and until their virtual identity is much more clearly demonstrable than it is at present, the advantage of further generalisation is problematical.

But both in this order of phenomena, and in some others to be noticed hereafter, the authoritative statements as to 'identity' of matter, force, or essence, are so extraordinary, and so impossible to be received or comprehended by the ordinary intelligence, that some special theory seems to be required to account for them; and I would venture to suggest one that would perhaps remove many difficulties and misunderstandings. I cannot but suppose that with a new philosophy there has arisen a new language or terminology, in which words have not the same meaning as they formerly had. One illustration will explain the bearing of this theory. On February 2, 1871, Professor Tyndall delivered a discourse at the Royal Institution on 'The Identity of Light and Radiant Heat.' The lecture was, as usual, interesting in the extreme; and the experimental illustrations were of the most brilliant and striking order. But a considerable part of these illustrations were absolutely dependent upon the *differences* that exist between light and radiant heat, as in the following experiment:—

A horizontal beam of light was reflected upwards by a

plane mirror, and when *the light was cut off* by the introduction of the opaque cell a *powerful beam of reflected heat was proved still to remain.* The luminous beam was then totally reflected to a horizontal direction; the light was again cut off, and a powerful deflection of the galvanometer needle was obtained by the *residual* heat-beam.[1]

In this, and several other experiments to show *identity*, we saw the beam of heat separated from the beam of light by *reagents*, so to speak; radiant heat would pass where light would not, and so on.[2] I conclude, therefore, that words of this kind have now a different signification to that which they formerly possessed, and that when Professor Tyndall speaks of chemical and mechanical forces being substantially the same, he intends to imply that they are as different as they well can be; and in like manner when, as we shall find shortly, Professor Huxley can see *no difference* between the formation of water from its elements under the influence of the electric spark, and the assimilation of carbon, hydrogen, oxygen, and nitrogen by a living organism, it may be that he intends to imply that the two processes are utterly and irreconcilably different,—in which he will be quite correct.

But the real question as to the *truth* of Evolution commences at the next step in 'Nature's great pro-

[1] *Proceedings*, 1871, p. 419.

[2] Professor Tyndall explained, in his treatise on *Light*, published in 1873, that when he said 'identity,' he did not mean identity in 'all respects.'

gression,' that is, in the progression from the inorganic to the organic. Of this part of the doctrine Professor Huxley is the best-known and most distinguished exponent. He claims no originality for the idea of Protoplasm as the 'Physical Basis of Life;' but he has made it all his own, and inseparably associated it with his name, in England at least, by the inimitable charm of style, and the marvellous fertility of illustration with which he has invested it, in the well-known essay in the 'Fortnightly Review' for February 1869. This essay was written, as it appears, with the double object of showing[1] that all life, activity, and intelligence, are solely due to the arrangement of the molecules of ordinary *matter*—and that *materialism* has no sound philosophic basis. In Professor Huxley's essay on the 'Genealogy of Animals,' he thus states the 'fundamental proposition of Evolution': 'That proposition is, 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 nebulosity 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 the properties of the molecules of that vapour, have predicted, say the fauna of Britain in 1869, with as much certainty as one can say what will happen to the vapour of the breath in a cold winter's

[1] See *Yeast*, p. 90.

day.' And yet Professor Huxley 'repudiates' the materialistic philosophy, and states in 'Yeast' that one great object he had in view in writing his essay on the 'Physical Basis of Life' was to 'show that what is called Materialism has no sound philosophic basis!' His mode of reconciling the latter proposition with the former will appear hereafter; the doctrine in question is as follows:—

The Physical Basis or Matter of Life is '*Protoplasm.*' This is composed 'of ordinary matter, differing from it only in the manner in which its atoms are aggregated, and is again resolved into ordinary matter when its work is done.'[1]

> The matter of life . . . breaks up . . . into carbonic acid, water, and ammonia, which certainly possesses no properties but those of ordinary matter. . . . Carbon, hydrogen, oxygen, and nitrogen are all lifeless bodies. Of these carbon and oxygen unite in certain proportions, and under certain conditions, to give rise to carbonic acid; hydrogen and oxygen produce water; nitrogen and hydrogen give rise to ammonia. These new compounds, like the elementary bodies of which they are composed, are lifeless. But when they are brought together, under certain conditions, they give rise to the still more complex body, protoplasm; and this protoplasm exhibits the phenomena of life.
>
> I see no break in this series of steps in molecular complication, and I am unable to understand why the language which is applicable to any one term of the series may not be used to any of the others.
>
> When hydrogen and oxygen are mixed in a certain

[1] P. 136. This and the following references are to the pages in the original essay in the Review above-mentioned.

proportion, and an electric spark is passed through them, they disappear, and a quantity of water, equal to the sum of their weights, appears in their place.

Is the case in any way changed when carbonic acid, water, and ammonia disappear, and in their place, under the influence of pre-existing protoplasm, an equivalent weight of the matter of life makes its appearance?

If scientific language is to possess a definite and constant signification whenever it is employed, it seems to me that we are logically bound to apply to the protoplasm, or physical basis of life, the same conceptions as those which are held to be legitimate elsewhere. If the phenomena exhibited by water are its properties, so are those presented by protoplasm, living or dead, its properties.

If the properties of water may be properly said to result from the nature and disposition of its component molecules, I can find no intelligible ground for refusing to say that the properties of protoplasm result from the nature and disposition of its molecules.[1]

This, then, assumes to be a scientific statement, clothed in 'scientific language,' and, as such, it is amenable to ordinary investigation as to its accordance with, or departure from, the known facts of science. I have quoted it at length, first, because it is rarely that in the history of Evolution we are brought face to face with anything that resembles *science*; and secondly, because it is the most important link in the chain of the doctrine, and with the demonstration of

[1] In Professor Huxley's essay on *Yeast* (see *Critiques and Addresses*, p. 90), he denies ever having 'said anything resembling' the assertion that 'life matter was due only to chemistry'—and that such an assertion would be 'absurd!!' The latter part of the statement is certainly true.

its truth or error Evolution stands or falls. If we are compelled to acknowledge the formation of living from non-living matter, by ordinary chemical affinities, Evolution has made good its position—all the rest is mere detail—and man *is* an automaton, 'without spirit or spontaneity.' If, on the other hand, it can be demonstrated that there is, and can be, no truth in this part of the doctrine, Evolution has no *locus standi*, and must relinquish all pretension to existence as a scientific hypothesis. To this statement of Professor Huxley's, then, I propose to apply the test suggested by himself, and inquire, '*Are these doctrines true?*'

I know of no form of negation sufficiently explicit, comprehensive, and emphatic, in which to reply to this question. The doctrines as here stated are so utterly at variance with the most familiar facts of chemistry, that it is marvellous they should have so long passed unchallenged—that is, on purely chemical grounds. On other issues, both relevant and irrelevant, they have been often objected to. If Professor Huxley expresses an *opinion* on a matter of science or philosophy, it is doubtless worthy of all consideration, *as such*, but if he makes a scientific statement, couched in 'scientific language,' then it is as open to scientific criticism as if the veriest tyro had said it.

To enter into detail: it is in no sense true that protoplasm 'breaks up' into carbonic acid, water, and ammonia, any more than it is true that iron, when exposed to the action of oxygen, 'breaks up' into

oxide of iron. A compound body can only break up into its constituent parts; and these *are not* the constituent parts of protoplasm. To convert protoplasm into these three compounds requires an amount of oxygen *nearly double the weight* of the original mass of protoplasm; speaking approximately, every 100 lbs. of protoplasm would require 170 lbs. of oxygen.

Under *no possible 'conditions'* can carbonic acid, water, and ammonia, when brought together, 'give rise to the still more complex body, protoplasm.' Not even on paper can any multiple, or any combination whatever of these substances, be made to represent the composition of protoplasm, much less can it be effected in practice. Carbonic acid ($C O_2$), water ($H_2 O$), and ammonia ($N H_3$) cannot by any combination be brought to represent $C_{36} H_{26} N_4 O_{10}$, which is the equivalent of protein or protoplasm.

But the most incredible of all the errors, if it be not simply a mystification, is found in the comparison between the formation of water from its elements, and the origination of protoplasm. Hydrogen and oxygen doubtless unite to form an equivalent weight of water; that is, an amount of water equalling in weight the combined weights of the hydrogen and the oxygen; and Professor Huxley asks, 'Is the case in any way changed when carbonic acid, water, and ammonia disappear, and in their place, under the influence of pre-existing protoplasm, an equivalent weight of the matter of life makes its appearance?'

The answer is, Certainly ; the case is changed in every possible way in which a process, whether chemical or otherwise, can be changed. But it must also be premised that the fact, as stated, is *not true* ; that when these three substances disappear under certain conditions, an '*equivalent weight* of the matter of life makes its appearance.' Every chemist knows what an 'equivalent weight' means,—knows also that there can be no weight of protoplasm 'equivalent,' chemically speaking, to any amount of carbonic acid, water, and ammonia, that may or can have disappeared. These are simple, well-known, and understood chemical facts, and need no discussion. But granting for the moment, and for the sake of argument, that these bodies disappear, and that protoplasm appears, it is manifest—almost too manifest to require stating—that there is *no resemblance whatever* in the two processes by which the results, which Professor Huxley considers identical, are obtained. In the formation of water the whole of its constituent parts combine to form an equal weight of the compound ; the case is entirely otherwise with regard to protoplasm, for here the so-called elements *do not combine at all.* On the contrary, they are uncombined or decomposed, by a process and by affinities most assuredly unknown in our laboratories. The carbonic acid and the ammonia are certainly decomposed, and whilst the carbon and nitrogen are assimilated, and add to the bulk of the plant, part of the oxygen is eliminated by the leaves,

and part is destined to the performance of various functions in the economy.

Yet we are invited to see in this complex programme of decomposition, selection, fixation, and rejection only a process analogous to the formation of water from its elements; and Professor Huxley can see '*no break*.' It might be interesting to inquire how wide a chasm must be before it is visible to an Evolutionist; and in the subsequent part of the inquiry it is probable that further illustrations will be met with of the Emersonian axiom, that 'the eye sees only what it brings with it the power of seeing.'

But what especially and generically distinguishes the formation of protoplasm from all these chemical processes is, that it is never formed except under the immediate contact and influence of pre-existing and living protoplasm.

It is this which constitutes the 'break' that Professor Huxley cannot see. It is this appearance of an *entirely new* and distinct order of affinities, that annuls the force of Professor Tyndall's truly elegant and powerful illustration, of a curve whose elements have been determined 'in a world of observation and experiment,' being prolonged into 'an antecedent world'—whence we 'accept as probable the unbroken sequence of development from the nebula to the present time.'[1] There is, there can be, no one curve the elements of which will comprehend the phenomena of

[1] *Scientific Use of the Imagination.*

matter, of life, and of mind. There is no transition from one order of activity to the other; there is no 'great progression from the inorganic to the organic.' To say otherwise is mere waste of time in asserting what is at once incapable of proof, and at variance with all known facts.

How such doctrines came to be received, can only be accounted for in Professor Huxley's own words, when treating on some other antagonistic 'teaching,' which he says was only 'tolerable on account of the ignorance of those by whom it was accepted.' Referring to some anatomical question, he says further that 'it would, in fact, be unworthy of serious refutation, except for the general and natural belief that deliberate and reiterated assertions must have some foundation.'[1] It is by this time tolerably clear that Professor Huxley's 'Chemistry of Life' has no foundation except that of 'deliberate and reiterated assertion.'

If such be the case with the chemistry, what is to be said for the argument founded upon it, or attached to it—if, indeed, argument it can be called? Seeing 'no break' in the processes by which life is evolved from inorganic matter, Professor Huxley jumps to the conclusion that we are no more justified in speaking of 'vitality' than we should be in speaking of 'aquosity,' thus overlooking the most obvious necessity for distinguishing between things that differ. Water has none but physical properties, or, in

[1] *Man's Place in Nature*, p. 85.

Professor Huxley's own words, none 'but those of ordinary matter;' therefore we require no special term to express succinctly the sum of its properties. If we did, 'aquosity' would be perhaps as good as any other. But a living organism has certainly some properties or functions which are materially different from those of 'ordinary matter,' *in addition to* those which it possesses as a chemical compound merely—that is, it *has* its mechanical and chemical relations, but it also has *something else.*

And here arises the distinction: we do not speak of 'vitality' so long as we discuss protoplasm only in its physical and chemical relations, but when in addition to these it has life, we require something to express that life, and we call the sum of its functions its 'vital properties.'

Names are to know things by. We are accustomed to call a certain class of forces 'mechanical,' and in general we understand what is meant by the term. When we meet with other manifestations of force, apparently differing from these in energy, complexity, and what we might also call *origination*, in a *motor* aspect, we call these chemical, electrical, magnetic, and the like. Doubtless these are closely inter-related, and it *may be* also that they are 'substantially' mechanical, according to Professor Tyndall's opinion. But it would not tend to clearness of thought, nor yet to comprehensibility of scientific language, to speak of the induced electric current as

a mechanical phenomenon ; nor of the effervescence of chalk on the addition of a strong acid as a magnetic manifestation.

Further, when we meet with phenomena indicating forces still more complex, still more active, and even *suggesting* spontaneity, we are not satisfied to sum these up under a category especially adapted to express only a simpler and lower order of energies. It appears unsatisfactory to call them chemical, electric, or magnetic, until we can demonstrate how these forces are disposed or combined so as to produce the complex manifestations of contraction, nutrition, and reproduction, to say nothing for the present of thought, sensation, and will. We want another and more specific name ; and inasmuch as these acts are *essentially* and *exclusively* the acts of living matter, we call the *sum* of such actions 'vitality,' and the forces which immediately preside over their production 'vital' or 'organic.' Moreover, until their identity with the forces of inorganic nature can be demonstrated, or inferred on some better ground than vague conjecture, reckless assertion, or hasty generalisation, we think ourselves authorised to believe in some essential difference. Vital or *organic* force or affinity is at least as different from chemical or magnetic force or affinity, as these are from those of a mechanical order.

I have said '*as* different ;' but this does not express the whole idea. Mechanical force is convertible

into all the others, under certain limitations, and the more active forces are all convertible into the mechanical. But by no means are we able to convert any of these forces into the higher order of energy that we have called 'vital.' Even this is not all: not only are we unable to produce *living* force, but we are unable to make a combination of *non-living* matter out of inorganic elements, resembling in any way matter that may or can live. Supposing protoplasm to be only a chemical compound—which is not impossible—the affinities whereby it is held together belong to a chemistry, of which we *know nothing*. We can decompose it into what we are pleased to call its elements, but it has never been re-formed, except under the direct agency of *actually living* protoplasm; and thus we are indebted not only for all organisation, but for all organisable matter, to *an original, specific, and self-propagating endowment*. It is of small moment what this endowment, which we ever and entirely fail to imitate, is called. It is sufficient for us to know that, so far as our present knowledge extends (and we have no right to dogmatise on conjecture), it differs infinitely more from chemical or electric force, than these differ from each other, or either of them from the mechanical. For anything I can see, the old expression 'vital force' is as good as any other. In any case the difference is specific, and not one of degree merely; and it is no part of true philosophy to overlook such distinctions, or to ignore

them, to satisfy the exigencies of a formula or a creed.

This inability to construct organisable matter (say protoplasm) out of its elements, is without doubt a recognised difficulty in the way of the absolute demonstration of Evolution. What is the usual answer to it, or method of meeting it? Professor Huxley rather ignores it; but Mr. Herbert Spencer feels that it must be met, with some form of words at least, and his followers copy him verbatim. He says:—

'The chasm between the inorganic and the organic is being filled up. On the one hand, some four or five thousand compounds, once regarded as exclusively organic, have now been produced artificially from inorganic matter; and chemists *do not doubt their ability* [1] so to produce the highest forms of organic matter. On the other hand, the microscope has traced down organisms to simpler and simpler forms, until in the *Protogenes* of Professor Haeckel there has been reached a type distinguishable from a fragment of albumen only by its finely granular character.' [2]

It seems incredible that this should be intended for serious argument. Does not every candid observer know that this said 'chasm' is not in any way 'being filled up;' and that the chemist could quite as easily construct a full-grown ostrich, as this despised bit of finely granulated albumen? And as for the 'four or five thousand compounds,' as well might the goldsmith

[1] There are men who '*do not doubt their ability*' to square the circle; but this confidence in their own powers is not generally supposed to entitle them to the rank of great mathematicians.

[2] *Principles of Psychology*, vol. i. p. 137.

say that he did not 'doubt his ability' to make gold out of a baser metal, because he had already moulded it and coloured it in four or five thousand different fashions. It is true that systematic writers on chemical science divide their subject into 'organic' and 'inorganic;' and also that, according to the individual views of the writer, many compound bodies are placed in one or other division interchangeably. It is further true that of late years many bodies once supposed to be exclusively of *organic origin* have been artificially formed. But it is not in any sense true that any substance even distantly resembling *organisable* matter has been formed. The line of demarcation is as wide as ever. For what are these 'organic' matters said to have been formed from their elements? They are chiefly binary and ternary compounds, as cyanogen, urea, certain acids of the compound radical class, some alcohols, ethers, and the like. Not one of them bears the most remote resemblance to anything that *can live.* Few of them contain nitrogen, and these few, chiefly *amides*, are only combinations of ammonia or ammonium with other binary or ternary compounds, and can only by courtesy or convention be allowed to be of 'organic' nature. Neither chemically nor physically are they in any way allied to viable matter. One least particle of albumen, granulated or otherwise, would be a thousandfold more crushing answer to the opponents of Evolution than myriads of such compounds.

If rightly considered, the very success of modern chemistry in this domain, whilst an impassable barrier still prevents any progress towards the construction of *organisable* matter, should lead us to the conviction that the affinities of life and living matter belong to a chemistry of which we know nothing, and which we shall in vain strive to imitate.

Let the matter be disguised or slurred over as it may, the fact remains, that we are utterly unable to imitate vital affinity so far as to make a bit of material ready for its use, or even to make any definite substance that will have similar chemical relations. But even could this be done, a further difficulty would remain—how to breathe into this dead matter the breath of life. We can neither give life to previously inert matter nor can we restore the life that has, however recently, left the organism. Living tissue, once dead, is dead for ever, as regards the individual organism.

