ON MR. SPENCER'S
UNIFICATION OF KNOWLEDGE.

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MR. SPENCER'S UNIFICATION OF KNOWLEDGE.

BY

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PREFACE.

THIS work, taken in conjunction with a previous one "On Mr. Spencer's Formula of Evolution," must be regarded as a criticism of the general logical construction of Mr. Spencer's philosophical system. The writer is not opposed to the author he criticises as regards the scientific doctrine of evolution or natural development, so far as it is known to us; but he sees great blanks in the deductive treatment, and great failures of explanation, which cause him to regard Mr. Spencer's presumed fulness of exposition as merely illusory.

In so far as Mr. Spencer's work is viewed as an attempt to show the *à priori* reasonableness of evolution by gradual development already established in various departments of science by *à posteriori* methods, it may be held to have accomplished its object; but in so far as it claims to have put together a framework of thought commensurate with all the sequences of the cosmos, it must be considered a disjointed structure, from which as yet several connecting parts are missing. And it will be found that the deductive system which Mr. Spencer attempts is so mystical in its fundamental ideas, as well as so incomplete in its logical connections, that, regarded as a system of Philosophy, it is as vague as it is ill constructed.

Thus, although the writer is fundamentally in sympathy with the goal of Mr. Spencer's attempt, and although he accepts the same *à posteriori* truths, he is nevertheless compelled to criticise adversely the ambitious claims of the system, with the faultiness of reasoning and general bad workmanship entailed by the supposed accomplishment of the endeavour. Although it is important that established truths should be frankly accepted, however inharmonious with previous beliefs, it is equally important that imperfections of theory should be freely acknowledged. The attempt to outrun the gradual growth of knowledge by filling in every hiatus with theoretical explanations is a positive obstruction to the progress of science.

Although the first principles of a science are the first in logical order, they are generally the last in order of discovery. They are arrived at by generalisations of extended experience. They mark the attainment of true scientific inductions, and manifest their correctness by the explanations they are able to afford. They enable us to discern the coherence of large classes of facts, and give us the power to forecast a line of sequences whereby we may direct them to the accomplishment of desired ends, or shape our actions to those coming events which are beyond our control. As an instrument of discovery, first principles are of very little value, and, on account of the many chances of error, and of the fascination which the idea of a completed system exercises over the imagination of great minds, the search after them has been fruitful of error.

The present undertaking, therefore, is to be regarded not as an attack upon the evolutionism of Lamarck, nor as an attack upon the evolutionism of Lyell or Darwin, nor yet upon the evolutionism of Spencer as regards the development of intelligence, but as an attack upon the theory which attempts to combine all these into one continuous process. Moreover, the criticism is not made upon the ground that such a theory, in the nature of things, cannot be established, but that as yet it is not established, and that in the endeavour towards its accomplishment Mr. Spencer fails. It may even be asserted that there is not anywhere discernible the probable or possible grounds of such an universal connection of sequences.

The writer finds himself in accord with Mr. Spencer in maintaining that any merely materialistic or mechanical interpretation of the universe is beyond question insufficient to account for what we find in it. He is not in accord with him in supposing that the theory of the "double aspect" is intelligible and capable of completing a logical explanation. He is not in accord with him in supposing that mysticism completes explanations partially effected by intelligible methods. And he is not in accord with him in his estimate of what can be accomplished by means of the concrete factors he actually employs, more particularly in the deductions of biology.

So curiously inconsistent is Mr. Spencer's position, as at the same time that of the scientific man giving concrete explanations of concrete sequences, and that of the mystic basing his explanations on symbolism, that the whole course of the criticism may be taken as a vindication of Mr. Spencer's final conclusion that:—

"Matter, Motion, and Force are but the x, y, and z with which we work our equations, and formulate the various relations among phenomena in such way as to express their order in terms of x, y, and z—though I have shown that the realities for which x, y, and z stand, cannot be conceived by us as existing thus or thus without committing ourselves to alternative absurdities." *

In the predicament thus described we actually find ourselves whenever we pursue to their logical results any of Mr. Spencer's formulas of explanation, if we attach to the terms employed any definite meaning; and in this verdict of the author himself is to be found the most potent vindication of the course of the present criticism.

The present work may indeed be regarded as undertaken in the interests of the purity of scientific thought, and for the promotion of correct methods of scientific investigation, by showing the futility of those methods which anticipate the results of study, and by exposing the consequent abuses of logic and of words, more particularly in the employment of the latter as more than merely representative of certain concrete facts. This, and any actual clearance of imperfect theory, constitute the only claim which the present book may have upon the attention of the student. To the higher claim of positive accomplishment it does not

* First Principles, p. 580.

aspire. The uses of criticism are negative only. Nevertheless this subordinate task has its own place in the elucidation of truth.