> If I quench thee, thou flaming minister,
> I can again thy former life restore,
> Should I repent me ;—but once put out thine,
> Thou cunning'st pattern of excelling nature,
> I know not where is that Promethean heat
> That can thy light relume. When I have plucked
> thy rose,
> I cannot give it vital youth again :
> It needs must wither.

Yet against those who see something more than chemistry, magnetism, electricity, and mechanics in the

affinities that hold together organic bodies, modern physiology launches the scathing sarcasm, that we might as well talk of a 'steam-engine principle,' a 'watch principle,' or a 'railroad principle' as of a vital force or principle. And Professor Huxley inquires with like pungency:—

> What justification is there, then, for the *assumption* of the existence in the living matter of a something which has no representative or correlative in the not-living matter that gave rise to it? What better philosophic status has *vitality* than *aquosity*? And why should *vitality* hope for a better fate than the other *itys*, which have disappeared since Martinus Scriblerus accounted for the operation of the meat-jack by its inherent *meat-roasting quality*, and scorned the *materialism* of those who explained the turning of the spit by a certain mechanism, worked by the draught of the chimney? (P. 140.)

This is very amusing—no one can be more so than Professor Huxley;—a little perception of facts and analogies would make it perfect. To all this the answer is obvious, if answer is required. All these are machines which man has made, and can again make, by the use of well-known forces and materials which he can combine at will; it is not therefore necessary to hypothecate any other force or principle. When man can make any, even the simplest organism, out of inorganic matter, then shall we be compelled to acknowledge that chemical and other forces are sufficient, and that the hypothesis of a vital principle has had its day and may cease to be. To Professor Huxley's

illustration I will respond seriously, when he has demonstrated to me that meat-jacks have been developed from the beginning of time, only and exclusively under the immediate contact and influence of pre-existing and actively working meat-jacks. Until then the analogy is scarcely close enough to need refutation or discussion.

Professor Huxley acknowledges candidly (p. 140) that 'the influence of pre-existing living matter is something quite unintelligible;' but, he adds, as if this were a complete answer by analogy, 'does any one *quite* comprehend the *modus operandi* of an electric spark which traverses a mixture of oxygen and hydrogen?' I suppose no one knows better than himself that the two cases are utterly distinct, and afford no illustration whatever one of the other. Certainly we *do not* comprehend the action of the electric spark, any more than we comprehend the essential nature of any affinity or force whatever. But we know that we can at will evoke and use the electric spark, in much the same way as we can utilise any other chemical agency. We can use it to combine the oxygen and hydrogen, and so form an equivalent of water; and by decomposing this water, with adequate adaptations, we can reproduce the same amount of the constituent parts, and liberate again the same amount of electricity, which can be used again and again indefinitely, making due allowance for the imperfection of our instruments. Can this be done with an organism? Can we arrest or store up

the organic force as it departs in the death or decomposition of an organism? Can we make the faintest or most distant approach to this? Professor Huxley knows that we cannot. He knows that not only is the action of a living organism 'something quite unintelligible,' but that it is unintelligible in a mode, and in a region of thought, quite apart from the unintelligibility of ordinary chemical or electrical affinities. To persist in saying, then, that vital force is nothing different from ordinary physical and chemical agencies, except perhaps in complexity, whilst confessing that it is 'quite unintelligible,' cannot be considered as a 'scientific statement clothed in scientific language,' but must be estimated as of the same value as the assertion so perseveringly enunciated by Mr. Pulvermacher, that 'Electricity is Life.'

But I think that the utterly fatal flaw in the physical theory of life, as set forth by Professor Huxley, is found in the considerations respecting *dead* and *living* protoplasm. The learned professor speaks of dead matter of life and living matter of life; he speaks of mutton as 'once the living protoplasm,' now the 'same matter altered by death' and cookery, but as not being by these alterations rendered 'incompetent to resume its old functions as matter of life' (p. 137). He speaks of its being subjected to '*subtle influences*' which 'will convert the dead protoplasm into the living protoplasm'—which will 'raise the complex substance of dead protoplasm to the

higher power, as one may say, of living protoplasm' (p. 138). All this is dwelt upon at some length, but not a hint is given that there is any difference in chemical constitution, or in 'arrangement of molecules' between the dead and the living; and indeed when it is alluded to at all, the idea is pronounced 'frivolous' (p. 135), unless I misapprehend the meaning of the writer's rather obscure and perhaps '*quâquâversal*' expressions.

Here, then, we enter upon a dilemma. The properties of protoplasm are said to be dependent altogether, as we have seen, upon the arrangement of its constituent atoms. But we find protoplasm in one condition manifesting only *passive* properties; and again, without any change, i.e. any known or knowable change, in its chemical properties or arrangement of particles, we find it exercising a vast variety of *active* properties, as assimilation, contraction, and reproduction; not to mention thought, feeling, and will. We have then an effect, nay, a whole train of marvellous effects, *without a cause*—a conclusion that the most enthusiastic Evolutionist would scarcely pronounce to be in 'harmony with scientific thought.' And from this dilemma we cannot escape, unless either by hypothecating a change, mechanical or chemical, of which, by Professor Huxley's own confession, we can possibly know nothing (p. 135), and on which 'we have no right to speculate'—or else by confessing that these '*subtle influences*' of which we have heard are only

another name for that *vital force or principle*, in which it is now so unfashionable and so unscientific to believe.

Had we not been assured on the highest authority that the principles of Evolution are founded 'on *certain knowledge*,' and also that these foundations could 'never be shaken,' we should have perhaps seen ground to suspect that this appeal to 'subtle influences,' to eke out a process that had been proclaimed with a sound as of many trumpets to be only chemical and mechanical, was merely an attempt to evacuate an untenable position with the honours of war—a somewhat ignominious giving up of the entire question. But Evolution is forbidden to be judged by any ordinary standard: it has privileges, a language, and an inviolability all its own; and those who think or believe otherwise, do not, as we have before seen, think or believe at all, but only think they think, and 'believe they believe.' [1]

One further consideration will aptly conclude this division of the subject. It has been urged, and it is granted, that the protoplasm, cell, or plasma is, in form and chemical composition, apparently identical in all living creatures. Is not this in itself a most pregnant and significant fact, as indicating that there

[1] It is interesting to know also that they lie like 'strangled snakes' around the cradle of this science; by the side of which stands the 'Majesty of Fact!' (see *Lay Sermons*, pp. 278, 279); and, on the authority of the learned and modest Dr. Büchner, that they are 'speculative idiots.'

is, beyond all our visual or chemical investigations, a distinct and special endowment in operation, of which we know absolutely nothing? For whilst it is true that man can 'assimilate lobster,' and the lobster can 'return the compliment' and assimilate man, it is equally true that the assimilated matter is converted into another and special form of plasma, destined to the performance of the most diverse and varied functions, according as it enters into the composition of the lobster or of man. Here, then, appears the knot of the whole question. All the activities of life (it is said) arise solely from 'the arrangement of the molecules of ordinary matter;' and here we have two such arrangements, in which there is 'no substantial difference,' manifesting a variety of functions, almost infinitely removed from each other in the two cases; for whilst the functions of the lobster protoplasm may be fairly summed up, as proposed, under the 'three categories' of 'nutrition, motion, and reproduction of the species,' the *same* protoplasm in man is found subservient to the manifestation of the 'higher faculties' of 'intellect, feeling, and will.' This might appear conclusive as to the existence of something beyond chemical and mechanical 'aggregation of atoms' as influencing the dynamic properties of life-matter; but Professor Huxley, whose resources are inexhaustible, cuts the knot by the summary declaration that '*all* the multifarious and complicated activities of man are comprehensible under these

categories,' nutrition, motion, and reproduction; and that these are 'substantially one' with, and include, 'those manifestations of intellect, of feeling, and of will, which we rightly name the higher faculties' (p. 130).

How this most marvellous proposition is elaborated and vindicated, will afford matter for future consideration.

CHAPTER IV.

HUMAN AUTOMATISM.

Arguments from Pathology; from Comparative Anatomy; and from Physiology—Physicism and Automatism—Professor Huxley's 'three-fold unity'—His chemical theories—Materialism—Conclusion.

DOCTRINES which, like those under discussion, reject the ultimate *data* of consciousness as untrustworthy, oppose the aggregate convictions and experience of men, and ignore the fundamental principles upon which society is constituted, are not *necessarily* to be rejected as false for these reasons, nor on account of any other 'logical consequences' whatever, however serious they may appear; unless such consequences involve a *reductio ad absurdum aut impossibile.* If science declares them true, they *must* be accepted as such, *ruat cælum*; there is no appeal. But if they are only advanced on the authority of *scientific men*, however eminent, the case is different. They *may* still be true; there is a certain presumption in their favour; but to ensure acceptance they must be supported by irrefragable scientific *proof.*

Professor Huxley affirms the Automatism of man; and brings to the support of his views a wealth of

learning and illustration, a force and grace of style, and a dialectic skill, which make him a most formidable champion of any doctrine that he may propound. His arguments are chiefly derived from four sources: (1) from physiology, in relation to molecular changes in nerve and muscle, during action; (2) from pathology, as illustrated by the case of the 'French sergeant'; (3) from comparative physiology, as in certain automatic actions of the frog; and (4) from considerations connected with man's origin and history.

If, in this discussion, precedence and prominence have been given to the last division of the argument, it is for this reason, that this alone can lead to a final and decisive result. The greater includes the less; and the doctrine of Evolution, if itself demonstrated, will prove all that the rest could hope to accomplish, and very much more. The history of the frog gives an instructive and interesting view of Automatism in a concrete form, but has no bearing upon general action. The case of the French sergeant is full of interest and mystery; but will afford at least *as* powerful an argument against general human Automatism, as in its favour, as may be inferred from the following extract from his history. He had been wounded in the head, and had been paralysed for two years. He recovered to a great extent, but from that time he began to live

> two lives, a normal life and an abnormal life. In his normal life he is perfectly well, cheerful, and a capital

hospital attendant, does all his work well, and is a respectable, well-conducted man. That normal life lasts for seven-and-twenty days, or thereabouts, out of every month ; but for a day or two in each month—generally at intervals of about that time—he passes into another life, suddenly and without any warning or intimation. In this life he is still active, goes about just as usual, and is to all appearance just the same man as before, goes to bed and undresses himself, gets up, makes his cigarette and smokes it, and eats and drinks. But in this condition he neither sees, nor hears, nor tastes, nor smells, nor is he conscious of anything whatever, and has only one sense-organ in a state of activity, viz. that of touch, which is exceedingly delicate. If you put an obstacle in his way he knocks against it, feels it, and goes to the one side ; if you push him in any direction he goes straight on, illustrating as well as he can the first law of motion. You see I have said he makes his cigarettes, but you may make his tobacco of shavings or of anything else you like, and still he will go on making his cigarettes as usual. His action is purely mechanical. And what is the most remarkable fact of all is the modification which this injury has made in the man's moral nature. In his normal life he is one of the most upright and honest of men. In his abnormal state, however, he is an inveterate thief. He will steal everything he can lay his hands upon; and if he cannot steal anything else, he will steal his own things and hide them away.[1]

It may fairly be urged, if this man in his *abnormal* state, seeing, hearing, tasting, smelling nothing, acting mechanically, and being an 'inveterate thief,' is an automaton, what is he when he has all his senses in full operation, and when he is an upright and honest man? Surely something very different from an auto-

[1] *British Medical Journal*, August 24, 1874.

maton—as are all other men who comport themselves in a manner so opposed to this kind of Automatism.

The argument from the physiology of the nervous system, if pursued to the uttermost, would probably only lead to a 'drawn battle,' in a scientific aspect; and then the general tendency of men to *think* that they possess some power of voluntary action would turn the scale against Automatism. In Professor Huxley's essay on the 'Scientific Aspects of Positivism' the position is thus stated, in the writer's peculiarly forcible and nervous style:—

> As the ages lengthen, the borders of Physicism increase. . . . . Even theology, in her purer forms, has ceased to be anthropomorphic, however she may talk. Anthropomorphism has taken stand in its last fortress—man himself. But science closely invests the walls; and philosophers gird themselves for battle upon the last and greatest of all speculative problems—Does human nature possess any free volitional or truly anthropomorphic element, or is it only the cunningest of all nature's clocks? Some—among whom I count myself—think that the battle will for ever remain a drawn one, and that, for all practical purposes, this result is as good as anthropomorphism winning the day.[1]

But the final struggle of Automatism, and what is here called Anthropomorphism, will have to be fought on the field of Evolution, and the battle cannot be a drawn one. Being in direct opposition to the instincts and convictions of humanity, the aggressive doctrine must *prove* its right to acceptance, or it will infallibly be rejected. If, on the other hand, the

[1] *Lay Sermons, &c.*, pp. 163–4.

doctrine of Evolution, as now set forth, be a true doctrine, I see (and wish to see) no escape from its logical and inevitable corollary, Automatism, in its fullest sense. Professor Huxley's conclusion, from his own premises, is equally cogent and perspicuous. 'But,' says he, 'I bid you beware that, in accepting these conclusions, you are placing your feet on the first rung of a ladder which, in most people's estimation, is the reverse of Jacob's, and leads to the antipodes of heaven. It may seem a small thing to admit that the dull vital actions of a fungus, or a foraminifer, are the properties of their protoplasm, and are the direct results of the nature of the matter of which they are composed. But if, as I have endeavoured to prove to you, their protoplasm is essentially identical with, and most readily converted into, that of any animal, I can discover no logical halting-place between the admission that such is the case, and the further concession that all vital action may, with equal propriety, be said to be the result of the molecular forces of the protoplasm which displays it.'[1] The 'conclusions' referred to in the opening of this passage were those noticed at the end of the last chapter, and it becomes necessary now to examine them further.

Professor Huxley proposes[2] to demonstrate that 'a threefold unity—namely, a unity of power or faculty, a unity of form, and a unity of substantial composition'

[1] *Lay Sermons, &c.*, p. 138.
[2] *Op. cit.*, p. 122.

—pervades the whole living world. In expanding the first idea as to unity of power or faculty, he affirms that 'all the multifarious activities of man are comprehensible under three categories. Either they are immediately directed towards the maintenance and development of the body, or they effect transitory changes in the relative positions of parts of the body, or they tend towards the continuance of the species;' that is to say, all the faculties of man consist in nutrition, motion, or reproduction of the species. And this classification is propounded as exhaustive, and not excluding 'intellect, feeling, and will, which we rightly name the higher faculties . . . inasmuch as to everyone but the subject of them they are known only as transitory changes in the relative position of parts of the body.'

It might not be inopportune here to inquire whether Professor Huxley has borne in mind, in this most marvellous of statements, his own far-famed canon, that 'it is the first duty of a hypothesis to be intelligible.' In the absence of any explanation, or any attempt at proof, unless Goethe's well-known epigram be intended for either, it is difficult to conjecture what the passage may mean. It seems equally to defy exegesis, commentary, or criticism. If the meaning be, as superficially considered it would appear, that mental operations are identical with muscular motion, because without this latter the former cannot be communicated to others, I confess my entire

inability to discuss it. If it possesses any more recondite meaning, it must be such as has no close bearing upon the doctrine in question, inasmuch as there is no further reference to it; and it is only illustrated by some interesting details of contraction in animal and vegetable tissues.

By a 'unity of form,' Professor Huxley seems to imply that all organisms, at some period of their existence, present themselves as particles of protoplasm, with or without a nucleus. If the position means more than this it is untenable. It appears to have but little doctrinal force or application, but it will be called upon hereafter as 'evidence for the defence.'

Finally, Professor Huxley predicates a 'unity of substantial composition' in all living beings, an all-important truth, the significance of which it would not be easy to over-estimate. It may be confidently asserted, without any paradox, that this one incontestable fact of itself overthrows or devitalises the entire doctrine which is founded upon it. For, if it be true, as asserted, that 'all vital action is the result of the molecular forces of the protoplasm that displays it;' if 'the properties of protoplasm result from the nature and disposition of its molecules;' and if, again, there is no 'substantial difference' between the protoplasm of the lobster and that of man, then should the functions of the protoplasm in both be identical; whereas we find them in the lobster strictly confined to the three categories of nutrition, motion, and repro-

duction ; whilst in man they are found subservient to all his 'multifarious and complicated activities,' which include certainly 'intellect, feeling, and will ;' and that these are *not* to be comprehended under either nutrition, motion, or reproduction, is too obvious to require, or even to admit of, proof. The dilemma is serious, and cannot be explained away by an appeal to any idea of greater complexity of structure or aggregation, which would only afford an answer to the ear, and not to the understanding. If language has any definite meaning, and if logical sequence has any force, the difficulty can only be solved by a frank acknowledgment, that every form of life has its own special forces and endowments, concerning which science can tell us nothing at present with any certainty, except that they are assuredly not to be explained by any theory of the molecular possibilities of protoplasm.

Professor Huxley's ideas as to the composition of protoplasm have already been noticed, and it has been shown that they are clearly opposed to the known facts of science. Here a simple alternative presents itself : either Professor Huxley is familiar with the elementary facts of organic chemistry, in which case he would be aware of the impossibility of such a composition ; or he is not so—on which supposition it was at least indiscreet to found an important practical doctrine, like that of human Automatism, on a purely fanciful chemical theory. Which alternative is to be adopted

may perhaps receive some illustration from a parallel passage in the essay 'On the Formation of Coal,'[1] where, referring to the burning of coal, it is said :—

> Heat comes out of it, light comes out of it, and if we could gather together all that goes up the chimney, and all that remains in the grate of a thoroughly-burnt coal-fire, we should find ourselves in possession of a quantity of carbonic acid, water, ammonia, and mineral matters, *exactly equal* in weight to the coal!

It requires but the most elementary acquaintance with the subject to recognise that the 'quantity' of these products would be at least twice, probably thrice, as great as the original weight of the coal. A due consideration and comparison of these facts will enable the reader to estimate at its true value the *science*, from which such stupendous consequences are so confidently deduced.