It is not to be expected that Mr. Spencer should reply to these criticisms. The public will fully appreciate his objections to the controversies attendant upon replies and rejoinders, as well from their unsatisfactory results as from the interruption of work which they entail. The public will fully understand that silence does not imply the lack of any answer to our positions, but that Mr. Spencer is occupied with work having greater claims upon his attention.

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ON MR. SPENCER'S UNIFICATION OF KNOWLEDGE.

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CHAPTER I.

§ 1. *The Unification of Knowledge as the Main Object of Mr. Spencer's Works.*

Mr. Herbert Spencer has published a number of volumes with the evident intention of producing a considerable effect upon the course of human thought. These volumes are full of suggestive thinking, and display in many respects great insight. The amount of care and research involved in their production is manifest, and their influence on modern thought, though vague, is undoubted.

At the same time, it may be questioned whether that portion of the public which has endeavoured to judge of Mr. Spencer's undertaking without theological prejudice, and has in part acknowledged his theories, has ever set itself thoroughly to understand him, to judge of the consistency and coherency of his works as a whole, to estimate properly his main endeavour, and to range in their due places his subordinate tasks. That such should be the case is not at all surprising, for the bias of modern thought is all in Mr. Spencer's favour, and men naturally prefer to have their thinking done for them, being pleased when they find their own half-formed theories receive apparently a full and cogent expression. Such, indeed, was the present writer's feeling; but having set himself to explain Mr. Spencer's works to a Philosophical Society, he found himself in the difficulties already set forth in a previous work and about to be stated in this.

Now, it must be clearly borne in mind that Mr. Spencer's series of books is essentially one work. The volumes on "Biology," "Psychology," "Sociology," "Ethics," &c., are not independent treatises upon these different sciences, but unite in a series as links in a continuous chain, forming one whole System of Philosophy. The question therefore arises, what is the main idea of Mr. Spencer's series of works? what is his principal purpose? what is the one great object he has in view, to which all these separate volumes are subservient?

That the unification of knowledge is the set purpose of Mr. Spencer's works appears, we think, open to no dispute. Whatever assertion we may make respecting other views of our author which he may consider misapprehensions, we believe that he will not shrink from acknowledging this intention as holding the first and foremost place in his Philosophy. It is the ruling idea of the whole work. It is the principal purpose he holds in view throughout the exposition of his doctrines. He not only sets it out plainly before his readers in commencing his labours, but he refers to it throughout the whole series of volumes as being the end, indeed, to which they subserve.

To make this clear, let us study the first chapter of the book on The Knowable ("First Principles"), entitled "Philosophy Defined," in which Mr. Spencer tells us what is Philosophy and what are its aims. On p. 131 we find it stated that Philosophy is "knowledge of the highest degree of generality;" and again we are asked—"What must be the specific shape here given to this conception? The range of intelligence we find to be limited to the relative. Though persistently conscious of a Power manifested to us, we have abandoned as futile the attempt to learn anything respecting the nature of that Power; and so have shut out Philosophy from much of the domain supposed to belong to it. The domain left is that occupied by Science. 'Science concerns itself with the coexistences and sequences among phenomena; grouping these at first into generalisations of a simple or low order, and rising gradually to higher and more extended generalisations." Science includes the family of the sciences—Mechanics, Physics, Chemistry, Geology, Biology, Psychology, Sociology, Ethics, &c. Philosophy is the knowledge constituted by the *fusion* of all these contributions into a whole. Science consists of truths more or less separated, and does not recognise these truths as entirely integrated,—and whatever "integrated" may mean, we presume it must imply unification.

We are next shown the historical growth and organisation of knowledge, from crude experiences embodied in particular propositions, to general propositions embracing a large number of experiences of a similar character. Some of the highest triumphs of Science have been achieved when classes of propositions of diverse characters have been unified in a proposition which has been able to embrace and express them all within the meaning of its terms. Thus it is seen that the organisation of knowledge is a building-up process; we go from induction to induction, ever reaching propositions of wider and more comprehensive sweep, the busy thinkers of humanity bringing the results of their labours to an edifice which mounts up pyramid-wise towards the apex which shall crown the entire structure.

As each wider general proposition is formed, it will be seen that the less-wide included propositions as well as isolated particular propositions, become, as a mode of thought, *corollaries* from that wider proposition. It is true the wider proposition itself has been reached inductively, and is justified by original observations and experience, and by the successive generalisations which led up to it; but when it is once formed, these in their turn become but corollaries of the more general proposition. Such general propositions form the key to knowledge, and enable us to foretell from given circumstances whole series of events. We find expressed in them the law of the relations of factors by which we are able to foresee a long course of sequences. These are the truths and generalisations of Science which constitute the triumphs of intellectual achievement.

What shall we say then? Shall we arrive at a time when these larger truths shall themselves be comprehended in some still wider generalisations, and may we eventually look forward to the unification of all knowledge in a single proposition? If so, the process must apparently be analogous to past methods. We must build up to it by wider generalisations of the widest scientific truths, and then we shall have a proposition from which all others are seen to be corollaries, and from which all future sequences can be deduced.

Thus we see that the unification of knowledge must have a double justification, and be capable of a double statement and exposition. It must be the legitimate outcome of an inductive or building-up process, and as a mode of thought it must be embodied in a proposition from which, as corollaries, all the included truths or propositions are deducible. This, then, is the goal of Philosophy, and will be found to accord with Mr. Spencer's teachings. After citing several instances in which a single scientific formula expresses a large number of diverse individual facts (which passages, for the fuller understanding of the argument, should be carefully read), he continues (p. 133):—

"And now how is Philosophy constituted? It is constituted by carrying a stage further the process indicated. So long as these truths are known only apart and regarded as independent, even the most general of them cannot without laxity of speech be called philosophical. But when, having been severally reduced to a simple mechanical axiom, a principle of molecular physics, and a law of social action, they are contemplated together as corollaries of some ultimate truth, then we rise to the kind of knowledge that constitutes Philosophy proper.

"The truths of Philosophy thus bear the same relation to the highest scientific truths that each of these bears to lower scientific truths. . . . It is the final product of that process which begins with a mere colligation of crude observations, goes on establishing propositions that are broader and more separated from particular cases, and ends in universal propositions. Or to bring the definition to its simplest and clearest form:—Knowledge of the lowest kind is *un-unified* knowledge; Science is *partially-unified* knowledge; Philosophy is *completely-unified* knowledge."

Mr. Spencer goes on to a passage which seems to mean, that if we frame an universal proposition, either rigidly by an inductive process not overstepping the bounds of actual knowledge, or by consciously overstepping these bounds and forming a hypothesis concerning the universal proposition, then we have two forms of Philosophy—in the one case the universal proposition is the product of the induction, and in the other case it is the means or instrument of exploration—in the latter event it must be justified by its agreement with experiences and the amount of interpretation it accomplishes in expressing the relations of sequences. Mr. Spencer would seem to imply that the strictly inductive method, by never going beyond the bounds of experience, is insufficient as a means of explanation, and we must have recourse to hypothesis, so that, setting out with some hypothetical universal truth, we judge of its merits by the results —the test being that its corollaries shall be found coincident with the sequences of Nature.

Mr. Spencer, it may be remarked, does not say this explicitly, but it seems to be what he attempts to say, and it is certainly what he ought to say to make it conformable to his previous reasoning. This is what he does say in the second paragraph of § 38 :—

"Two forms of Philosophy, as thus understood, may be distinguished and dealt with separately. On the one hand, the things contemplated may be the universal truths : all particular truths referred to being used simply for proof or elucidation of these universal truths. On the other hand, setting out with the universal truths as granted, the things contemplated may be the particular truths as interpreted by them." (*Query, deduced from them?*) "In both cases we deal with the universal truths; but in the one case they are passive and in the other case active —in the one case they form *the products of exploration*, and in the other case *the instruments of exploration*."

However, our only object at present is to establish the fact that Mr. Spencer's main purpose is the unification of knowledge. We see that he sets it down as the goal of Philosophy, and we can only suppose, after this precise initial statement, that not only the "First Principles" but all his other works are written with this end in view. We therefore propose entering upon a broad examination of these works, with the purpose of ascertaining how far they contribute to that end. But first we will inquire as to the conditions of the proposed unification itself.

§ 2. *The Form of the Unification of Knowledge.*

What, then, must be the form of the unification of knowledge? We hold that all knowledge is expressed in propositions. All knowledge is of the relations of things or the relations of sequences, and all coherent knowledge is expressed in propositions of one sort or another. Firstly we have singular propositions, next wider propositions, again propositions of a still more general character, and finally perhaps universal propositions. But nothing is worthy of the name of knowledge that cannot be set down in a proposition. Still more: nothing is worthy of the name of a proposition, the terms of which do not convey a distinct impression to the mind, the separate parts of which have not distinct meanings and definite intelligibility. This is indeed our experience in the actual progress of Science. Scientific progress has been made by the formulation of science, that is, by the framing of specifically knowable propositions, and it is only when generalisations of thought have taken this definite form that they have been entitled to a place in the organisation of knowledge, and formed firm points for fresh departures. If, then, the formation of Philosophy must be by a method analogous to that of Science, the outcome must have equally the proper form of knowledge, and appear with clear intelligibility in a proposition framed of definite terms. To say that it should not so do is to say that we seek for the unification of knowledge in non-knowledge and in other ways than the ways of Science.

"The answer to every question which it is possible to frame," says Mr. Mill, "is contained in a Proposition, or Assertion. Whatever can be an object of belief, or even of disbelief, must, when put into words, assume the form of a proposition. All truth and all error lie in propositions. What, by a convenient misapplication of an abstract term, we call a Truth, is simply a True Proposition; and errors are false propositions." *

A proposition consists of three parts—a subject, a predicate, and a copula. What, then, should be the terms of an unificatory proposition? It must be all-embracing; it must comprise the cosmos. In order to do this our *subject* must be thus expressed: All existences, all sequences, or all existences and their interrelations, or the interrelations of all existences; the *copula* will be the word "are;" and the *predicate* will be the universal truth which is to unify knowledge.