Leaving now this branch of the subject, I revert to some considerations respecting the nature and tendencies of this doctrine. We are told that one great object of the essay on 'Protoplasm' was to show 'that what is called *Materialism* has no sound philosophical basis.'[2]

Indeed, both Professor Huxley and Professor Tyndall, whilst avowedly adopting a 'materialistic terminology,' seem to evince a somewhat morbid objection to being considered materialists; overlooking the most obvious first principle of nomenclature, that 'names are

[1] *Critiques and Addresses*, p. 109.
[2] *Yeast*, p. 96.

to know things by.' By common consent it has been agreed to know that school of philosophy which relegates all thought and intelligence to the domain of matter, by the name of 'Materialistic'—not as a term of reproach, but as a distinctive epithet. Materialism is quite as good as any other *ism*, if it be *demonstrably true*—personally, I should say *better*, always under this limitation.

Professor Huxley says: 'This union of materialistic terminology with the repudiation of materialistic philosophy, I share with some of the most thoughtful men with whom I am acquainted.' This simply amounts to a confession that the writer's words are not intended to express his ideas, and that other 'foremost thinkers' make an equally deceptive use of words. But it has become customary of late years to consider it immaterial what language is used to express, or it may be to conceal, our ideas. Thus Professor Huxley continues that—

> In itself it is of little moment whether we express the phenomena of matter in terms of spirit; or the phenomena of spirit in terms of matter; matter may be regarded as a form of thought; thought may be regarded as a property of matter: each statement has a certain relative truth. But with a view to the progress of science, the materialistic terminology is in every way to be preferred. (P. 146.)

Language is indeed of 'little moment,' if it be true that thought *may* be 'regarded as a property of matter;' but to assert this is to assume the whole point

in dispute—to beg the entire question. Mr. Herbert Spencer thinks the

> question is scarcely worth deciding; since either answer leaves us as completely outside of the reality as we were at first.
>
> Nevertheless, it may be as well to say here, once for all, that were we compelled to choose between the alternatives of translating mental phenomena into physical phenomena, or of translating physical phenomena into mental phenomena, the *latter alternative* would seem the more acceptable of the two.[1]

If all this be merely 'padding,' it is perhaps legitimate enough. If it be intended for science or philosophy, or to convey any kind of information, it would appear to be a failure. One single illustrative example would be worth volumes of such rhetorical artifice as this. Hard, soft, round, angle, curve, colour, form, and a host of similar words are known as 'terms of matter.' Thought, will, feeling, perception, idea, reason, and the like, are generally known as 'terms of spirit or mind.' Now, when Mr. Spencer has defined an epicycloid curve in 'terms of mind,' or when Professor Huxley has expressed a misapprehension or an error of judgment in 'terms of matter,' then, and not until then, will we believe that terminology is a thing of 'little moment,'—and until then we will also believe that there is something we call matter, and something else which is *not* matter, and which we are accustomed to call mind, which are not to be

[1] *Principles of Psychology*, vol. i. p. 159.

confounded or mistaken one for the other; and the phenomena of each of which respectively are not to be expressed in terms of the other, except by an arbitrary departure from the recognised and accepted meaning of language.

But whilst the terminology made use of is confessedly materialistic, some process of reconciliation with a spiritualistic philosophy is obviously required; and accordingly Professor Huxley states[1] that he had led his readers into 'the materialistic slough' in which they were now plunged, in order to point out 'the sole path' by which, in his judgment, 'extrication was possible.' I confess to some disappointment on traversing this path. I hoped for a rational, or at least plausible, dialectic account of some method by which matter could assume consciousness and volition. But such is not to be found. The method of extrication is certainly summary enough, if not either new or satisfactory. It consists wholly and solely, in refusing to recognise any difference between matter and spirit, on the remarkable ground that we know nothing with certainty about either, and that it is of no consequence! And this is all, except a fragment of morality, which only makes 'confusion worse confounded.'

Why trouble ourselves about matters of which, however important they may be, we do know nothing, and can know nothing? We live in a world which is full of misery and

[1] *Lay Sermons*, p. 139.

ignorance, and the plain duty of each and all of us is to try to make the little corner he can influence somewhat less miserable, and somewhat less ignorant, than it was before he entered it.[1]

A very excellent doctrine, without doubt, and one upon which, it may be freely acknowledged, the learned and eloquent speaker has ever strenuously, consistently, and successfully acted. But may it not be asked, 'What does it all mean? If I am an automaton, how can I have any *duties* to perform? Conversely, if I have any *duties*, how can I be an automaton? What is duty? and *why* and how shall I do it?' I can only solve this and all cognate difficulties, by supposing that it is with Automatism as with Materialism; that Professor Huxley unites the use of the automatic terminology with the repudiation of the automatic philosophy; and that, in fact, 'what is called' Automatism 'has no sound philosophical basis.' I cannot more appropriately conclude this notice of the doctrine of 'The Physical Basis of Life' than with an extract from the author's own anthology of criticism, where, speaking of the theory of creation, he says:—

That such verbal hocus-pocus should be received as science will one day be regarded as evidence of the low state of intelligence in the nineteenth century, just as we amuse ourselves with the phraseology about Nature's abhorrence of a vacuum, wherewith Torricelli's compatriots were satisfied to explain the rise of water in a pump.[2]

[1] *Lay Sermons*, p. 145. [2] *Ibid.*, p. 285.

CHAPTER V.

ORGANIC EVOLUTION.

Statement of the doctrine—Professor Tyndall's views—Origin of lif and organic matter—Theory of continuity—Chemical relations—Organic force — Conservation and correlation of forces — Life theories compared with physical theories—Conclusion.

THE general doctrine of Evolution, so far as it bears upon human Automatism, involves three propositions:—

1. That the earliest organisms were the natural product of the interactions of ordinary inorganic matter and force.
2. That all the forms of animal and vegetable life were successively and gradually developed from the earliest and simplest organisms.
3. That man is only a higher animal, and the lineal descendant of a family of apes; or, quoting the words of Professor Tyndall, that 'the doctrine of Evolution derives man, in his totality, from the interaction of organism and environment through countless ages past.'[1]

[1] *Belfast Address.*

It would be manifestly impossible, within any reasonable limits, to enter exhaustively into an examination of the various topics involved in these propositions—the conservation of force, spontaneous generation, the origin and transformation of species, the genealogy of animals, man's position in nature, and the whole domain of metaphysics and psychology. This would require many volumes, instead of a few pages. What I propose to do, for the present, is to notice the latest utterances on the subject, and to attempt to gather from them, whether there is any evidence for these three branches of the doctrine of Evolution, of sufficient weight and cogency to satisfy even those whose interest it is, in a philosophical point of view, to accept such evidence; or whether, on the contrary, they are founded upon assertion and conjecture as to what may, might, could, or should occur under circumstances that cannot be defined, or conditions that cannot be fulfilled.

Professor Tyndall is the latest, and unquestionably the most philosophical expositor of the properties of matter. Profoundly versed in physical science, endowed with an almost unrivalled faculty for experimental investigation and demonstration, skilled in weighing evidence, candid in argument, and open to the reception of the arguments of others, his guidance towards the formation of an opinion as to the origin of life cannot be otherwise than valuable. Let us, therefore, hear what he says, both in his character of philo-

sopher, and of man of science; for there is at least an *apparent* antagonism in the two forms of doctrine.

As a philosopher, Professor Tyndall discerns in matter[1] 'the promise and potency of all terrestrial life.' He sees the earth, 'once a molten mass, now not only swathed by an atmosphere, and covered by a sea, but also crowded with living things' (p. 351). He believes with Mr. Herbert Spencer[2] that this 'life under all its forms has arisen by an unbroken evolution, and through the instrumentality of what are called natural causes;' and has no doubt that '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 conclusions of pure intellect point this way and no other.'[3] He sees, with the eye of the imagination, a primitive 'nebular haze,' gradually contracting into a 'molten mass,' in which are 'latent and potential' not only all the forms of life, noble and ignoble, 'but the human mind itself—emotion, intellect, will, and all their phenomena . . . all our philosophy, all our poetry, all our science, and all our art;' all are 'potential in the fires of the sun.'[4] A fuller and more uncompromising expression of the doctrine can scarcely be imagined.[5]

[1] P. 524. This and the following references are to the pages in the last edition of the *Fragments of Science.*

[2] *Principles of Psychology*, vol. i. p. 464. [3] *Introduction*, p. 352.

[4] *Scientific Use of the Imagination*, p. 453.

[5] Professor Huxley not only discerns all this in the 'cosmic vapour,'

Now, what does the man of science respond to all this?

Without *verification* (he says) a theoretic conception is a mere figment of the intellect. The region of theory . . . lies behind the world of the senses, but the verification of theory occurs in the sensible world. To check the theory we have simply to compare the deductions from it with the facts of observations. If the deductions be in accordance with the facts, we accept the theory; if in opposition, the theory is given up.[1]

A truly philosophic method, preparing us for what follows—a scientific *judgment* which claims the most earnest and thoughtful consideration:—

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, my reply is, that evidence considered perfectly conclusive by many has been

but considers it 'no less certain . . . that a sufficient intelligence could, from a knowledge of the properties of the molecules of that vapour, have predicted, say the fauna of Britain in 1869, with as much certainty as one can say what will happen to the vapour of the breath in a cold winter's day.'—*Genealogy of Animals.* This is worth a moment's attention. In a homogeneous vapour, as this is supposed to be, the probability of the combination of any one atom with any other, is defined by the number of the atoms contained in that vapour. This number defies even approximate determination. Any unit we could select, however multiplied, would give no idea whatever on the subject. To say that all the men that ever lived could not count the possible combinations of these atoms, were they to do nothing but count for myriads of æons, is to say little. And as I suppose that no man, however 'sufficient' his intelligence might be, would venture to predict the position of three balls on a billiard-table after ten ordinary strokes, it baffles all imagination to think what the intelligence referred to by Professor Huxley could be.

[1] *Fragments of Science*, p. 469.

adduced; and that were some of us who have pondered this question to follow a very common example, and accept testimony because it falls in with our own belief, we also should *eagerly close* with the evidence referred to. But there is in the true man of science a desire stronger than the wish to have his beliefs upheld; namely, the desire to have them true. And this stronger wish causes him to reject the most plausible support, if he has reason to suspect that it is vitiated by error. Those to whom I refer as having studied this question, believing the evidence offered in favour of 'spontaneous generation' to be thus vitiated, cannot accept it. . . . . In reply to your question, they will frankly admit their inability to point to any satisfactory experimental proof that life can be developed, save from demonstrable antecedent life.[1]

But further than this: the researches of Pasteur, justly termed by Professor Huxley 'models of accurate experimentation and logical reasoning,' and the brilliant and conclusive demonstrations of Professor Tyndall himself, as related in his essay on 'Putrefaction and Infection,' have amply proved, beyond doubt or dispute, that without the presence of germs (that is, of antecedent life), no organisms ever originate under the conditions specified by the supporters of the theory of 'spontaneous generation.'

Here, then, is a distinct want of accordance between philosophical theory and scientific observation. But it is obvious that it could not rest here. In the interests of the Evolution hypothesis, it was necessary to reconcile this antagonism, or to represent it as only

[1] *Belfast Address*, p. 525.

apparent and temporary; and this has been done by crediting matter in the distant ages of the past with powers and faculties which it does not possess, or cannot be shown to possess, in these times. The method is worthy of some attention, in detail.

Professor Huxley, in his essay on 'Biogenesis and Abiogenesis,' one of the ablest and most lucid expositions ever given of that problem, says, that although he thinks '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,' yet he sees 'no reason for believing that the fact has been accomplished yet.' But he continues :—

> Were it given to me to look beyond the abyss of geologically recorded time, to the still more remote period when the earth was passing through physical and chemical 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.[1]

In like manner, Professor Tyndall believes that if a planet were '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,'[2] one of the 'consequences of its refrigeration' would be the development of organic forms; for 'who will set limits to the possible play of molecules in a cooling planet?'[3]

[1] *Critiques and Addresses*, p. 239.
[2] *Vitality*, p. 464.
[3] *Ibid.*, p. 644.

Doubtless these conjectures are worthy of respectful consideration, in deference to the high authorities whence they emanate; but still they are only conjectures of the vaguest possible kind, and would require very much explanation to give them any scientific value.

What (it might be asked) were those 'conditions' through which the earth was passing? Was there any different matter present at that time? That is not contended. Was there any now unknown kind of force in operation; or were the same forces acting in greater intensity? The latter would seem to be the idea suggested; but it can scarcely be considered plausible, since surely we have at our command forces *at least as* intense as any that could be compatible with the development or continuance of life. If organic matter could be originated by the interactions of moisture, and inorganic matter, in a cooling state, with any amount or any combination of heat, light, and electricity, surely we ought to be able to imitate the process. I cannot see that a cooling planet would be much more likely to produce minute organisms than a cooling flask; and Dr. Bastian's question is full of force and pertinence when he asks:—

> If such synthetic processes took place then, why should they not take place now? Why should the inherent molecular properties of various kinds of matter have undergone so much alteration? [1]

[1] *Beginnings of Life*, preface, p. x. Dr. Bastian is the latest, and

When we are told that our earth was once a nebulous haze, then a fiery cloud, then a molten spheroid, and afterwards passed through various different physical conditions as it cooled, we accept the history as at least possible, or even highly probable, because in each of its steps there is something that falls in with our previous knowledge of physical law and action; and because each of these hypothecated changes in physical condition can be imitated experimentally as often as we wish. Very many, if not most, of the forms of matter can be manifested in a solid, a fluid, or a gaseous state, according to temperature, pressure, and other conditions; so far therefore there is nothing either incredible or unlikely in such a history of the physical development or evolution of the earth.

It is otherwise when we are authoritatively told that the same forces that rounded the planet have developed the organism. We ask for an illustration, or an imitation of the process, but in vain; nay,

certainly by far the most formidable, of the champions of the doctrine of 'Spontaneous Generation.' His volumes are full of the records of arduous, thoughtful, and conscientious work, and must ever retain a conspicuous place in the literature of biological science. It is not within my present scope of purpose to enter into the details of this question; they are too extensive to be introduced under the present plan. And, moreover, the time is not the most favourable for justice to be done to such works as those alluded to. The investigations of M. Pasteur and Professor Tyndall have, for the time being at least, satisfied the majority of scientific men that the hypothesis of Abiogenesis or Archebiosis is not necessary to account for the facts in question. It is a subject obviously open to experimental demonstration, and perhaps the last word has not yet been said.

more, it is demonstrated to us that such an imitation is utterly impossible. The seeker after truth then naturally replies, 'You have doubtless other reasons for holding to this doctrine; as it stands at present, it is but an 'unverified theoretic conception,' and as such can have no scientific value, or certainly not one of sufficient weight to entitle you to found upon it so important a practical doctrine as that of human automatism.'

Professor Tyndall *has* other reasons, profound, beautiful, and philosophical; whether conclusive or not, it remains to be seen. Having premised that the strength of the doctrine of Evolution does not consist in experimental demonstration, but in its general harmony with scientific thought, he proceeds:—

> Those who hold the doctrine of Evolution are by no means ignorant of the uncertainty of their data, and they only yield to it a provisional assent. They regard the nebular hypothesis as probable, and in the utter absence of any evidence to prove the act illegal, they extend the method of nature from the present into the past. Here the observed uniformity of nature is their only guide. Within the long range of physical inquiry, they have never discerned in nature the insertion of caprice. Throughout this range, the laws of physical and intellectual continuity have run side by side. Having thus determined the elements of their curve [1]

[1] 'From a few observations of a comet, when it comes within the range of his telescope, an astronomer can calculate its path in regions which no telescope can reach; and in like manner, by means of data furnished in the narrow world of the senses, we make ourselves at home in other and wider worlds, which can be traversed by the intellect alone.'—*Fragments of Science*, p. 71.

in a world of observation and experiment, they prolong that curve into an antecedent world, and accept as probable the unbroken sequence of development from the nebula to the present time. [1]

This is a truly refined conception; and a perfectly legitimate method of supplementing the lack of direct evidence, where this is obviously unattainable. But we must be careful not to be led away either by force of thought or grace of style, into forgetfulness of whither we are going. It must be remembered that this is the last stronghold of the theory of the material origin of life, involving the most essential and radical principle of Evolution, and its necessary corollary, Automatism. Observation has failed to give any support to the doctrine; experiment has demonstrated its present impossibility; conjecture is valueless; but the 'law of continuity' has still to be tested. Let us inquire what it tells us.

Going backwards from generation to generation into the far distant ages, and passing 'from the highest to the lowest organisms,' each form of life in long succession declares, in inarticulate but unmistakable language, 'I derived my life from antecedent life.' But we may imagine ourselves finally to arrive at the period when the *first* organisms appeared on our globe. What do they tell us? If there be any such 'laws of physical and intellectual continuity' as have been spoken of, extending across this line, then

[1] *Scientific Use of the Imagination*, p. 456.

they also to our interrogation, 'Whence came ye?' must reply, 'From antecedent life.' If instead of this they say, 'We are the natural product of the interactions of inorganic matter and force,' then the 'continuity' of thought is no longer possible—the curve is broken, or becomes 'transcendental,' not to be defined by any mental equation. A possible verbal resource here might be to indicate a gradual and insensible transition from the organic to the inorganic. Apparently pointing in this direction, Professor Tyndall continues:—

> On tracing the line of life backwards, we see it approaching more and more to what we call the purely physical condition. We come at length to those organisms which I have compared to drops of oil, suspended in alcohol and water. We reach the *protogenes* of Haeckel, in which we have a type distinguishable from a fragment of albumen only by its finely granulated character.[1]

This is a profoundly important statement—one demanding the utmost attention, and one in which, unless I am greatly mistaken, there is a misapprehension of so serious a nature as to vitiate the entire argument. The *protogenes* is minute, and *apparently* insignificant; it is also nearly homogeneous; but who knows so well as Professor Tyndall, or who has so clearly and beautifully demonstrated as he, that *apparent* homogeneity is no argument for the absence of structure? This little organism is either

[1] *Belfast Address*, p. 524.

living or not living ; we know of no transition forms ; there are none such ; this would involve a contradiction in terms. If living, as it is by the terms of the case, it is a fragment of living '*protoplasm*,' which protoplasm, as Professor Huxley has demonstrated, has the same 'powers and faculties,' the same 'form,' and the same 'substantial composition,' whether seen in the 'dull foraminifer,' in those 'broad discs of glassy jelly which may be seen pulsating through the waters of a calm sea,' or in 'the flower which a girl wears in her hair, and the blood which courses through her youthful veins.'

There is nothing to justify us in concluding that in the *protogenes* there is any approach whatever to the 'purely physical condition.' The line of demarcation between this 'fragment of albumen' and any inorganic matter is as defined, if not as wide, as between the eagle and the rock on which the eyry is built. The protoplasm of the *protogenes* is, organically at least, as active[1] as that of any other organism ; its formation from inorganic matter equally defies our efforts ; its functions are as incapable of expression by any physical formula. On what grounds, then, scientific or transcendental, can we expect to hear this form of life declare, 'I came

[1] 'Nor are such organisms insignificant by reason of their want of complexity. It is a fair question whether the protoplasm of those simplest forms of life, which people an immense extent of the bottom of the sea, would not outweigh that of all the higher living beings which inhabit the land put together.'—*Lay Sermons*, p. 128.

direct from the universal mother who brings forth all things as the fruit of her womb,[1] and I own no other parentage?' Surely in this we should be able to discern no '*unbroken* sequence of development from the nebula to the present time!' and what has become of the 'observed uniformity of nature?'

But in nothing is the weakness of this doctrine more manifest than in the nature of the attempts so constantly made to justify a belief, that chemistry will in the future be more successful in forming organisable matter from inorganic elements, than it has been in the past. Professor Tyndall, who may reasonably be expected to make the best of the case, finds nothing more to say than this:—

> The matter of the animal body is that of inorganic nature. There is no substance in the animal tissues that is not primarily derived from the rocks, the water, and the air. Are the forces of organic matter, then, different in kind from those of inorganic matter? The philosophy of the present day negatives the question. It is the compounding, in the organic world, of forces belonging equally to the inorganic, that constitutes the mystery and the miracle of vitality. Every portion of every animal body may be reduced to purely inorganic matter. A perfect reversal of this process of reduction would carry us from the inorganic to the organic; and such a reversal is at least conceivable!![2]

An organism that has to exist in, and derive its means of continuance from, the external world, must of necessity consist of the same matter (in part) as

[1] *Belfast Address*, p. 524.
[2] *Vitality*, p. 463.

that world, under whatever theory of ontology it is supposed to exist. By no logical process, however, can this fact be considered as absolutely determining the nature of the forces operating upon it, or inherent in it; that is an altogether independent question. But the concluding sentence of the last quotation contains certainly one of the most marvellous of all the conceptions ever set forth in scientific guise. If we imagine a crystal vase dashed to myriads of atoms on the ground, a manuscript burned to ashes, a living body killed by a fall of a thousand feet from a balloon, an exploded barrel of gunpowder; a 'perfect reversal' of any of these events or processes, would be in every way as practicable as that which is here pronounced 'at least conceivable.'[1] The cause must indeed be considered hopeless into the service of which such suppositions as this are pressed. A house may be reduced to its proximate elements, of stone, brick, wood, iron, &c.—and a 'perfect reversal of this process of reduction' is certainly conceivable; but this affords very imperfect evidence

[1] 'The first quantitative analyses of organic bodies were made by Gay-Lussac and Thénard. The substance to be analysed was mixed with a known weight of chlorate of potassium, and made up into small pellets, which were dropped one by one through a stop-cock of peculiar construction, into an upright glass tube heated to redness, the gas thereby produced escaping by a lateral tube, and being collected over mercury,' &c., &c. Such is the beginning, and only a very small part of the process described in Watts' *Dictionary of Chemistry*, a 'perfect reversal' of which we are asked to consider as conceivable. The modern practice is almost indefinitely more complex.

that a house has ever been spontaneously developed out of these materials, without the 'intrusion' of some intelligent constructive agency.

And thus it is seen that observation and reason, experiment and analogy, alike refuse any support to the doctrine that derives life from the interactions of inorganic matter and force. Pending the production of additional evidence, we are entitled, at least, to hold it as 'not proven,' and absolutely to reject, as a baseless conception, any other doctrine, as that of human Automatism, which is built upon it.

But is this negative conclusion all that can be arrived at? Is there nothing positive to be known concerning the origin of life on the earth? I think there is; and that it can be shown with tolerable certainty that there is a break in the 'curve' so often alluded to; and that the appearance of the earliest organic forms was attended by phenomena which admit of no explanation by any combination of inorganic forces.

> Not with the vagueness belonging to the emotions, but with the definiteness belonging to the understanding, the scientific man has to put to himself these questions regarding the introduction of life upon the earth. . . . As far as the eye of science has hitherto ranged through nature, no intrusion of purely creative power into any series of phenomena has ever been observed.[1]

I will not further complicate a sufficiently involved

[1] *Apology for the Belfast Address*, p. 547.

question by insisting that absolute scientific evidence can be produced to prove a 'purely *creative* power' as intruding at any period of the world's history. This, however, may be affirmed with certainty, that at a certain epoch in that history, a *new* power or force was manifested, a force that was not a continuation or modification of any one that had previously existed, nor, so far as can be shown, was it any combination of these. To avoid unnecessary verbiage and repetition, I will at once call this the 'Organic Force,' not as suggesting a theory, but merely for a name by which it may be known.

Why is this 'organic force' entitled to be called a *new* power or force? For this reason, that we know absolutely nothing of force but from its effects, and that this force produces effects that no other known force or combination of forces can accomplish. To take but one simple instance: the organic force in vegetable tissue can decompose carbonic acid, at ordinary temperatures, into carbon and oxygen. Now this cannot be effected by the intensification of any one, or by any combination, of the ordinary forces of the inorganic world, and therefore we are not only entitled, but if we would be consistent we are compelled, to recognise that with the first forms of vegetable life there was manifested an *intrusion* of some new power into the world, by whatever name, 'creative' or otherwise, it may be called. Assuredly at this point in the world's history, there was a most

noteworthy disturbance of the laws and direction of matter and force—*sudden* and *catastrophical,* not gradual and imperceptible; for we know of no gradual transition from death to life; and unless we can suppose ordinary matter itself spontaneously to assume powers or faculties *exactly opposite* to those previously inherent in it, we are impelled to believe that this disturbance, this institution of an entirely new order of energy, this inauguration of a new epoch, this clothing of the earth with a living garment, was the direct result of a fiat from without, of a power which was 'certainly not mechanical.'

I do not know how any candid inquirer can close his eyes to so patent a fact as this introduction of a new force. It is customary to evade this necessity by calling it *chemistry.* Be it so; the name will do as well as any other for those who, to satisfy the exigencies of an 'unverified theoretic conception,' will be content to classify the most opposed phenomena in one and the same category. If life force be chemistry, it is a chemistry unknown in our laboratories; producing effects exactly the reverse of most of the chemistry with which we are acquainted; and residing only in an organic structure, which is indebted for its properties to a special endowment, handed down to it through countless generations and ages of antecedent life.

Whatever test we apply to this force, it is found to differ *toto cælo* from all known inorganic forces.

All these can be demonstrated and made evident to the senses ; they can be made to pass from one mass of matter to another, by contact, by impulse, by radiation, by transmission ; they can be measured by our instruments ; they can for the most part be collected in volume, or in some other way accumulated, and stored up for use at will. Can we effect anything even remotely resembling all this with the organic force or energy? Can we collect it, or its component parts—if it be 'compounded' of inorganic forces—as it leaves the dying organism? No ; all this is impossible. And if the 'mystery and miracle of vitality' be merely 'the compounding, in the organic world, of forces equally belonging to the inorganic,'[1] it is evidently due from those who assert this doctrine, that they should show at least some resemblance or analogy between the two classes of actions, or that they should give some hint as to how any possible or conceivable combination of inorganic forces can be made, even in thought, to represent the actions of a living organism. As this has never been done and can never be done, the assertion must pass, amongst the rest, as indicating a relation which *ought to be* true in order to support the theory of Evolution ; but which, in the present state of our knowledge, does not seem to have any scientific foundation.

One point remains to be noticed, which will still

[1] *Vitality*, p. 562.

more clearly mark the difference between vital or organic, and any form of inorganic, force; which will, in fact, if demonstrated, prove the existence of a chasm between the two orders of energy that cannot, even dialectically, be bridged over. I refer to certain considerations connected with the great discovery of modern times, the doctrine of the conservation and correlation of forces. It will be necessary briefly to state what these doctrines are, and then to inquire, what are their relations to organic force? With regard to the 'Conservation of Force,' Helmholtz thus formulates it:—

> The total quantity of all the forces capable of work in the whole universe remains eternal and unchanged throughout all their changes. All change in nature amounts to this —that force can change its form and locality without its quantity being changed. The universe possesses, once for all, a store of force which is not altered by any change of phenomena, can neither be increased nor diminished, and which maintains any change which takes place on it.[1]

An important position, and one that is susceptible of scientific demonstration, so far as observations on finite quantities can determine the conditions of the infinite. But we are more particularly interested in the question of the Correlation of Forces, a doctrine the beauty and importance of which can scarcely be over-estimated—one that forms the basis of all modern philosophical thought on physical subjects, and that is associated almost as a 'household word' with the

[1] *Popular Lectures*, p. 360.

name of our distinguished countryman, Sir W. R. Grove. In his own words, its bearing and tendency are thus sketched :—

> Light, heat, electricity, magnetism, motion, and chemical affinity, are all convertible material affections ; assuming either as the cause, one of the others will be the effect; thus heat may be said to produce electricity, electricity to produce heat, magnetism to produce electricity, electricity magnetism, and so of the rest. Cause and effect, therefore, in their abstract relation to these forces, are words solely of convenience. We are totally unacquainted with the ultimate generating power of each and all of them, and probably shall ever remain so ; we can only ascertain the *normæ* of their action ; we must humbly refer their causation to one omnipresent influence, and content ourselves with studying their effects, and developing, by experiment, their mutual relations.[1]

Following out in a little fuller detail the application of this doctrine, we learn that, beginning with any one of these physical forces, we may form cycles of greater or less comprehensiveness, each one bringing us back to the point whence we started. Thus, beginning with mechanical motion, we can observe its conversion into heat ; and this heat may be either at once reconverted into motion, or it may give rise to light, to electricity, or to chemical affinity. The cycles may embrace two, three, or all of these forms of force. Motion may produce heat or light ; light or heat may produce chemical affinity ; this in turn may produce electricity,

[1] *The Correlation of the Physical Forces.* Preface to 5th edition, p. xiv.

and this magnetism; whence, again, we may derive mechanical motion. The order of the elements of the cycle may be almost indefinitely changed. Probably, were our means of investigation perfect, we might observe the immediate production of any one term of the series by any other. The quantities of the resultant forces are also definite and constant.

It is in attempting to incorporate organic force into this cycle of transformations, that by our entire failure we arrive at the conviction that life, in its essence, is something beyond any combination of physical forces; in short, that LIFE HAS NO PHYSICAL CORRELATE.

For, in the first place, no one will contend that the organic force is directly interchangeable with any *one*[1] term of the series; therefore in so far at least it differs from any physical force; for in the cycles alluded to one force only was required to produce another, not a combination of several. But is the organic force *interchangeable* with any number or any combination of the other forces? This requires careful consideration: the negative answer, however, cannot be doubtful.

Each individual *action* of an organism will have its physical correlate; the motion of an organism will

[1] Oken certainly asserts that 'galvanism is the principle of life,' and that 'there is no other vital force than the galvanic polarity.'—*Physiophilosophy*, sec. 884. He also proceeds to say that 'organism is galvanism residing in a thoroughly homogeneous mass . . . a galvanic pile, pounded into atoms, must become alive. In this manner nature brings forth organic bodies.' But these instructive details were written under '*a kind of inspiration.*'

produce heat not the less that it is an organism; chemical changes will produce electric conditions in the organism as well as outside it; but the force itself which underlies, originates, combines, and utilises all these single manifestations, is something which has no known or conceivable correlative.

It may be objected to this that 'life' is but the sum of the individual actions of an organism, and that the sum of the correlates of these would represent the correlate of a living organism. The position is untenable; but a full discussion of it would lead us away into irrelevant issues. It is not contended by the most ardent believers in Evolution that we can trace with any accuracy the correlations of living force.

But granting, for the sake of the argument, everything that can be claimed, it is still evident that there is no true 'correlation,' in any definite or scientific sense, between life and any of the forces commonly known as *inorganic*. For whilst organic force can give origin to, or, we may even say, can be converted into, the various forms of physical force, the converse does not hold good; no physical force or combination of forces can be reconverted into organic force; so that whilst the relations of the ordinary physical forces represent a closed curve or cycle continually returning upon itself, the introduction of organic force into any point in the series carries the line off into infinitude, and renders the curve as incapable of closure as a parabolic projection. The 'reciprocity' is one-sided.

Mr. Herbert Spencer deals with this question in his own peculiar manner, of which we have already seen one or two examples. He commences by acknowledging candidly the difficulty of the subject, and thus continues :—

> Involved as are the phenomena of evolution, it is not to be expected that a definite quantitative relation can in each case, or indeed in any case, be shown between the forces expended in successive phases. We have not adequate data for this ; and probably shall never have them. . . . The most we can hope is to establish a qualitative relation, that is, indefinitely quantitative—quantitative in so far as involving something like a due proportion between causes and effects. If this can be done, however, some progress will be made towards the solution of our problem.[1]

After some details of evolution of inorganic bodies under conditions for which 'it is impossible to assign a reason,'[2] but which are all traced ultimately to a 'still progressing motion' of the substance of the sun and of the earth towards their respective centres of gravity, he sets forth this position—'That the forces exhibited in vital actions, vegetable and animal, are similarly derived, is so obvious a deduction from the facts of organic chemistry, that it will meet with ready acceptance from readers acquainted with those facts.'[3]

And it must be acknowledged that this acceptance will follow most naturally from these '*facts* of organic

[1] *First Principles*, chap. ix.
[2] *Ibid.*, p. 266.
[3] *Ibid.*, p. 271.

chemistry' as known and set forth by Mr. Herbert Spencer. One of these so-called facts refers to the decomposition of carbonic acid and water by vegetable tissue, and is stated as follows: 'To overcome the powerful affinities which hold their elements together requires the expenditure of force, and this force is supplied by the sun.'[1]

On such science and on such facts is the modern 'Constructive Philosophy' built up! The plain and simple answer to this statement is, that the sun *does not* supply the required force. The sun might beat for thousands of years upon carbonic acid and water without altering their chemical constitution in the least. The analytic force is inherent in an organism, which performs what no combination of inorganic forces can effect. The sun's rays stimulate and favour this action, but are not even *essential* as an accessory to their production. Hear Professor Huxley:—

> Take, for example, the singular fact that yeast will increase indefinitely when grown *in the dark*, in water containing only tartrate of ammonia, a small percentage of mineral salts, and sugar. Out of these materials the *torulæ* will manufacture nitrogenous protoplasm, cellulose, and fatty matters, in any quantity, although they are wholly deprived of those rays of the sun, the influence of which is essential to the growth of ordinary plants. There has been a great deal of speculation lately as to how the living organisms buried beneath two or three thousand fathoms of water, and therefore in all probability almost deprived of light, live. If any of them possess the same powers as yeast (and the same

[1] *Loc. cit.*

capacity of living without light is exhibited by some other fungi), there would seem to be no difficulty about the matter.[1]

Mr. Spencer proceeds to state that 'the *irresistible inference* is that the forces by which plants abstract the materials of their tissues from surrounding inorganic compounds—the forces by which they grow and carry on their functions—are forces that previously existed as solar radiations' (p. 272). From that point there is naturally but little difficulty in arriving at a *qualitative* correlation, at least, for the organic force; and after traversing a dense jungle of verbiage, in which revelations of the same scientific value as that just quoted abound, Mr. Herbert Spencer emerges into open country with a declaration concerning 'the forces called vital, which *we have seen* (!) to be correlates of the forces called physical.'[2]

Subsequently, by virtue of much repetition, the doctrine is considered to be so far established that it may serve as a basis for further argument; and it is referred to in another work in these terms:—

> Now that the transformation and equivalence of forces is *seen* by men of science to hold, not only throughout all inorganic actions, but throughout all organic actions; now that even mental changes are recognised as the correlatives of cerebral changes, which also conform to this principle; and now that there must be admitted the corollary, that all actions going on in a society are measured by certain antecedent energies, which disappear in effecting them, while

[1] *Critiques and Addresses*, p. 90.
[2] *Op. cit.*, p. 278.

they themselves become actual or potential energies from which subsequent actions arise, it is strange that there should not have arisen the consciousness that these highest phenomena are to be studied as lower phenomena have been studied—not, of course, after the same physical methods, but in conformity with the same principles.[1]

It is somewhat amusing that this passage, perhaps as full of unverified assumptions as any equal number of words in the English language, occurs in a chapter especially devoted to holding up to reprobation and ridicule the practice of forming and expressing opinions, before having duly considered the grounds on which any such opinions should be based, or without having the power to estimate the facts which bear upon them. From what has been said before it is obvious that until the convertibility of inorganic into organic force can be demonstrated, no 'correlation' between the two can be recognised, and therefore can only be '*seen* by men of science' in the form of an assertion or a theoretic conception. It is still more certain, if possible, that 'mental changes' are not '*correlatives*,' in any demonstrable or scientific sense, of 'cerebral changes;' but the whole domain of psychology I wish to defer to a future occasion, as it is too important and extensive to be treated as a mere collateral issue; and the same considerations apply to the sociological question introduced in the third clause. It must suffice here to say, that Mr. Spencer has hitherto failed to adduce any valid evidence, or even any strong

[1] *The Study of Sociology*, p. 6.

inferential reason for believing, that either life or thought have any definable correlative in the inorganic world.

In concluding this branch of the inquiry, I wish to institute a comparison between the mode in which I have attempted to establish the existence of a special 'organic force,' and certain methods now of universal application in physical science.

In all modern investigations into the nature and properties of the imponderables, especially light and heat, we find a certain ETHER occupying a prominent position as the substratum of these phenomena, concerning which I will quote a few sentences from Professor Tyndall's lectures on 'Heat as a Mode of Motion'—lectures which will be esteemed models of scientific thought and demonstration so long as science is remembered:—

> According to the theory now universally received, light consists of a vibratory motion of the molecules of the luminous body; but how is this motion transmitted to our organs of sight? Sound has the air as its medium, and a close examination of the phenomena of light, by the most refined and demonstrative experiments, has led philosophers to the conclusion that space is occupied by a substance almost infinitely elastic, through which the pulses of light make their way. . . .
>
> The luminous ether fills stellar space; it makes the universe a whole, and renders possible the intercommunication of light and energy between star and star. But the subtle substance penetrates further; it surrounds the very atoms of solid and liquid substances. . . .