What then is the right method of procedure for framing this universal proposition? Can we reach it as the natural outcome, by induction, of the present state of the sciences? or does that state justify us in framing some hypothetical proposition which we can afterwards verify by the identification of its corollaries with the course of nature, and thus cause it in its turn to assist the inductive process, by enabling us to fill up the blanks in the connections of the sciences? or must we start boldly with some purely original hypothesis and try it on its own merits? Evidently the former course is that justified by experience. We must consider how Science leads—see if we can frame a proposition in harmony with it, and then test it as described. This is indeed the manner of Mr. Spencer, save that he refrains from the rigid test of one definite proposition.

Nevertheless we are under the necessity of framing one, and one only, and the first question that arises is whether we must include in our subject "all existences" or only their interrelations? But since existences for the most part are compound and had preceding histories, they must, according to Mr. Spencer ("First Principles," p. 541), be included in our proposition. He says:—

"It was shown that a Philosophy stands self-convicted of inadequacy, if it does not formulate the whole series of changes passed through by every existence in its passage from the imperceptible to the perceptible, and again from the perceptible to the imperceptible. If it begins its explanations with exist-

* J. S. Mill's Logic, vol. i. p. 21.

ences that already have concrete" (*Query, perceptible?*) "forms, or leaves off while they still retain concrete forms; then manifestly, they had preceding histories, or will have succeeding histories, or both, of which no account is given. And as such preceding and succeeding histories are subjects of possible knowledge, a Philosophy which says nothing about them falls short of the required unification. Whence we saw it to follow that the formula sought, equally applicable to existences taken singly and in their totality, must be applicable to the whole history of each and to the whole history of all."

This passage must be accepted with some modifications. Evidently the perceptible and the concrete are treated as identical. Evidently also the history of the passage of the imperceptible into the concrete or perceptible is beyond the pale of knowledge and therefore of Philosophy, although Mr. Spencer says here that it is the subject of possible knowledge. Also the element of perceptibility, though a condition of an existence being within knowledge, is not a condition of the independent existence and order of nature. Several of these matters will hereafter have to be discussed. In the meantime it seems evident from the passage quoted that we shall have to include in our subject

"All existences and their interrelations;"

the copula of course will be the word "are," and the predicate will be the ultimate truth.

And since this ultimate truth, whether it be a rigid induction or of a hypothetical nature, must be subjected in the end to the deductive test, the predicate must commence with the words "corollaries of," which for convenience we shall hereafter incorporate with the copula, leaving the final or ultimate truth to be expressed in the predicate as the problem for investigation.

§ 3. *Mr. Spencer's Unificatory Predicates.*

In seeking the requisite proposition, we shall pursue a rather mixed method; for while our main object will be the ascertainment of Mr. Spencer's opinions, we shall find it more convenient to consider all the varieties of predicates which could be employed to make our proposition complete. As to Mr. Spencer, he seems to forget that unificatory implies oneness. He has quite a number of universal truths, and no doubt there *are* a number of universal truths; but when, as in § 38, he speaks of interpreting things by means of universal truths in the plural, where is the unification? Surely there must be *one* ultimate truth from which even the universal truths are derivable. And from this initial confusion we never get clear. Throughout Mr. Spencer's works we are continually finding that something or other is a corollary from some of the ultimate truths; but this does not constitute an unification of knowledge—it is only a partial unification, which falls short of the goal of Philosophy. These universal truths have to be unified.

Further, we find that Mr. Spencer nowhere sets down his proposed unifications in the distinct form of a proposition. Whatever ideas he may have, or whatever opinions he may wish to convey, as to what precisely does constitute the unification of knowledge, he does not put them down anywhere in the form of a distinct proposition, but leaves us to gather his opinions in an indistinct manner from incoherent statements scattered here and there throughout his works. And if we set ourselves the task of gathering these opinions for the purpose of completing our unificatory proposition by furnishing it with a predicate, what do we find? We find that quite a variety of different methods of the unification of knowledge are taught by Mr. Spencer! In studying these in detail, we see that they arrange themselves into six classes, which we may call the Mystical, the Psychological, the Physical, the Metaphysical, the Supraphysical, and the Symbolical. And if we make good our criticism, what becomes of Mr. Spencer's unification of knowledge?

§ 4. *The Mystical Methods of the Unification of Knowledge.*

One of the first requisites in the treatment of a complicated study is the collection of all the material that properly appertains to it, and the demarcation of all that is extrinsic. It is, therefore, with great satisfaction that the student observes Mr.