This ether also, 'whose motions are the light of the universe,' is itself invisible; it is imponderable and impalpable; it cannot be isolated, nor compressed, nor attenuated, nor exhausted, nor excluded from any space. It is of 'almost infinite tenuity,' and yet its 'properties are those of a solid rather than of a gas. It resembles jelly rather than air.' [1]

But how, it may be asked, do we arrive at a knowledge of the existence and properties of this ether? By a perfectly legitimate and philosophical process, which consists in reasoning backwards from effects to causes or substrata—from phenomena to that which underlies them. Light and heat are demonstrated to be modes of motion, tremors, undulations, or vibrations. But where motion is, there must be something that moves; what is that something in the case of light? Sound consists of movements of air; but undulations of air will not account for the phenomena of light, nor will any form of motion of any of the ponderable matters with which we are acquainted. Thought following thought in this manner, at last brings the investigator face to face with the inevitable supposition, that all space is filled with this substance 'of almost infinite tenuity;' not because he can *demonstrate* it, but because *nothing else will fulfil the conditions or account for the phenomena.*

Now, suppose an objector says, 'Matter I know, and force I know, but what is this? You call it

[1] *Fragments of Science*, p. 4.

substance, but that cannot be allowed. All the substance with which I am acquainted can be weighed, or measured, or handled, or in some other way be made evident to the senses in a concrete form. Nature is uniform in her action, and does not produce matter with such negative qualities as those of ether, because the exigencies of your hypothesis require it. Your ether is an incomprehensible and therefore intolerable paradox. You say that light cannot be accounted for by the undulations of any known ponderable matter. That is possible in the present state of science; but no doubt some time you will know better how to arrange ordinary matter so as to produce the necessary undulations. *Therefore* the theory of the ether *is* an *extinct belief*.'[1] What would be the effect of such a remonstrance as this? Without doubt it would be treated as altogether unworthy of an answer, and very justly so treated.

Mutatis mutandis, the argument may apply to the theory of a vital or organic 'substance' or force. We meet with certain phenomena differing most widely from, and in many cases opposed to, those of the inorganic world—undulations, vibrations, motions, special chemical powers, to say nothing of more obscure and complicated manifestations. We know (or think after many attempts that we know) that no arrange-

[1] It is a favourite formula of Mr. Herbert Spencer's, when speaking of the doctrine of Special Creation, to say that it belongs to a family of extinct beliefs.

ment or combination of any of those matters or forces which we call inorganic will produce these effects. We hypothecate, in consequence, another *special* force, not correlated to those of the inorganic world, in the same way that these are correlated to each other; and as a name to know it by we call it the VITAL or ORGANIC FORCE. Is this in any way more unphilosophical than the hypothesis of an ETHER?

And when we go back far beyond the records of geological time, and stand in imagination on the line that marks the beginning of life on our earth; when we see on one side of this line matter obeying only simple and easily formulated laws, and on the other the same matter assuming complex forms and functions, not to be imitated by any human skill or science, not reducible to any mechanical formula, not explicable by any play of molecular attractions and repulsions; when we are unable to comprehend that this matter can have spontaneously assumed these wondrous faculties and endowments, it is, perhaps, not an unphilosophic spirit that leads us reverently to trace in these phenomena the presence of a power that

> Lives through all life, extends through all extent,
> Spreads undivided, operates unspent.

And whilst lost in wonder at the infinitely varied forms of beauty everywhere arising, and the ever-changing yet ever-perfect adaptations of structure to function, of organism to environment, telling of an

intelligence and a constructive power, in comparison with which the most exalted of human faculties are but vanishing quantities: were we then permitted to ask this new-sprung life whence it came and what was its origin, it would be in no spirit of superstition or vain belief, but in accordance with the strictest rules of inductive philosophy, that we should expect to hear the answer, 'The Hand that made us is Divine.'

CHAPTER VI.

ORIGIN OF SPECIES.

Alleged superiority of Evolution over all other theories of Ontology—Mr. Spencer's 'Evanescence of Evil'—Origin and transmutation of species—Various theories—Mr. Darwin's 'Natural Selection'—Absence of all evidence—Abandonment of the theory—Conclusion.

THE superiority of the Evolution hypothesis over every other ontological theory is, according to Haeckel, chiefly manifest in this—that by its means alone we are able to give a mechanical explanation of the most complicated organic phenomena.

In fact (he continues) such events as the origin and formation of the organs of the senses present to the eye of the understanding, guided by the light of Evolution, no more difficulties than the explanation of any ordinary physical processes, such as earthquakes, winds, or tides. By the same light, we arrive at the very weighty conviction, that all the natural bodies with which we are acquainted are *equally living*; and that the distinction which has been held as existing between the living and the dead does not really exist. When a stone which is thrown into the air falls again to the earth according to definite laws; when a crystal is formed from a saline fluid; when sulphur and mercury unite to form cinnabar; these facts are neither more or less mechanical life phenomena than the growth and

flowering of plants, than the propagation and sensory faculties of animals, or the perceptions and intelligence of man.[1]

This is a most attractive programme, and one full of interest and promise: unfortunately nothing is effected here or elsewhere towards completing the 'explanation.' It is asserted again and again that life is but mechanical force, and that soul and spirit and thought are but higher manifestations of the same; but no attempt, even the feeblest, is ever made to justify the wild assumption, or to show how mechanical force can be conceived as representing either life or thought.

Indeed, Evolution is charged with many burdens, too heavy and grievous to be borne; and it breaks down utterly under the weight of them. Guided still by the light of this doctrine, we are supposed not only to be able to trace clearly the past history and present condition of man, but even to predict, and with still greater certainty, if possible, his future progress. Mr. Herbert Spencer, in his 'Social Statics' (p. 79), predicts the 'evanescence of evil,' and the consequent perfecting of man's nature, as an inevitable corollary of the laws of Evolution, as follows:

All imperfection is unfitness to the conditions of existence.

This unfitness must consist either in having a faculty or faculties in excess, or in having a faculty or faculties deficient, or in both.

[1] *Natürliche Schöpfungsgeschichte*, by Dr. Ernst Haeckel, 6th ed., 21.

A faculty in excess is one which the conditions of existence do not afford full exercise to; and a faculty that is deficient is one from which the conditions of existence demand more than it can perform.

But it is an essential principle of life that a faculty to which circumstances do not allow full exercise diminishes, and that a faculty on which circumstances make excessive demands increases.

And so long as this excess and this deficiency continue, there must continue decrease on the one hand, and growth on the other.

Finally, all excess and all deficiency must disappear—that is, all imperfection must disappear.

Thus the ultimate development of the ideal man is logically certain . . . . as certain as any conclusion in which we place the most implicit faith—for instance, that all men will die. . . . Progress . . . is not an accident, but a necessity. . . . As surely as there is any efficacy in educational culture, or any meaning in such terms as habit, custom, practice, so surely must the human faculties be moulded into complete fitness for the social state, so surely must the things we call evil and immorality disappear, so surely must man become perfect.

This is a fair instance of the statements made and the arguments used in the interests of the Evolution hypothesis; and, as such, it merits some brief notice. As Mr. Herbert Spencer usually reasons with some appearance of accuracy upon facts as present in his own mind, it is to be regretted that these facts are not more in accord with those known to physiologists and observers of nature generally. Whatever may be man's destiny in the future, nothing can be more certain than that he will not be perfected by any

evanescence of evil effected as here supposed. For it is in no sense to be received as true that 'a faculty, on which circumstances make excessive demands, increases.' A faculty duly *exercised*, in accordance with individual and social requirements, improves, within certain definite limits; but a faculty on which *excessive* demands are made inevitably deteriorates, or is lost entirely. The eye, the ear, the brain, when moderately exercised, improve as to function; if *excessive* demands are made upon them, their functions fail; and if these demands be continued, disorganisation often ensues. Digestion is certainly not improved by excessive demands on its powers—nor the circulation, nor any other physiological function.

The history of man, whether physical or general, affords as little support to this doctrine of perfectibility as does physiology. If certain nations or communities have advanced towards a higher state of physical condition, of social aggregation, or of mental and moral cultivation, and are therefore to be considered as illustrations of the law that 'all imperfection must disappear,' it can scarcely be contended that those nations or communities which have either remained stationary or have degenerated are illustrations of the same law. Yet history abounds with such instances. In some Eastern nations, notably in China, there is comparatively little change of any kind within historic periods; probably no one would be likely to see there any indications of the evanes-

cence of evil; and yet China and its dependencies may be supposed to contain nearly half, certainly more than one-third, of the population of the earth. It is not necessary to enter into any details as to degenerations; their history is the history of all nations that have risen and fallen again; where 'unfitness to the conditions of existence' has resulted in decay rather than in progress.

This digression from the main subject of this inquiry has been introduced with the object of showing what care it is necessary to exercise in examining doctrines like these, set forth with much confident use of language, before accepting them as valid. Further illustrations will occur as we proceed.

In the preceding chapter the evidence for the first of the three propositions concerning the origin of organic forms was investigated—viz. '*That the earliest organisms were the natural product of the interactions of ordinary inorganic matter and force.*' It appeared to be a result of the inquiry that neither observation, experiment, nor reason gave any testimony in favour of such a view; and that life was in all cases due either to antecedent life, or to a power or force from without that was not identical, nor correlated with the ordinary physical forces. The two remaining propositions which now claim attention are more conveniently combined in one for discussion, and may be thus formulated:—'*That all the forms of animal and vegetable life, including man himself, have been*

successively and gradually developed from the earliest and simplest organisms.'

A casual survey of the vegetable and animal world exhibits to the inquirer an infinite number of forms, having almost every conceivable variety of general aspect and attribute; whilst a closer investigation shows certain relationships of type and function to subsist amongst certain members. Individuals are closely grouped together with such identity of structure, and such constancy of character derived from parent to offspring, as to be ranked as species. Various species present such analogies one to the other as to be classed under more extended heads, as *genera.* Genera, again, that are allied by certain affinities, are united to form natural orders; and these are grouped again, according to such general characters as they may possess in common, into classes and sub-kingdoms. Thus all the varieties of our domestic dog or cat are so alike in essential structure, that they are respectively considered as distinct *species.* But the dog has many points of resemblance to the wolf, the dingo, &c.; and the cat has similar relations to the lion, tiger, and puma. The allies of the dog are therefore united to form a *family*, called *Canis;* and those of the cat are similarly united into the family *Felis.* But the *Canidæ* and the *Felidæ* are again allied by important points of structure, food, and habits to each other and to the bears (*Ursidæ*), martens (*Mustelidæ*), and seals (*Phocidæ*); and these

families are aggregated to constitute the natural order of the CARNIVORA. These form one of the great divisions of the class MAMMALIA—a section of the great sub-kingdom of the VERTEBRATA.

Up to a comparatively recent period the majority of naturalists held, with regard to these divisions, that only the members of what were called *species* (such as were fertile together, and had fertile offspring), had any true alliance, any blood-relationship; and that a family, a genus, an order, or a class was simply an *ens rationis*, a mental classification for convenience only.

But so early[1] as 1796, Goethe alluded to the development of the higher animals, and man himself, from lower forms of life; and in 1807 he somewhat expanded the idea, with references to embryology. He was soon followed by Oken, who, as we have before seen, claims 'a kind of inspiration,' but whose inflated dogmatism presents few tangible points for either intelligent acquiescence or dissent. His doctrine as to organisms is as follows:—[2]

(900) Every organic has issued out of mucus.

(901) *The primary mucus out of which everything organic has been created is the sea-mucus.*

(905) The sea-mucus, as well as the salt, is produced by

[1] De Maillet's *Telliamed* was published almost fifty years before, in 1748; but, except as indicating some belief in the variability of species, it requires little notice as a philosophical work.

[2] The figures refer to the sections in the Ray Society's edition of Oken's *Physiophilosophy*.

the light. *Light shines upon the water, and it is salted. Light shines upon the salted sea, and it lives.*

(906) All life is from the sea, none from the continent.

(912) The first organic forms, whether plants or animals, emerged from the shallow parts of the sea.

(913) *Man also is a child of the warm and shallow parts of the sea in the neighbourhood of the land.*

(930) The primary organic is a mucus point.

(934) The first organic points are vesicles.

(958) No organism has been created of larger size than an infusorial point. No organism is, nor has one ever been, created which is not microscopic.

(959) Whatever is larger has not been created, but developed.

(960) Man has not been created, but developed.

Oken, it will be seen, allows the existence of a Creator, whose function is to create microscopic points. Philosophers are wiser now. Lamarck followed in 1815 with some daring speculations, which I venture to think were indefinitely more philosophical[1] than any of the theories of Evolution which have been propounded since that time, inasmuch as they had *some* basis in physiological truth. But it is unnecessary now to notice these doctrines at any length, since it is at the present time generally believed that 'there is but one hypothesis as to the origin of species of animals in general which has any scientific

[1] Lamarck's account of the development of the giraffe's long neck is infinitely more practical and probable than Mr. Darwin's; as well as his general, though perhaps somewhat vague, ideas of the production of various other structures by means of attempted and increased function, or desire for action.

existence—that propounded by Mr. Darwin.'[1] That hypothesis is too well known to require any extended introduction, but may be briefly stated thus:—Owing to the high geometrical rate of increase of each species, there is a constant struggle for life going on amongst all living creatures, in which struggle 'the weakest go to the wall,' and the strongest, that is, the 'favoured races,' survive. These favoured races are so favoured in virtue of their having been born (in obedience to chance, or some law, the conditions of which are unknown) with a structure in so far differing from that of their species, as to afford them an advantage, however slight, over their brethren in the said struggle. This is innate variability; and when a variation occurs, thus enabling its possessor to survive where others die, there is a prospect of a race being formed with this peculiarity, which, slowly augmenting for thousands of generations, at last gives character to a new species. And the slow accumulation, through countless ages, of similar modifications, by natural selection, forms distinct genera and orders. The same powers which we daily see producing what we call *varieties* are on this theory capable of producing *species* in longer periods, and in still more extended periods, genera, orders, and classes. There are thus three essential elements in this theory—variability, struggle for existence, and natural selection—and by means of these, it is supposed that,

[1] Professor Huxley's *Man's Place in Nature*, p. 106.

beginning with the *monera* (which was evolved from inorganic matter), we have in the course of long ages obtained all the forms of life that have ever appeared on our globe, including man himself, without the 'intrusion' of any creative power.

It is not my intention to attempt any detailed investigation of these views. This has been done so often by far abler hands than mine, that it would appear as though nothing more could be said by friend or foe without mere repetition. What can be done by a calm and highly cultivated critical faculty, a profound knowledge of natural history and of all biological science, and a clear logical reason, to refute the fallacies of natural selection, has been done by Mr. St. George Mivart in his 'Genesis of Species,' and later in his 'Lessons from Nature.'[1] But the theory has a source of vitality which does not lie in the domain of facts or reason, and will therefore doubtless survive for a time.

There are, however, a few general considerations upon which I think due stress has not been laid, tending to indicate that this hypothesis 'does not really exist, although it may seem to do so,' as was said by a distinguished writer concerning another

[1] Mr. Mivart's final verdict is as follows :—'With regard to the conception as now put forward by Mr. Darwin, I cannot truly characterise it but by an epithet which I employ with great reluctance. I weigh my words, and have present to my mind the many distinguished naturalists who have accepted the notion, and yet I cannot hesitate to call it a *puerile hypothesis*.'—*Lessons from Nature*, p. 300.

theory ; in other words, that it has no scientific basis. The first is this—that the hypothesis of natural selection is not *directly* supported by any single fact in the whole range of natural history or palæontology ; but that on the other hand every fact which is known with any certainty in those sciences, so far as it bears upon natural selection, directly opposes it. In adducing evidence of these positions I will neither give my own observations nor those of any opponent of the theory, but will call upon its friends and supporters to bear their testimony, first, as to the evidence for the succession of life upon the earth from lower to higher forms ; and, secondly, as to the existence of any instance of conversion of one species into another.

Professor Huxley, whose authority in all matters of natural history and palæontology is indisputable, and who cannot be suspected of any antagonism to Evolution in general, or to Mr. Darwin's views in particular, thus writes in 1862 :—

> What, then, does an impartial survey of the positively ascertained truths of palæontology testify in relation to the common doctrines of progressive modification, which suppose that modification to have taken place by a necessary progress from more to less embryonic forms, or from more to less generalised types, within the limits of the period represented by the fossiliferous rocks ?
>
> It negatives those doctrines, for it either shows us no evidence of such modification, or demonstrates it to have been very slight ; and as to the nature of that modification,

it yields no evidence whatsoever that the earlier members of any long-continued group were more generalised in structure than the later ones. . . . Obviously if the earliest fossiliferous rocks now known are coëval with the commencement of life, and if their contents give us any just conception of the nature and extent of the earliest fauna and flora, the insignificant amount of modification which can be demonstrated to have taken place in any one group of animals or plants is quite incompatible with the hypothesis that all living forms are the results of a necessary process of progressive development, entirely comprised within the time represented by the fossiliferous rocks.

Contrariwise, any admissible hypothesis of progressive modification must be compatible with persistence without progression through indefinite periods.[1]

This momentous judgment was somewhat revised in the anniversary address to the Geological Society in 1870. It was fully confirmed 'so far as the *invertebrata* and lower *vertebrata* are concerned;' but it was to some extent modified in reference to the higher *vertebrata*, where there seemed to be 'a clear balance in favour of the evolution of living forms one from another'—this with sundry qualifications. The learned writer gives it also as his opinion that should such an hypothesis as that of progressive modification 'eventually be proved to be true,' *the only way in which it can be demonstrated will be* 'by *observation and experiment* upon the existing forms of life.'[2]

[1] Essay on *Persistent Types of Life*, in *Lay Sermons*, p. 225.

[2] *Ibid.*, p. 226.

With regard to the second point in question, the transmutation of species, the same authority writes thus :—

> After much consideration, and with assuredly no bias against Mr. Darwin's views, it is our clear conviction that as the evidence stands, it is not absolutely proven that a group of animals, having all the characters exhibited by species in nature, has ever been originated by selection, whether artificial or natural.[1]

This was written in 1860; it was confirmed in 1863, in the essay on 'Man's Place in Nature;' and up to the present time the evidence stands exactly where it did; observation and experiment alike having hitherto failed to make evident the slightest approach towards specific transmutation. Notwithstanding which, Professor Huxley now declares that Evolution, which was once 'a matter of speculation and argument,' has now 'become a matter of fact and history. The history of Evolution, as a matter of fact, is now distinctly traceable. We *know* it has happened, and what remains is the subordinate question of how it happened.'[2] The *cacoëthes* of assertion appears to increase in intensity, as the cause becomes more hopeless.

Again, on the other hand, it has been clearly demonstrated that certain *specific* forms of life have remained absolutely unchanged during immeasurable periods of time, even since the chalk period. Professor Huxley says :—

[1] *Lay Sermons, &c.*, p. 295.

[2] *Address at Buffalo*, Aug. 25, reported in the *Times* of September 14, 1876.

The *Globigerina* of the present day, for example, is not different specifically from that of the chalk ; and the same may be said of many other *Foraminifera.* I think it probable that critical and unprejudiced examination will show that more than one species of much higher animals have had a similar longevity ; but the only example which I can at present give confidently is the snake's-head lamp-shell (*Terebratulina caput serpentis*), which lives in our English seas, and abounded (as *Terebratulina striata* of authors) in the chalk.[1]

Failing any direct support from palæontology, or from the phenomena of the now-living world, Mr. Darwin's theory can only claim acceptance in so far as it can be shown to be probable from the operation of the three principles of Variation, Struggle for Existence, and Natural Selection. Whether these are really living and acting principles, or whether they are mere names for non-existences, is the question now to be discussed.

1. Does *specific* variability exist in nature? The answer to this question would be readily given in the affirmative by a majority of living naturalists ; and yet if anything whatever is amenable to proof by observation, experiment, or reason, it can clearly be proved that the answer should be negative.

It needs no accumulation of instances to show that animals vary in form, colour, and generally in what may be called structure. Probably no one animal was ever exactly like another. Any boy who

[1] *On a piece of Chalk,* an address delivered in 1868, republished in 1874. *Lay Sermons,* p. 198.

has kept rabbits, pigeons, dogs, cats, or any animals whatever, is as familiar with certain facts of variation as the most learned naturalist. The *causes* of variation are obscure—its limits are undefined structurally, but perfectly definite physiologically. It is quite true that by artificial selection the breeder of stock may 'not only modify the character of his flock, but change it altogether—he may summon into life whatever form and mould he pleases' (Youatt). It is true, as Lord Somerville observes, concerning the breeders of sheep, that 'it would seem as though they had chalked out upon a wall a form perfect in itself, and then had given it existence.' But these, and all the instances that can be adduced (and they are innumerable), are the most convincing and irresistible arguments *against specific variability.* For whilst we can vary form, colour, and structure indefinitely, the specific physiological characters remain always and absolutely the same. The sheep is always a sheep, the dog is always a dog, the rabbit is always a rabbit, even if we succeed in varying their form and appearance until they are almost unrecognisable as such. The physiological characters, as marked by fertility, are absolutely constant; no variation in this respect, to even the slightest extent, has ever been observed in nature, or developed by art.[1] To suppose that it can ever begin to be other-

[1] 'Our acceptance of the Darwinian hypothesis must be provisional so long as one link in the chain of evidence is wanting; and so long as

wise, is merely an unwarranted conjecture, such as would be rejected summarily in any other science. If any biological position can be established beyond doubt, it is this, that indefinite structural variability, with absolute physiological stability, must be considered as proof that specific differences are not dependent on structure alone ; but that they are due to a special endowment not to be traced to the 'molecular possibilities of protoplasm.'

A species presents two groups of qualities—A (morphological or structural), and B (physiological or functional). With such certainty as attaches to any of our knowledge, we know that A varies constantly, and within very wide limits ; with exactly the same certainty we know that amidst all these variations B remains absolutely constant. The inevitable corollary of this proposition is that B (mathematically speaking) is not a function of A; in physiological language, that *function* is not essentially dependent upon *structure*. This truth meets us everywhere in biological research.

By the use of this method, we are compelled to recognise B as indefinitely more important than A, as being a constant quantity, whereas the latter is indefinitely variable. If we are told that our classifications are founded necessarily upon A, it may be replied,

all the animals and plants certainly produced by selective breeding from a common stock are fertile, and their progeny are fertile with one another, *that link will be wanting*.'—*Man's Place in Nature*, p. 107.

without any intention of epigram, 'So much the worse for the classification;' for this, to be of any value, should be founded upon constant elements. The truth is, however, that variation occurs chiefly in *non-essential* particulars, and has no more effect in altering specific nature, than allowing a man's hair and beard to grow has upon his personal individuality.

Furthermore, there is an entire absence of evidence of any '*favourable* variation' ever having occurred; and there is an utter vagueness in even surmising what kind of variation might really be favourable in itself, without entailing unfavourable results in its necessary accompaniments.[1] When we consider also that the supposed variations are so slow, and so infinitesimally minute, that it might require 'a million or a hundred million generations'[2] to establish the characters of a 'well-marked variety,' we are fairly justified in hesitating to believe in any such inconceivable agencies. If anyone proposed to move one of the Pyramids by shooting paper pellets at it, he might be logically right in urging that no force, however small, can be lost, and by accumulation must be effective; but we should scarcely argue the question with him.

[1] Mr. Darwin confesses to this difficulty in many places, and often uses such expressions as the following:—'It is good thus to try in our imagination to give any form some advantage over another. Probably in no single instance should we know what to do so as to succeed. It will convince us of our ignorance on the mutual relations of all organic beings; a conviction as necessary as it seems difficult to acquire.'—*Origin of Species*, p. 78.

[2] *Ibid.*, p. 124.

There are two final considerations necessary to be remembered in attempting to form a judgment on this subject. The first is that 'varieties' generally manifest a tendency towards *reversion* to the original type, when removed from the influence of artificial agencies. The second is this, that although our knowledge of all the circumstances connected with the formation of 'races' is very imperfect, yet what we do know with any certainty *decidedly opposes* the theory of their being formed by slow and minute variations. On the contrary, all the marked instances with which we are acquainted have occurred *suddenly*, and under conditions of which no adequate explanation could be given; as in the case of the Ancon sheep. This certainly was not an example of selecting and preserving a variation favourable to the individual or to the race.

2. Is there anything in nature which can be called a 'Struggle for Existence,' within the meaning of the hypothesis? Certainly not, if by 'struggle' is implied any event or combination of events, the result of which can in any way be influenced by slight individual variations. It is true that all organic beings tend to multiply at a rate which, if unchecked, would in any one instance very soon overstock the earth. The elephant is supposed to breed more slowly than any other known animal; yet at the lowest computation one pair might easily be the ancestors of fifteen millions in five centuries. As to the multiplication of the lower animals, the understanding is baffled in

attempting to realise their increase. In five generations one aphis may be the parent of 5,904,900,000 individuals, and there may be twenty generations in a year. The female flesh-fly will have 20,000 young ones; and in five days any pair of these are qualified to produce as many more; and Linnæus asserts that three flies of the *Musca vomitoria* could devour the carcase of a horse sooner than a lion. The unchecked produce of one pair of herrings or mackerel would in a very few years crowd the Atlantic until they had no room to move; and it would not require a century for any pair of birds, or any of our domestic animals, so to stock a continent, that not an individual of any other species could exist there.

It is evident, then, that of all the countless myriads of living creatures born within any given period by far the greater part must be destroyed; and this wholesale destruction is effected by means which absolutely preclude any idea of 'struggle,' as influencing the result in the slightest conceivable degree. When clouds of locusts devastate an entire district; when countless millions of aphides destroy vegetation, and are themselves helplessly swallowed up in mass by ladybirds and other enemies; when the great ant-bear destroys thousands of ants, with their dwelling, for a single repast; when the *Balænoptera* engulfs whole shoals of herrings and smaller fish for a mouthful; when thousands of small fry—shrimps, crabs, molluscs, and medusæ—disappear for each meal of the common

Greenland whale; when the bear or the badger destroy and devour the nests of bees wholesale—surely in all this the most vivid imagination can see no room for 'struggle,' or any possibility of 'survival of the fittest.' For what advantage could it afford an insect that was about to be swallowed by a bird, that it possessed a thousandth fragment of some property not possessed by its fellows? What preservation against ravages of the slugs would be afforded by an 'infinitesimal' difference between one weed and its neighbour? What minute difference would avail the duckling that the fox was about to carry off? These may perhaps be deemed feeble and trifling illustrations; yet it is only by bringing the principle to some such practical test as these that its truth or probability can be recognised. It sounds at first plausible enough to say that profitable variations will naturally tend to the preservation of individuals; but when we put it to the test, and see that it is theoretically improbable, and that there is a total lack of direct evidence that such has ever been the case, we are disposed to look upon it as more sound than sense. The balance of the organic world is preserved by the order of nature, in obedience to which the stronger prey upon the weaker; and against this law, without which nature itself would be a chaotic impossibility, there is no appeal, no resistance, no 'struggle.'

It must be observed, before leaving this part of the subject, that Mr. Darwin himself, beyond the

general idea of struggle and survival, has no definite notion of the circumstances demanding such struggle, nor of its essential nature. The following are only a few out of innumerable illustrations that might be brought forward. In the 'Origin of Species,' at p. 109, it is stated that 'from the high geometrical ratio of increase of all organic beings, each area is already *fully stocked* with inhabitants, &c.;' but on the next page it is said that 'probably no region is as yet *fully stocked*.' At p. 110 it is stated that 'it is the most closely allied forms—varieties of the *same species*, and species of the *same genus*, or related genera—which, from having nearly the same structure, constitution, and habits, generally come into the severest competition with each other.' Here we seem to have arrived at a general principle; but at p. 114 another view requires support incompatible with this, and we are told that 'the advantages of diversification of structure, with the accompanying differences of habit and constitution, determine that the inhabitants which thus jostle each other most closely shall, as a general rule, belong to what we call *different genera* and *orders*.' And at p. 121 (all these occurring in the same chapter, and in different parts of the same argument) we find again that the struggle 'will be most severe between those forms which are *most nearly related* to each other in habits, constitution, and structure.' From all which it is not unnatural to conclude that the idea of 'a struggle for

existence' is not to be reconciled with the observed facts of nature.

3. If there be any cogency in the foregoing considerations, the conclusion from them is inevitable, that 'Natural Selection' is a mere euphuism for a negation—a happy phrase for something that is not—representing only a casual residuum after wholesale and indiscriminate destruction. In itself it is absolutely 'nothing;'[1] in its application as a theory to individual phenomena it is full of the most irreconcilable incoherencies. Two illustrations only will suffice to show the impossibility of rationally adapting the imaginary principle of natural selection to existing facts. In Madeira there are various kinds of beetles, some having wings largely developed, some having moderate ones, and some without. It is rather amusing to see the manner in which these differences are reconciled to the theory. The large wings are 'quite compatible with the action of natural selection. For when a new insect first arrived on the island the tendency of natural selection to enlarge or reduce the wings would depend upon whether a greater number of individuals were saved by successfully battling with the winds, or by giving up the attempt, and rarely or never flying.'[1] Then, in the same page, the author adds that certain considerations have made him 'believe that the wing-

[1] This phrase is used by Mr. St. George Mivart, in his *Lessons from Nature*, p. 300.

[2] *Origin of Species*, p. 136.

less condition of so many Madeira beetles is mainly due to the action of natural selection, but combined probably with disuse. For during thousands of successive generations each individual beetle which flew least, either from its wings having been *ever so little* less perfectly developed, or from indolent habit, will have had the best chance of surviving from not being blown out to sea; and, on the other hand, those beetles which most readily took to flight would oftenest have been blown out to sea, and thus have been destroyed!' The second instance is taken from the account of the action of natural selection upon certain blind animals in the caves of Styria and of Kentucky. Natural selection has acted here by preserving blind animals, because those which had sight might be subject to 'inflammation of the nictitating membrane.'[1] But it seems that in one of the blind rats the eyes themselves are of 'immense size;' and it would appear to be a most extraordinary mistake of natural selection to preserve this animal merely *because* blind, whilst its 'immense' eyes still remain subject to the objectionable inflammation. It is difficult to imagine any reasoning more puerile, occurring in a grave scientific work, the results of which upon natural history and philosophy generally were destined to be so important.

If I dwell for a brief space longer upon some of the impossibilities involved in the reception of this

[1] *Origin of Species*, p. 137.

theory, it is because, although virtually abandoned by its author, as will be seen presently, it still lives in the minds of many, and acts as a serious obstacle to the advance of science.

There is no principle more frequently and distinctly enunciated in Mr. Darwin's work than that natural selection can only act by preserving and perpetuating *exceedingly minute* variations, of such a character as will enable their possessor to contend more vigorously in the struggle for life. We have already seen that there is no such struggle. But even if there were, variations so minute as are constantly insisted upon could by no possibility give their possessor any advantage. We should entirely fail to form any conception how a very slightly enlarged sebaceous follicle, a minute pimple on the nose of a fish, or a microscopic point of ossification or consolidation amongst the muscles of any animal, could give its possessor any superiority over its fellows; yet by the terms of the hypothesis such and no other must have been the origin of the mammary gland; of the powerful offensive weapons of the sword-fish or saw-fish; and of locomotor organs generally amongst the higher animals. But the earliest rudiments of a gland, or other organ, of an offensive weapon, or of a limb, must have been absolutely functionless, and therefore useless to its possessor, if developed in this way. The application of the principle is therefore impossible.

The absence of transitional forms between different species has always been recognised as a serious difficulty. Professor Huxley, who is much more Darwinian than Mr. Darwin himself, says that this difficulty 'has no force;'[1] but Mr. Darwin does not fail to see how serious it is. He says:—

> Geology assuredly does not reveal any such finely-graduated organic chain; and this perhaps is the most obvious and gravest objection which can be urged against my theory. The explanation lies, as I believe, in the extreme imperfection of the geological record.[2]
>
> I do not pretend that I should have ever suspected how poor a record of the mutations of life the best preserved geological section revealed, had not the difficulty of our not discovering innumerable transitional links between the species, which appeared at the commencement and close of each formation, pressed so hardly on my theory.'[3] And 'he who rejects these views on the nature (i.e. the extreme imperfection) of the geological record, will rightly reject my whole theory.[4]

After these plain confessions of want of support from geology as it now is, the difficulty is cut at once. Where are the transition forms connecting the species in the same formations? The answer is ready; they are not preserved—the conditions were unfavourable. 'Where are the remains of those infinitely numerous organisms which must have existed long before the first bed of the Silurian system was deposited?'[5] This question refers to the fact of

[1] *Lay Sermons*, p. 296.
[2] *Origin of Species*, p. 280.
[3] *Ibid.*, p. 302.
[4] *Ibid.*, p. 342.
[5] *Ibid.*, p. 343.

finding creatures of high organisation in the earliest seas, whence the supporters of 'Evolution' were obliged to suppose countless ages of development before the age of trilobites. The answer to it is equally trenchant and conclusive: 'They may now all be in a metamorphosed condition, or may lie buried in the ocean.'[1] Can Mr. Darwin fail to see that there cannot be imagined any theory of ontology too wild and monstrous to be supported by argument like this?

But geology has its tale to tell, and one which appears not only not to support, but clearly to controvert, the development theory. It never was the highly generalised types or the small and feeble species or germs that first appeared either amongst molluscs, fish, reptiles, or mammals. Where are now the representatives of the gigantic fishes of the old red sandstone? Where are the mighty reptile tyrants of air, earth, and water of the oolite? Have they been 'improved' and 'preserved' into the puny representatives of the modern reptile class? Where are the ponderous monsters that shook the eocene and miocene earth with their massive tread? Where is the megatherium, unless *improved* into the feeble sloth of the present day? These races appeared in the plenitude of their power; and as their dynasty grew old, it was not that the race was 'improved' and preserved in consequence; but they dwindled,

[1] *Origin of Species*, p. 343.

and were, so to speak, degraded, as if to make room in the economy of nature for their successors. But this is too large a subject to enter upon at present.

Mr. Darwin gives some imaginary details respecting the development of certain instincts concerning which it may be sufficient to remark that, had they been given by an opponent in the form of satire, or of a *reductio ad absurdum*, the purpose would appear to have been well answered. One instance may be given. The American cuckoo builds its own nest; probably the English cuckoo did so once, but perhaps accidentally and occasionally laid an egg in another bird's nest.

> If the old bird profited by this occasional habit, or if the young were made more vigorous . . . then the old bird or the fostered young would gain an advantage. And analogy would lead me to believe that the young thus reared would be apt to follow by inheritance the occasional and aberrant habit of their mother. . . . By a continued process of this nature, I believe that the strange instinct of our cuckoo could be, and has been generated.[1]

The final and utterly fatal blow to the theory of natural selection is found in the fact of the existence of *neuters* or sterile females in insect communities, such as the working ants. These differ widely both in structure and instinct from both parents, and yet, being absolutely sterile, are unable to transmit their peculiarities. Their development by natural selection,

[1] *Origin of Species*, p. 217.

therefore, is simply a contradiction in terms, a formal impossibility. Mr. Darwin recognises the difficulty to the extent of saying, that it *at first* appeared 'fatal to his whole theory;' and adds, 'It may well be asked, how is it possible to reconcile this case with the theory of natural selection?'[1] It certainly is not possible; and all that is said by way of illustration does not tend in the slightest degree either to remove or lessen the difficulty.

On a general survey of the theory, nothing strikes the inquirer more forcibly than the total absence of direct evidence of any one of the steps. No one professes to have ever seen a variety (producing fertile offspring with other varieties) become a species (producing no, or infertile, offspring with the original stock). No one knows of any living or any extinct species having given origin to any other, at once or gradually.[2] Not one instance is adduced of any variety

[1] *Origin of Species*, pp. 236, 237.