Spencer adopt this precautionary method in distinguishing between the proper objects of study and those speculative and shadowy subjects upon which so much human energy has been absolutely wasted. Mr. Spencer very properly holds these inquiries in contempt, like others before him, and teaches that modesty of thought which is the characteristic of the true man of science, retaining his attention within the bounds of the Knowable, and so restraining his thought that his energy is expended in useful organisation within the actual limits of knowledge, instead of wasting its force in useless flights into the regions of the Unknowable. This satisfaction, however, is but of short duration; for the student finds, after making this mental effort to clear the ground of extraneous speculative growth, and after preparing himself for the masterly task of the co-ordination of all that is knowable under the guidance of his new teacher—a task he contemplates with great zest and satisfaction—that all the work is spoiled by the re-introduction of that Unknowable which had just been repudiated. For in the book on the Knowable the Unknowable is always presenting itself. It meets one at every turn, and each important term is a back-door into the Unknowable. Elaborate results of careful structure are vitiated by continual references to the unknowability of the factors employed.

This is a fundamental defect in Mr. Spencer's exposition of his philosophy, and calls for serious attention, since he is apparently conscious of the fact himself, and is prepared to justify it. We ourselves, in our study, fully understood that when we had reached the end of the book on the Unknowable we had done with it for ever; and that is why, in all our subsequent studies of the book on the Knowable, we so persistently ignored it, and held that we had to deal with terms and propositions of a knowable character, and having definite values only.

It is not necessary for our present purpose, although we are engaged in pointing out this great fundamental defect of exposition, that we should enter fully into the study of the Knowable and the Unknowable, but it is necessary that we should illustrate the nature of the distinction, so as to lead up to and make clear our point of criticism. The general subject of the limits and conditions of human knowledge receives attention in some of the following sections of this chapter, and also in sect. 1 of chap. ii. For our immediate design, let us consider our knowledge of oxygen and hydrogen. What do we know of these two substances? We turn to a book on chemistry, and find all their several properties or attributes fully set out. We find that oxygen has certain definite properties, without which it would cease to be oxygen as we know it; and when we speak of oxygen, it is this indissoluble set of attributes that we refer to. We mean no less than this. Do we mean anything more? Certainly not. All we mean by oxygen is a bundle of attributes or properties. Curiosity asks, "What ties this bundle together? What is the *nexus?*" (for these questions always sound more impressive in Latin). "What is the substratum upon which all these properties are built? What is the nature of the substance or matter in which all these attributes inhere?" Well, we do not know, and we do not see why such a question should be asked at all. The question derives its point from the further question, "In what respect does this *nexus* or substratum differ from that of hydrogen, so that the latter ties together another and different set of attributes?" No doubt, if we could understand this and the further distinctions between all the other elements, it would enormously extend the boundaries of science; but this is held to be unknowable, and certainly is unknown. Actual knowledge is limited to the ascertained properties of oxygen, hydrogen, and the rest, and it does not pertain to the realms of science to say anything at all about the nexuses and the substrata. Our knowledge is precise, clear, definite, and without any confusion; we know in chemistry what we are talking about. Chemical science, indeed, is so far advanced that the laws of atomic combination are set forth. Under Mendejeleef's law, the discovery of a new element was predicted; and, as in the celebrated case of the planet Neptune, it was looked for and found —taking its place in an orderly series.

Let us suppose now that since we cannot understand the nexus or substratum of oxygen and hydrogen, they are therefore to be regarded as differentiated manifestations of an Unknowable Power, we would ask, Does this add to our knowledge of oxygen or hydrogen taken singly? We would also ask, Does it add to our knowledge of them taken together, or taken in their interrelations? It cannot be said that it adds any information or increases our knowledge of them one iota. If any one chooses to assert this theory, we may be willing to admit the truth of it—we are scarcely in a position to deny it—but when we come to look at our question in the dry light of reason, we are bound to confess that the Unknowable Power which manifests itself thus and thus does actually manifest itself thus and thus, no more and no less, and is actually known to us as thus conditioned. This is the material with which Science deals, and to which Philosophy, taken as the unification of the sciences, must be rigidly confined. The unification must be accomplished *within* the bounds of knowledge: if the unknowable is mixed up in it over and beyond the known conditions—as a factor, but a factor of unknown value—then the whole organisation or co-ordination of the sciences is vitiated and comes to nought. Hence it appears to us that the question as to the nature of the nexus or substratum of matter is quite as much beyond the purview of philosophy as it is of science, and does not affect the consideration of our studies in the least.

Mr. John Stuart Mill may here be cited as giving the weight of his reasoning to the same effect. He acknowledges the unknown cause, but disclaims it as holding a place in the truths of science or philosophy. In his "Logic," chap. ii., § 7, there is a very excellent discussion of the metaphysical questions concerning the nature of "body." It would carry us beyond our present object to discuss these questions here. It is only requisite to note that Mr. Mill admits the unknowability of the substratum of matter, or of the laws of the differentiation of the attributes of matter, and also the unknowability of the substance of mind.