[2] A formal exception must here be made in favour of Dr. Büchner, who states (*Force and Matter*, p. 80), that '*Holothuriæ* engender snails!' and adds, 'If such an extraordinary process is possible that a *holothuria* should produce a snail, what naturalist can deny that conditions may once have subsisted in which . . . an ape, nay, *any other animal*, may have given birth to man?' As this snail event is less likely to occur, zoologically speaking, than that a hen should hatch from one of her eggs a puppy dog, we may infer the value of Dr. Büchner's revelations generally. This learned and cautious gentleman (in his preface, p. cii.), states that *his* method of investigation 'has already conducted him to truth, enlightenment, and deliverance of his fellowmen from obsolete and pernicious prejudices.' That it has also conducted him to literary sobriety and decency is evident from his comments on all who think differently to himself, whom he calls a 'howling pack,' 'mental slaves,' and 'yelping curs.' (See preface, p. lxxxvi.)

having ever arisen which did actually give its possessor, individually, any advantage in the struggle for life. Not one instance is recorded of any given variety having been actually selected for preservation, whilst its allies became extinct. There is an abundance of semi-acute reasoning upon what might possibly have occurred, under conditions which seem never to have been fulfilled; but not the least fragment of direct testimony, either derived from human experience or from the geological record.

It is often said that it requires but little ingenuity to find objections to the Darwinian theory—that they lie on the surface—that Mr. Darwin himself was the first to recognise and acknowledge them. All this is to a certain extent true; but that an absolutely fatal objection to a theory lies on the surface, is no sufficient argument for rejecting such an objection, or refusing to recognise its validity. Mr. Darwin did, indeed, from the first acknowledge certain difficulties, with a candour which has perhaps done more to advance the spread of his doctrines than any other course would have effected. His error consisted in looking upon these difficulties as something to be *got over*, in many cases by mere forms of words; and in not *earlier* recognising that more than one of the objections were absolutely and essentially fatal to the whole doctrine. It would appear that now Mr. Darwin has virtually abandoned the theory of natural selection as an agency for the production of species;

that is, if words and ideas are allowed to have the same significance in regard to Evolution that they have in ordinary usage. In the 'Origin of Species' we are more than once told that it would be '*fatal*' to his theory if the discovery were made of characters[1] or structures which could not be accounted for by 'numerous, successive, slight modifications;' and now in the 'Descent of Man,' vol. ii. p. 387, we find the following passage:—

> No doubt man, as well as every other animal, presents structures which, as far as we can judge with our little knowledge, are not now of any service to him, nor have been so during any former period of his existence. . . . Such structures *cannot be accounted for by any form of selection*, or by the inherited effects of the use and disuse of parts.

Immediately afterwards he refers to their production by '*unknown causes*,' which obviously, like Professor Huxley's appeal to '*subtle influences*,'[2] as a source of life-phenomena, involves a relinquishment of the entire position.

The conclusions which necessarily follow from the foregoing observations may be briefly summed up in one syllogism, embracing not only natural selection, but also the larger theme of Organic Evolution generally—

[1] On this subject see also Mr. Mivart's *Lessons from Nature*, p. 337.

[2] See conclusion of Chapter III.

'Without *verification* a theoretic conception is a mere figment of the intellect:'[1]

But the theory of Organic Evolution is an unverified theoretic conception:[2]

THEREFORE ORGANIC EVOLUTION IS A MERE FIGMENT OF THE INTELLECT.

[1] Professor Tyndall's *Fragments of Science*, p. 469.

[2] As seen above, Professor Huxley gives it as his judgment that the only way in which such an hypothesis can be proved to be true is '*by observation and experiment upon the existing forms of life.*' It is fully acknowledged that hitherto *these* have given no direct evidence in favour of the theory.

CHAPTER VII.

THE PEDIGREE OF MAN.

Origin of Species, continued—Arguments from Morphology and Embryology—Descent of Man—Professor Huxley's doctrine—Structure and essential nature—Mr. Darwin's views—'Our ancestors'—Haeckel's 'Pedigree of Man'—Conclusion.

THERE is, however, a further aspect of this question of Evolution. Although *unverified* as yet, it is not *proved* that *some* form of evolution may not be verified in the future. What has been done so far amounts merely to a demonstration that the doctrine, as now generally propounded, receives no direct support from facts; and that 'natural selection,' in particular, is simply impossible. It *may be* that '*the continuous operation of the ordained becoming of living things*'[1] is effected under certain limitations by some kind of evolution; but inasmuch as it still lacks any vestige

[1] Owen's *Palæontology*, p. 3. Notwithstanding Professor Huxley's criticism upon this phrase, which he characterises as a 'quâ-quâ-versal proposition . . . which may be read backwards, forwards, or sideways, with exactly the same amount of signification' (*Man's Place in Nature*, p. 106), it seems to me to be at least as full of meaning as 'Nature's great progression from the formless to the formed—from the inorganic to the organic—from blind force, to conscious intellect and will' (*ibid.*, p. 108).

of proof, the doctrine in no way warrants its supporters in upholding it as the only possible or thinkable system of ontology.

'The strength of the doctrine of Evolution consists not in an experimental demonstration (for this subject is hardly accessible to this mode of proof), but in its general harmony with scientific thought.'[1] There is no doubt that if we can set aside the consideration of its adverse relation to all the phenomena revealed by 'observation and experiment,' much may be said, involving both reason and probability, in favour of this harmony with scientific thought. It must not, however, be forgotten that scientific thought can only mean the aggregate thoughts of scientific men; and that the doctrines of Evolution are not accepted universally. Mr. Darwin writes, in 1871:[2] 'Of the older and honoured chiefs in natural science, many unfortunately are still opposed to evolution in every form.' Since that time it is certain that, on the Continent at least, the doctrine has been met by many distinguished botanists and zoologists with growing disfavour. Nevertheless Evolution, if modestly and temperately advanced, forms an excellent nucleus around which to group many facts of science, and upon which to expend the energies and genius of philosophical research. And as the dreams of the alchemists became the *vera causa* of chemical science, so it may be

[1] *The Belfast Address*, by Professor Tyndall, p. 527.
[2] *Descent of Man*, p. 2.

anticipated that at some future time, what are now the crude and baseless speculations of Evolution may lead to a truer knowledge of natural law, and a more perfect system of biology.

The strongest arguments in favour of the derivative origin, or evolution, of living forms, are found in the study of homologies (Morphology), and of Embryology, and these must now be briefly noticed.

Homology is the name applied to the investigation of those profound resemblances which have so often been found to underlie superficial differences between animals of very different form and habit. Thus man, the horse, the whale, and the bat, all have the pectoral limb, whether it be the arm, or fore leg, or paddle, or wing, formed on essentially the same type, though the number and proportion of the parts may more or less differ. Again, the butterfly and the shrimp, different as they are in appearance and mode of life, are yet constructed on the same common plan, of which they constitute divergent manifestations. No *à priori* reason is conceivable why such similarities should be necessary, but they are readily explicable on the assumption of a genetic relationship and affinity between the animals in question, assuming, that is, that they are the modified descendants of some ancient form, their common ancestor.[1]

The manifold indications of community of plan with diversity of execution, met with so constantly in the organic world, are phenomena full of the deepest interest and the most profound significance. It cannot be doubted that community of descent, genetic

[1] This passage is taken from Mr. Mivart's General Summary of the Doctrine of Natural Selection : *Genesis of Species*, p. 7.

relationship, or blood affinity, combined with *indefinite variability*, would satisfactorily account for them. But as these conditions are entirely hypothetical, and involve a *petitio principii*, we must inquire whether they can be explained by no other means. If it be clearly demonstrated that they cannot, then *derivation* must be accepted. If, on the other hand, it can be shown that rational analogies indicate another possibility, then the question will still remain *sub judice*.

Our knowledge of the *causes of form* throughout nature is absolutely *nil*, but we know something concerning its accessory conditions, and from this knowledge it can be clearly demonstrated that similarity and identity of form do not necessarily depend upon community of origin. For the support of this proposition I would appeal to the phenomena of crystalline *isomorphism*, the fundamental law of which, as stated by Mitscherlich, is that 'bodies having a similar chemical constitution have also the same crystalline form, as determined by the measurement of their angles.' As an example, it is shown that the corresponding salts of phosphoric and arsenic acids, containing equal numbers of atoms of water, crystallise in the same forms.'[1] Those who reduce all inorganic and organic forces to the same category cannot consistently object to an illustration of organic laws from the inorganic world; and here we have identity of form produced, and in other and allied instances all kinds

[1] See Watts' *Dictionary of Chemistry*, 'Isomorphism.

of small modifications of form, where any idea of genetic relationship is altogether out of the question. This illustration *proves* nothing as to organisms, further than this, that matter in general aggregates into certain special forms, in obedience to a force of which we know nothing. If simple salts aggregate into identical and allied forms, where their constitution is different, and where genetic affinity is impossible, is it inconceivable that, without this affinity, matter so much more complex in composition may aggregate also into allied forms?

Wherever we turn in biological research, we are compelled, if we will be logical, to recognise behind every outer form of living things a '*special endowment*' which can by no ingenuity be formulated in terms of molecular complication. It may be humbling to our pride to have to take refuge in a phrase; but what can we do? The 'endowment' *is there*, in whatever it may consist; otherwise we are compelled to recognise diverse effects proceeding from the same cause. 'The primordial germs of a man, a dog, a bird, a fish, a beetle, a snail, and a polyp are in no essential structural respects distinguishable;'[1] yet, in virtue of what we must of necessity call a special endowment, each ultimately assumes its destined form. A fragment of begonia leaf grows into a begonia plant; a morsel of divided polyp grows into the same species of polyp—all due to an endowment which we can in nowise ra-

[1] Professor Huxley's *Lay Sermons*, p. 104.

tionally connect with mere organisation. It does not appear as if that most cumbrous, most incomprehensible, and most hopelessly complicated and impossible of doctrines, called Pangenesis, could help us at all in the emergency. We can form no definite conception of the nature of this endowment any more than we can of the nature of life itself; but it is surely better to acknowledge our ignorance, than dogmatically to assert that it is something which it demonstrably is not.

Again, if similarity of structure and typical formation be admitted as an argument for community of origin, surely it would be reasonable, conversely, to view diversity of typical formation as an argument for independent origin. Now, there are at least five distinct types upon which the members of the animal kingdom are constructed, which cannot possibly be reduced to any general expression or formula. The *Protozoa*, the *Cœlenterata*, the *Mollusca*, the *Annulata*, and the *Vertebrata* have all different archetypes, which have no natural or derivative relation one to the other. There is no traceable structural or developmental relation between any two of these, and we have it affirmed on the highest authority that '*there is not the least evidence to prove that a form, in the slightest degree transitional between any two of the groups . . . either exists or has existed during that period of the earth's history which is recorded by the geologist.*[1] This

[1] *Lay Sermons—Study of Zoology*, p. 103.

is a most important statement, and one which would appear to be absolutely fatal to any idea of unbroken causative or genetic succession of organic forms. But Evolution is more than hydra-headed, and error dies hard. We 'must not for a moment suppose, because no such transitional forms are known, that the members of the sub-kingdoms are disconnected from, or independent of, one another. On the contrary, in their earliest condition they are all alike,'[1] and their primordial germs are in no essential structural respect distinguishable; and this is considered to be conclusive evidence that they are all 'bound together by an all-pervading unity of organisation,' —including five distinct and utterly unassimilable types!

The argument from embryology is derived from the fundamental fact that the primordial germs of all animals (above the very lowest, of which we know little or nothing) are absolutely alike in all essential particulars. They are approximately (in most instances) of the same size; they are of the same chemical composition; and they present themselves under an absolutely identical form, that of a simple cell. Further, the history of this cell corresponds, in all types, to a remarkable extent. In all cases it divides first into two similar cells, then into four, eight, sixteen, and so on, until it arrives at the stage of the *Morula* (Haeckel) or 'mulberry mass.' Then com-

[1] *Lay Sermons—Study of Zoology*, p. 103.

mences another order of transformations, the first of which is the appearance of the 'blastodermic vesicle.' So far the process is virtually identical in all cases; and in the case of the higher animals, man included, the development of the embryo so closely corresponds, up to a late period, that at a tolerably advanced stage, say of the dog and man, the appearances are exceedingly similar.

For further illustration, the development of the higher animals may be represented as passing through certain stages, A, B, C, D, &c. . . . to Z—all those below Z representing closely corresponding stages in the lower forms; not the forms of the completed animal, but what may be considered a sketch or diagram of these or their embryos. We may suppose, for instance, that calling Z the perfected development of man, W might represent the incomplete ape, T forms of the lower mammalia, S the amphibia, P fishes, M annelida, F amœboid creatures, and so on. Then each one of these divisions at some period in the course of its development represents (typically or diagrammatically) the divisions *before it* in the alphabet, just as S, representing say the frog, presents at one period of its history the form of P (fishes), as a tadpole. They do not in all cases present the whole of the letters preceding, but always some, and always in order, although the order may be broken. Thus the series might be A, C, K, S, &c., but never in the form of any succession like B, M, F, D, or the like; and

particularly it must be remarked that the embryonic forms of any given race, say N, never represent any further or higher development, as P or S, but always and exclusively the types below, as K, L, M, &c. It is also 'a general law, that the more closely any animals resemble one another in adult structure, the longer and the more intimately do their embryos resemble one another; so that, for example, the embryos of a snake and of a lizard remain like one another longer than do those of a snake and a bird; and the embryo of a dog and of a cat remain like one another for a far longer period than do those of a dog and a bird; or of a dog and an opossum; or even than those of a dog and a monkey.' [1]

From all this has been deduced, in modern times, the beautiful and philosophical doctrine of the correspondences between Ontogenesis and Phylogenesis,[2] a doctrine the importance and utility of which can scarcely be over-estimated, so long as its domain is not extended to the explanation of phenomena, to which it is in nowise applicable. It is thus formulated by Haeckel:[3]—

These two divisions of our science, Ontogenesis and Phylogenesis, stand in the closest possible connection; and the one cannot be understood without the other. This fundamental biogenetic law, upon which the comprehension of the entire doctrine of organic evolution absolutely depends, may

[1] Professor Huxley's *Man's Place in Nature*, p. 65.

[2] *Ontogenesis*, the history of individual development. *Phylogenesis*, the history of genealogical development. *Biogenesis*, the history of life-development generally (Haeckel).

[3] *Anthropogenic*, p. 7.

be shortly expressed thus :—*The history of the germ is an abstract or epitome of that of the race* ; in other words, *Ontogenesis is a brief recapitulation of Phylogenesis* ; or, in somewhat greater detail, thus :—The series of forms presented by the individual organism during its development from the original germ to its perfect condition is a short and compressed repetition of the long series of forms presented by the ancestors of this organism, from the earliest periods of the so-called organic creation up to the present time.[1]

Professor Haeckel further proceeds to deduce from this the doctrine that 'Phylogenesis is the *mechanical cause* of Ontogenesis,' on the supposition that each stage of development is directly inherited from some early member of the genealogical tree.

The facts of natural history and biology generally that group themselves around this idea are interesting and instructive in the highest degree. But to reason from the *correspondences* of embryonic development with lower forms of animal life, that they stand in relation of necessary cause and effect, is laying upon the doctrine a burden which it can by no means bear. A full examination of the subject is not only impossible within our limits, but would be unnecessary and out of place. It must suffice here to show that the facts of Ontogenesis by no means involve necessarily the admission of a common origin.

It is somewhat remarkable that it seems never to have occurred to the supporters of this doctrine that, on *mechanical* principles, those principles to which they are so ready to appeal in other departments, the

development of a simple cell, under any theory whatever of ontology, must of necessity present a certain uniformity. The germ is *the same* in form and in chemical constitution, and therefore in 'molecular possibilities,' in all cases; on physical principles, therefore, it is only natural to suppose that its development *must* run the same course, if it be allowed that physical forces have anything to do with development. The mystery is not why the embryo in all cases *should* present certain resemblances, but why it *should not.* On ordinary principles we should expect that *all* germs *should* pass through the stages A, B, C, &c., more or less of them, if such be the case with any one of them—and it is altogether unnecessary to call in a '*deus ex machinâ*' in the form of Phylogenesis to account for so obviously probable a fact. What possible reason is there that it should be otherwise? Why should germ A follow a certain course of development, and germ B, identical in all ascertainable particulars, and placed under similar conditions, follow a different one? And how is it made any the more or the less probable by attributing to them a common origin? Why one germ should be arrested at E, another at M, and another go on to Z, certainly does involve a mystery; but one not elucidated by either Phylogenesis, or any other *mechanical* hypothesis. Why the *differentiæ* ever occur is assuredly not to be explained by community of origin.

From all this it would appear that, although the

phenomena of morphology and embryology would give interesting corroborative testimony in illustration of an *already proved* doctrine of Evolution, they can by no means be made to serve as proof in themselves; and that we must accept the sound and philosophical judgment of Professor Huxley on this subject, that the truth of derivation of species can only be *proved* by 'observation and experiment upon the existing forms of life.'

If the doctrine of Organic Evolution fails to establish its claim to existence as a scientific hypothesis with regard to the brute creation, still less can it bear the weight of the supposition that man is *only* a higher brute, owing his origin to direct descent from brutes, and to natural selection amongst these. Before discussing this subject, I wish to make one preliminary remark. Man's 'essential bestiality'[1] has of late years been so often and so dogmatically asserted, that an impression has gone abroad, that the statements are founded on some positive scientific data. Thus when men of Mr. Darwin's eminence state that unless we 'wilfully close our eyes, we may . . . . recognise our parentage'—that 'the grounds upon which this conclusion rests will never be shaken'—and that only he who is content to look upon nature 'like a savage' can 'any longer believe that man is

[1] I believe the phrase is Mr. Mivart's, occurring in a most destructive criticism of the doctrine in question, but I have not the exact reference.

the work of a separate creation,'[1] then those who still believe that scientific men must have some foundation for their confidently-expressed opinions, will naturally attach considerable weight to them. Let it then be clearly understood in the outset, that whatever may be asserted, in language however positive, there is absolutely nothing known scientifically concerning man's origin; and that all that has been or can be said consists merely of rash and hasty inferences and deductions from the general doctrines of Evolution, the value of which we have been attempting to estimate, and which (we have seen strong reason to believe) is only an '*unverified theoretic conception;*' in other words, a figment of the imagination.