"Body having now been defined the external cause, and (according to the more reasonable opinion) the *hidden* external cause, to which we refer our sensations; it remains to frame a definition of Mind. Nor, after the preceding observations, will this be difficult. For as our conception of a body is that of an unknown exciting cause of sensations, so our conception of a mind is that of an unknown recipient, or percipient, of them; and not of them alone, but of all our other feelings. As body is the mysterious something which excites the mind to feel, so mind is the mysterious something, which feels, and thinks" (p. 81).

"Thus, then, as body is the insentient cause to which we are naturally prompted to refer a certain portion of our feelings, so mind may be described as the sentient *subject* (in the German sense of the term) of all feelings; that which has or feels them. But of the nature of either body or mind, further than the feelings which the former excites and which the latter experiences, we do not, according to the best existing doctrine, know anything; and if anything, logic has nothing to do with it, or with the manner in which the knowledge is acquired" (p. 82).

This seems to correspond with the Unknowable Power of Mr. Spencer, which manifests itself to us and in us in various ways. We ask again, What is the value of such a power in a system of knowledge? How does it affect the organisation of knowledge? If it is placed out of the sphere of the knowable, how can it have any place in the endeavour to systematise knowledge? If it has not, then let it for ever be banished from our minds in the attempt: if it has, and yet we are unable to fix it in our minds in its mode of operation, then we have mere mysticism, and not science at all.

Mr. Mill proceeds to say, when discussing the import of propositions, p. 134, that although they deal with phenomena and their relations, yet indirectly they deal with the substrata which are the hidden causes of phenomena. Nevertheless all they assert of these is their mere existence, and all their value, influence, and efficacy are summed up in the knowledge of the phenomena in which they manifest themselves. In actual practice the so-called substances may be completely ignored: their only place is that of verbalisms in a logical classification.

"In the first place, sequences and co-existences are not only asserted respecting Phenomena: we make propositions also respecting those hidden causes of phenomena which are named substances and attributes. A substance, however, being to us nothing but either that which causes, or that which is conscious of, phenomena; and the same being true, *mutatis mutandis*, of attributes; *no assertion can be made, at least with a meaning, concerning these unknown and unknowable entities*, (beyond their mere existence,) except in virtue of the Phenomena by which alone they manifest themselves to our faculties."

Thus we see that Mr. Mill agrees with Mr. Spencer in his acknowledgment of the Unknowable, but consistently rejects it from the list of things respecting which any proposition can be made.

To make our case more clear, let us take Mr. Spencer's own illustrations of the office of Philosophy at p. 132 of "First Principles."

"If we ascribe the flow of a river to the same force which causes the fall of a stone, we make a statement, true as far as it goes, that belongs to a certain division of Science. If, in further explanation of a movement produced by gravitation in a direction almost horizontal, we cite the law that fluids subject to mechanical forces exert re-active forces which are equal in all directions, we formulate a wider fact, containing the scientific interpretation of many other phenomena; as those presented by the fountain, the hydraulic press, the steam-engine, the air-pump. And when this proposition, extending only to the dynamics of fluids, is merged in a proposition of general dynamics, comprehending the laws of movement of solids as well as of fluids, there is reached a yet higher truth; but still a truth that comes wholly within the realm of Science."

This is followed by a second series of illustrations, ending in the law of the relation between the amount of heat and the amount of molecular change, and by a third series, drawn from the phenomena of sociology, and ending in the law that each man seeks satisfaction for his desires in ways costing the smallest efforts.

Now it is quite clear that the several individual instances upon which these generalisations are founded, as well as all the subsidiary generalisations leading up to the wider ones, are matters of clear knowledge. If we add that they are all differentiated manifestations of an Unknowable Power, we know no more about them than we did before, and we do not more clearly understand the nature of their interrelations as a whole.

Mr. Spencer says of them that "so long as these truths are known only apart and regarded as independent, even the most general of them cannot, without laxity of speech, be called philosophical. But when, having been severally reduced to a simple mechanical axiom, a principle of molecular physics, and a law of social action, they are contemplated together as corollaries of some ultimate truth, then we rise to the kind of knowledge that constitutes Philosophy proper. The truths of Philosophy thus bear the same relation to the highest scientific truths, that each of these bears to lower scientific truths, &c."

It is thus seen that even when we reach Philosophy it is still within the limits of the knowable—it is merely Science extended. Extended it may and indeed must be to its furthest limit—pushed out to its most extreme boundary—but it is still Science. It is a pity, indeed, that it should be called anything else but Unitative Science, for when we get to speaking of Philosophy the mind begins to soar. Philosophy is the intoxication of Science rather than Science itself; it sees visions, dreams dreams, grows poetic, prophetic, religious, and, by exciting the moral and spiritual emotions of our nature, causes us to lose the calm, clear, and cold apprehension of knowable things which is the characteristic of Science. In this respect we do not say that Philosophy is wrong, nor that its broadest views should not so affect us. The consideration of this subject, indeed, we hope to take up in a future work; but in the meantime, having firmly settled ourselves to the task of unifying knowledge under Mr. Spencer's guidance, we never intend to allow ourselves, while engaged in this special undertaking, to get off our feet or stray away from the knowable. So that when Mr. Spencer says he looks for the unification of knowledge in the derivation of the three scientific truths already specified, as corollaries from some ultimate truth, we can only understand him to mean that this ultimate truth is arrived at first inductively, that it is intelligible (that is to say, knowable), and then that it can be used deductively. If we go on to say that this ultimate truth is a manifestation of the unknowable, we do not add to our knowledge by saying so. The ultimate truth must express what we know in the first instance, and if any one likes to say that it also expresses what we do not know, in that it, like all other truths, is a manifestation of the unknowable, he does no harm and he does no good, regarding the matter in its purely scientific aspect. Its value depends upon its validity as an ultimate induction, and upon its capacity for deductive interpretation.

We see, therefore, that the unification of knowledge must be effected within the limits of the knowable, and we expect this from Mr. Spencer when he so deliberately sets apart the unknowable and the knowable for separate treatment.

Nevertheless, the book on the Knowable is pervaded by references to the Unknowable Power. Now either the Unknowable Power puts itself wholly into the bondage of conditions or manifestations, or it does not, and the quantity remaining so unconditioned is constant or variable. If the Unknowable Power wholly manifests or conditions itself, then the Unknowable Power is wholly known in its manifestations, and these known, it may be ignored. But this will be the case also if that which remains unconditioned and unmanifested never interferes with that which is conditioned and manifested. If, on the other hand, it does so interfere, then it becomes matter of knowledge, in so far as thus manifested; but the *unification* of knowledge in this case is not possible, for the elements of knowledge are of a variable character. So that in the one case all references to the Unknowable Power are confusing and illegitimate, and in the other case the task of unification is utterly hopeless. Still more is this the case if it does interfere in ways that are unknowable by us.

This is Mr. Spencer's actual treatment of his subject. He defines matter (chap. iv.), he explains motion (chap. v.), he says what he means by the term "force" (chap. vi.), in their scientific meanings, and he also treats of all of them in chap. iii. Yet the two former, viz., Matter and Motion, are but modes of the latter—Force, and by the latter we mean the "persistence of some power which transcends our knowledge and conception. The manifestations, as occurring either in ourselves or outside of us, do not persist; but that which persists is the unknown cause of these manifestations. In other words, asserting the persistence of force is but another mode of asserting an unconditioned reality, without beginning or end." And as at the commencement, so at the end of his work, Mr. Spencer holds the same opinions. On pp. 557, 558, he reiterates the doctrine of an Unknowable Power which works in us certain effects.

"These effects have certain likenesses of kind, the most general of which we class together under the names of Matter, Motion, and Force; and between these effects there are likenesses of connection, the most constant of which we class as laws of the highest certainty."

But we submit that those laws which come within the scope of Science are just as valuable to us, and are not in the least augmented or diminished in value by the acknowledgment of an Unknowable Power behind them, of which they are but manifestations. And the writer who introduces an Unknowable Power in the unification of the Knowable is responsible for misleading students not sufficiently wary to understand that this Unknowable Power,—whatever may be its value in moral and emotional aspects,—is of no effect whatever in this particular purpose.

If we say, then, that a stone thrown from an eminence will fall to the ground, and we can formulate the law by which its motion is effected, so as to be able to calculate the time it will take to reach the ground, we are not much wiser if some philosopher tells us that the fall is effected by some Inscrutable Power. We find no reference to an Inscrutable Power in any treatise on mechanics or chemistry. We make no allowance for it in the actual construction of machinery, guns, ships, buildings, &c., nor in any of the processes of manufactures. These only recognise scrutable or knowable powers. And as in the smaller so in the greater matters of Science; it is just as evident that an inscrutable power which manifests itself thus or thus is known by, and limited by, its known manifestations, and the unification of knowledge is to be effected within the limits of actual knowledge only.

It is true that some of the language of Science, in the imperfection of our knowledge, consists of words acknowledging powers; and the laws of their action being only partially known, the greater stress of meaning belongs more to the former than to the latter. But this is an evidence of our ignorance rather than of our knowledge. As knowledge increases the defect will pass away. Thus we now speak of the law of gravitation, and care nothing about the powers or attractions of which it is the law. We speak of the laws of motion and laws of chemistry simply as the formulæ of the action of unknown powers, but care nothing about those powers when we are able to formulate their laws. Thus in the growth of knowledge the remaining terms expressive of powers will give place to propositions expressive of laws of action. In the same way some of the scientific or pseudo-scientific words which Mr. Spencer uses—viz., equilibration, polarity, &c.—now express meanings in which the acknowledgment of unknown powers is expressed; but when we are able to formulate their laws, the laws will be everything and the powers nothing. So to speak, as the knowable advances the unknowable recedes, or becomes of less account.