In Professor Huxley's brilliant sketch, entitled 'Evidence as to Man's Place in Nature,' the structural and developmental relations between man and certain of the higher animals are set forth in the most graphic and incisive manner. It is conclusively demonstrated that the differences in structure, however great they may appear, are greater between certain different races of men, than between the lowest man and the highest ape. It is shown in particular (p. 78) 'that the difference in volume of the cranial cavity of different races of mankind is far greater absolutely, than that between the lowest man and the highest ape, while, relatively, it is about the same.' It

[1] *Descent of Man*, vol. i. p. 213, and vol. ii. pp. 385, 386.

is further demonstrated that, 'whatever system of organs be studied, the comparison of their modifications in the ape series leads to one and the same result—that the structural differences which separate man from the gorilla and the chimpanzee are not so great as those which separate the gorilla from the lower apes' (p. 103). With regard to the embryological proof, it is remarked (p. 66) that 'it is very long before the body of the young human being can be readily discriminated from that of the young puppy,' . . . . and 'that it is only quite in the later stages of development that the young human being presents marked differences from the young ape, while the latter departs as much from the dog in its development as the man does.' The author adds :—

> Startling as the last assertion may appear to be, it is demonstrably true, and it alone appears to me sufficient to place beyond all doubt the structural unity of man with the rest of the animal world, and more particularly and closely with the apes. (P. 67.)

These, in common with all the arguments advanced on this side of the question, are admirably adapted to prove, that which I suppose it has never occurred to anyone to doubt—namely, that man is an animal. It is difficult to conceive what else he could be, if he were intended to be a living, active, and intelligent creature in any form ; and if an animal, then it is certain that the type of his formation must correspond to that of some of the higher mammalia.

(For a clear and logical demonstration of this position, the reader is referred to Mr. Mivart's 'Lessons from Nature,' in the chapter on 'Man.') The real question at issue is not whether man is an animal, but whether he is not also something more and higher—something endowed with attributes differing not only in degree, but also in kind, from those of the brute—attributes of which the brute has not even the most elementary germ.

I think Professor Huxley satisfactorily answers this question in the work already quoted. After showing 'that no absolute structural line of demarcation, wider than that between the animals which immediately succeed us in the scale, can be drawn between the animal world and ourselves,' he indicates the essential superiority of man, as being 'the *only consciously intelligent* denizen of this world' (p. 110), and adds that 'no one is more strongly convinced than I am of the vastness of the gulf between civilised man and the brutes, or is more certain that, whether *from* them or not, he is assuredly not *of* them.'

But this is not all: after showing how very closely man corresponds *structurally* with the higher apes—so closely that there is less difference between him and the gorilla, than between the gorilla and the lower apes—Professor Huxley frankly recognises an '*immeasurable* and *practically infinite* divergence of the human from the simian stirps' (p. 103). This is a statement of the utmost significance, and involves a final and

perfect demonstration of the truth that has been forced upon our attention more than once in the course of this inquiry, namely, that *structure* does not even approximately represent essential nature. We first saw reason to believe that structure (or molecular composition) was *not life*; subsequently it appeared that structure was not the essence of species, or specific difference; and now it is perfectly evident that structure does not cover nor even indicate the essential nature of man. For, with a certain difference in *structure* between the lower apes and the gorilla, we find but a moderate, certainly finite, and easily measurable difference of *nature* between them; whilst with *a less marked difference* of structure between the gorilla and man, we have a divergence of *nature* '*immeasurable* and *practically infinite*.'

Can any demonstration be more complete and cogent, that man's specific characteristics are not to be defined by details of bodily structure? It is by the possession of attributes and faculties that either do not exist at all, or are merely rudimentary, in the brute, that his essentially distinct nature and origin are indicated. By the possession of intelligently articulate language, of a conscious reasoning and reflective faculty, of a moral sense, of a religious sentiment; by his power of conceiving abstract ideas of truth, justice, &c.; by his faculties of judgment and conscious volition; by all these it is demonstrated that man is neither *from* nor *of* the brute; that he 'differs

fundamentally from every other creature which presents itself to our senses; that he differs absolutely, and therefore differs in origin also.'[1] And great as are all those marks of distinction, one perhaps still more important remains behind, that is, man's capability for continuous progress—his power of utilising and profiting by the 'registered experience' of successive generations.

Whether any animals may be considered to possess any rudiments, from which, by means of evolution and natural selection, articulate speech might be supposed to be developed, is very doubtful, even in the minds of the Evolutionists.[2] Mr. Darwin freely confesses that 'articulate language is peculiar to man.'[3] Professor Huxley is of the same opinion, but attributes the want of it in the higher brutes to some 'inconspicuous structural difference,' as slight as might be imagined to exist between 'a watch that keeps accurate time, and another that will not go at all,' owing to some trifling accident, such as a 'hair in the balance-wheel, a little rust on a pinion,'[4] or the like. With reference to this question of structure, it is not uninteresting to consider the fact, that the power of uttering articulate words is not found in those races, the structure of whose

[1] *Lessons from Nature*, p. 190.

[2] Except the ingenious Dr. Büchner, the value of whose statements we have already seen. He says that animals *have* articulate speech.

[3] *Descent of Man*, vol. i. p. 54.

[4] *Man's Place in Nature*, p. 103.

vocal organs is nearest to that of man ; but in such creatures as parrots, whose vocal organs are so different to those of man, that it is not altogether easy to trace either the analogous or the homologous parts.

With regard to volition and the reasoning faculty, we may observe some germs in animals, although it is not always possible to distinguish how much may be due to mere reflex action. As relating to the other distinguishing characteristics of man, they do not seem to be present in even the most rudimentary form in the brute. There is evidently no indication of progressive possibility ; it needs no discussion to show that the religious sentiment has no representative whatever, nor such abstract ideas as truth and justice ; and Mr. Darwin's abortive attempt to trace back the 'moral sense' to some development of gregarious or social instincts is so completely beside the mark, that it really presents no point for criticism. Professor Huxley, with great sagacity, says nothing about it.

Turning to the genealogical tree of the human race, as sketched by Evolutionists, we meet with many points of interest. Mr. Darwin finds that—

> The early progenitors of man were *no doubt* covered with hair, both sexes having beards. Their ears were pointed and capable of movement, and their bodies were provided with a tail. . . . The foot . . . was prehensile, and our progenitors, *no doubt*, were arboreal in their habits, frequenting some warm forest-clad land. . . . At an earlier period the progenitors of man *must have been* aquatic in their habits.

And so we are traced backwards in our pedigree until we find the race derived from 'a group of marine animals resembling the larvæ of existing Ascidians,' which were our 'most ancient progenitors in the kingdom of the Vertebrata.'[1]

On this Ascidian and its larva it is necessary to make a few remarks, which will illustrate the mode in which the hypothesis of Evolution, and of man's origin in particular, is built up. It is known that there is no transition form between the *Invertebrata* and the *Vertebrata*; but as a recognised hiatus between any two classes would be fatal to the 'unbroken sequence of nature' in which the Evolutionist delights, it must be filled up or 'bridged over,' *coûte que coûte*; and the Ascidian has been selected to represent the transition form. Now, this Ascidian is not even a highly-developed mollusc, but a creature of low organisation, about on a level with an oyster, fixed to the rock during the whole of its adult life, and having no nervous system to speak of, with the exception of one ganglion and a few nervous fibres, between the two layers of its bag-like body. In this adult form it evidently will not answer the required conditions, but it is said to have been discovered that its *larvæ* 'are related to the Vertebrata in their manner of development, in the relative position of the nervous system, and in possessing a structure closely like the *chorda dorsalis*

[1] *Descent of Man*, vol. i. chap. vi.

of vertebrate animals.' And thus we are supposed to 'have at last gained a clue to the source whence the Vertebrata have been derived.' [1]

I would ask for especial attention to this point; for it is here demonstrable either that the zeal for theory has led Mr. Darwin and his school into grievous and palpable error, or that there is no truth in the doctrines of embryology as set forth by all systematic writers. If the relations between Ontogenesis and Phylogenesis as above stated have any existence in nature, no embryonic form of any animal can possibly represent any *higher* type of development than the animal itself. For instance, the larvæ of M might exist as L, F, or D, but never as P or S. Yet we are here called upon to believe that the larva of a mollusc appears, not in the form of a lower mollusc, or one of the *Cœlenterata*, but that it is actually organised, living, and moving in the form of an adult being of a different sub-kingdom, the highest of all, the *Vertebrata*. I am not in a position to dispute *the fact*, if such it be. I have neither seen any dissection of the larva in question, nor heard of any. All that I would urge is this, that such a fact will utterly destroy the entire theory and science of embryology. If there be any truth whatever in this science, it is perfectly clear that the existence of a quasi-vertebrate larva in the Ascidians is a very cogent

[1] *Descent of Man*, p. 205.

argument that the Ascidians have descended from some vertebrate type, but certainly not that the *Vertebrata* have descended from *Ascidians*.

Professor Haeckel has apparently perceived this difficulty, as a matter of theory, and provides for it in the most characteristic manner, by inserting in our genealogical tree a form of animals which he calls *Chordonia*, which 'developed themselves from the *Annelida*, by the formation of a spinal marrow and a *chorda dorsalis!*'[1] Other details of their structure are given very systematically, and it is shown how they became the parents of the nearest now-living genera, the *Ascidians*, &c. The author does not even profess to have any evidence to produce that such animals ever existed; there is no living representative of them; there is no fossil evidence of their early existence; the sole *raison d'être* of the class is, *that they are required by the hypothesis*. This interpolation of imaginary classes of animals occurs frequently in Professor Haeckel's history of man, as we shall see presently. Meanwhile, should it be supposed that I have exaggerated this most ready and compendious method of constructing scientific natural history, I would commend to the reader's careful attention Professor Haeckel's twenty-second chapter, on the 'Brute Ancestors of Man,' in the work already quoted.

Thus our study of the pedigree of man, as set forth by Mr. Darwin, lands us in a serious dilemma.

[1] *Natürliche Schöpfungsgeschichte*, p. 583.

Either the pedigree is hopelessly shattered, at the most important point in its development, by collision with embryology ; or this doctrine, that upon which Evolution is mainly supported, is proved to be a delusion, inasmuch as it cannot by any possibility be strained to include Mr. Darwin's facts. The antagonism is real and irreconcilable ; it must be left to the transcendental philosophers of the school of Evolution to decide, which part it will be the most to the advantage of their doctrine that they should uphold.

With regard to the remainder of Mr. Darwin's 'Descent of Man,' it is not necessary to say much. It has been weighed in the balance and found wanting. It is as unsatisfactory and inconsequent in argument, as it is charming in style, rich in fancy, and fertile in illustration. The volume and a half relating to 'Sexual Selection' may be considered as a delightful story of the loves of the birds and beasts, with about as much real bearing upon the science of Evolution as the 'Loves of the Angels.' A theory of selection which ought, if a true principle, to be of universal application, and yet leaves perhaps nine-tenths of the forms of life obviously out of its domain, can scarcely take rank as a scientific hypothesis. It certainly adds but little to our knowledge of man's nature, and gives only the feeblest of support to any theory of his origin. It gives no single instance of the actual operation of selection in the formation of species, but abounds with suggestions of what 'might have been'

(which soon becomes '*must have been*') under unknown or impossible conditions.[1]

Professor Haeckel pronounces upon man's pedigree with the most unhesitating confidence. He speaks of 'our ancestors' as *Monera*, 'our ancestors' as worms, 'our ancestors' as fishes, &c., &c., with the greatest freedom. We are reminded that when we speak of 'poor worms' or 'miserable worms,' we should remember that '*without any doubt* a long series of extinct worms were our ancestors.'[2] He recognises twenty-two distinct stages in our evolution, which I will briefly recapitulate, as comprising the latest data of philosophy on this subject. Of these, eight belong to the invertebrate, and fourteen to the vertebrate sub-kingdom. What follows is only an abstract of the chapter before referred to.

1. The *Monera* is the earliest form of life. It arose in the Laurentian epoch by spontaneous generation from inorganic matter. Its acceptance as our earliest ancestor is necessary 'on the most weighty general grounds.' 2. The *Amœbæ*; and 3. The *Compound Amœbæ* come next. They are to be accepted on embryological considerations; as also are 4. The *Planœada*, represented by some ciliated animalculæ. 5. The *Gastræa* (Urdarmthiere) are a purely imaginary class of animals. They are placed here

[1] Those who are interested to know to what lengths zeal for theory will occasionally carry its supporters may find an illustration in *Nature* for Nov. 2, p. 18. The subject is scarcely adapted for quotation.

[2] *Anthropogenic*, p. 399.

because required as ancestors for the *Gastrula*, itself an imaginary order, derived from embryological exigencies.[1] 6. The *Archelminthes*, or earliest worms, represented now by the *Turbellaria*. 7. The *Scolecida*, the actual annelidan representatives of which are not known. 8. The *Chordonia*, noticed above, also a purely imaginary type, having no known extinct or living representatives, but being '*undoubtedly*' the progenitors of all the Vertebrata, through the Ascidians.

9. The *Acrania*, represented by the Amphioxus, the lowest form of vertebrate animal, a rudimentary fish, having certain resemblances to the Ascidians. 10. The *Monorhina*, which was the parent stem of the sharks, through the Amphirhina, represented by the modern lampreys. 11. The *Selachii*, or shark tribes, from which sprung—12. The *Dipneusta*, or Lepidosirens, from which originated—13. The true Amphibia, and—14. The *Sozura*, another order of Amphibia, interpolated here 'because required as a necessary transition stage between the true Amphibia,' and—15. The *Protamniota*, or general stem of the Mammalia, reptiles, and birds. 'What the *Protamniota* were like,' says Professor Huxley, 'I do not suppose anyone is in a position to say,'[2] but they

[1] The reader is requested not to view this as a gloss or caricature on the text. It is as nearly a precise abstract as I can make it; and the work in question is considered one of the most philosophical treatises on biology of modern times.

[2] *Critiques and Addresses*, p. 318.

are *proved* to have existed, because they were the necessary forerunners of—16. The *Pro-mammalia*, the earliest progenitors of all the *Mammalia*. The nearest living genera are the Echidna and Ornithorynchus. 17. *Marsupialia*, or kangaroos. 18. The *Prosimiæ*, or half-apes, as the indris and loris. 19. The *Menocerca*, or tailed apes. 20. The *Anthropoides*, or man-like apes, represented by the modern orang, gibbon, gorilla, and chimpanzee, amongst which, however, we are not to look 'for the direct ancestors of man, but amongst the *unknown* extinct apes of the Miocene.' 21. The *Pithecanthropi*, or dumb ape-men —an unknown race—the nearest modern representatives of which are cretins and idiots ! ! (p. 592). They '*must have*' lived, as a necessary transition to—22. The *Homines*, or true men, who 'developed themselves from the last class, by the gradual conversion of brute howlings into articulate speech,' &c., &c.

With regard to the immediate ape-like ancestors of man, it is distinctly and very emphatically set forth, (p. 577) that none of the modern anthropoid apes can be regarded as our direct progenitors :—

> This opinion is never held by thoughtful supporters of the descent-theory, although often attributed to them by their *thoughtless* opponents. Our ape-like ancestors are long since extinct. Perchance their fossil remains may some time be found in the tertiary deposits of Southern Asia or Africa. They must nevertheless be ranked amongst the tailless catarhine anthropoid apes.

It is perhaps scarcely necessary again to state,

that such a scheme of progression as that just briefly sketched has no existence in nature. There is no evidence of it in existing forms of life; there is no indication of it in fossil remains; and there is no possibility of such a progression, even as a matter of theory, in accordance with the recognised laws of Morphology. There are at least four distinct types of animal life, the *Cœlenterata*, the *Mollusca*, the *Annulosa*, and the *Vertebrata*, between no two of which is there any transition form or forms, either known or conceivable—that is, if Morphology be a science at all, or anything beyond an incoherent aggregation of irrelevant and unconnected details of structure.

The reader is now in a position to judge of the value of the evidence, which I have endeavoured fairly to epitomise, both as to Evolution in general and the pedigree of man in particular; and also to determine whether it is necessary to do more than to leave both the original and the derived doctrine to perish from inherent weakness. The connection of these doctrines with Human Automatism is nothing new or strange. All that has been said by Professor Huxley is very little more than an amplification of what was most clearly and tersely set forth by Lamarck more than sixty years ago.

Lamarck discerned with perfect clearness the strict logical dependence of Human Automatism upon a physical theory of life. It will be evident from a

consideration of the following extracts from the introduction to his 'Histoire Naturelle des Animaux sans Vertèbres,' how little progress has been made in this department of biological science since his days :—

> Every fact or phenomenon that can be observed is essentially physical. . . . All movement or change, every acting force, and every effect whatever, are due necessarily to mechanical causes, governed by laws. . . . Every fact or phenomenon observed in a living body is at once a physical phenomenon and a product of organisation. (Preface, p. 11, *et seq.*)

He further refers to these physical phenomena as 'constituting life' (p. 12), and to sensation and thought being due to changes in a 'particular system of organs capable of giving rise to these physical, mechanical, and organic phenomena.' From these general principles the conclusions are natural and inevitable, that 'all living bodies or organisms are subject to the same natural laws as are lifeless or inorganic bodies; that the ideas and faculties of the mind generally are but manifestations of movements in the central nervous system;' and finally, that 'the *Will is in truth never free.*'

But, be the doctrine new or old, it cannot be denied that it is a strictly logical deduction from the postulate.

If man is but the product of the molecular forces of matter, from which he is evolved without the 'in-

tervention of any but what are termed secondary causes;' if he is merely a 'co-ordinated term of Nature's great progression,' or a result of 'the interaction of organism and environment through cosmic ranges of time,' then is he indeed, hopelessly and helplessly, a mere automaton, with neither choice, will, nor responsibility. But if, on the other hand, it has been or can be proved that such doctrines find no support from science, from observation, from experiment, or from reason, then the doctrine of Human Automatism is relegated to the domain of all such 'figments of the imagination,' and man may trust implicitly to the consciousness which tells him that he is no mere machine, but a responsible free agent, with duties to perform to his God, his neighbour, and himself; and a conscience to prick him if he performs them not.

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