In any case, the unknown and the unknowable can never explain or unify the known. To attempt to do so is mysticism; and one of the many phases of Mr. Spencer's work is mysticism of the character just explained. The unification of knowledge effected is an unification within the lines of Science as far as we can go, and then the final unification is an act of mental despair in the unification by means of an Unknowable Power. Before it, all is one; in it, one is all. Out of it, all proceeds; into it, all go. It is the unity of processes; all things and their interrelations are but manifestations of it. The question is, Does anybody understand this? and if so, to what object and in what manner is the valuable information to be applied? The test is in the application. Mr. Spencer has omitted inorganic evolution. He has subjected himself to criticism in biological evolution, and it will be seen, when we come to criticise it, that the interpretations, whatever value they may have, are not derived from the Unknowable Power, but from certain known manifestations of it.

Unfortunately, in the study of Mr. Spencer's works, we meet with a certain number of words and phrases which are capable of being understood in a variety of different meanings; and it will be found in the present criticism that under the various sections thereof we shall have to treat of the same words. The reason is that they bear different senses under each head. Thus the word Force may be used in a mystical sense, in an abstract, physical, or symbolic sense; and our examination will be rather one of different systems founded upon these different senses of the same terms than one dealing with differently expressed systems of Philosophy.

The sense we have now to deal with is that which takes them all to be but expressions for manifestations of an Unknowable Power, and invests them with a mysticism derived therefrom, seeming to confer upon them a greater aptitude for explanation and for the unification of knowledge than they would possess if the idea of an Inscrutable Power behind them were not present to the mind. This is mysticism, and it means that what we do not know is the explanation of what we do know. We have found in various instances that the value of terms, propositions, and scientific laws is derived from what is knowable in them, and that their value is not in the least affected by the addition of an Inscrutable Power. Mysticism is an attempt to read into these terms, propositions, and laws a value derived from this attribution to them of an Unknowable Power as their cause or manifestation. We deny the validity of the attempt in general, and we shall have to examine some instances in detail.

There are various forms of Mysticism, according to the education or natural bias of individual minds. They are the Religious, the Metaphysical, and the pseudo-Scientific forms. What is common to them all is the recognition of an Inscrutable Power at work in the cosmos. They differ in respect to what is read into this Inscrutable Power, according to the convictions, the reasoning, or the sentiment of individuals. The Inscrutable Power derives its value in human interests from the manner in which it is regarded, for this is the bond of relation it has with humanity. What should be the attitude of the human mind towards it—whether it should be regarded as an Intelligent Divine Being, or as Self-Determining Being, or as an Unknowable Force—we reserve for discussion when we come to consider Mr. Spencer's Ethics. All we are concerned with at the present time is to see how Science and the process of increasing generalisation of knowledge which ends in unification is affected by this method of treatment.

The widest of all generalisations, according to Mr. Spencer, is "the Persistence of Force;" so that the unification of knowledge is effected when we are able to say—"All existences and their interrelations are corollaries of the Persistence of Force." The Persistence of Force may be taken as a scientific, that is to say, a knowable phrase, and one that has a limited and definite meaning, arrived at in the process of inductive science-building, of which we have before spoken; and, in this respect, it does not properly come on for discussion under our present heading of the Mystical, but will have to be considered under the head of the Physical Methods of the Unification of Knowledge. But seeing that Mr. Spencer refuses to be tied down to any definite meaning which may be attached to the term, and repudiates as misrepresentations any conclusions deduced from attaching any definite meaning to it, and since he states, in the most emphatic manner, that all he means by the term Force is, that it is a symbol like the algebraical "*z*," we are bound not to consider this method of the unification of knowledge among the physical methods of the unification of knowledge, because in these methods we are obliged to give definite meanings to the terms we employ. We shall, of course, in order to make this an exhaustive criticism, so consider the proposition; but, in the meantime, what is the value of the proposition if the term "force" is regarded merely as a term deriving its value not from processes of induction, but from these *plus* an Unknowable Power?

It is to be presumed that the proposition can have no value if the term "force" has no meaning. Therefore it must when it is used have some indistinct meaning. It must be half understood—or it must be changeable and mean something sometimes, or sometimes have one meaning, sometimes another. This is the only way to get anything out of it, to mean something when we pronounce it, or to make it a principal term in an all-comprehensive proposition applicable to all the interrelations of existences.

From the foregoing two things are evident. Firstly, that in the scientific progress from un-unified knowledge to partially unified knowledge, and to still more unified knowledge, the process is a truly scientific one from first to last; that is to say, the general propositions, though wide, are still definite—they have true meanings—are intelligible, and of practical worth in actual application. Knowledge never by any process of induction oversteps itself into the Unknowable; it builds with solid bricks, and never makes an archway into thin air. It is obvious that the ultimate truth of Science which is to unify its component parts—if indeed such an end can ever be attained—must be within the scope of knowledge and not beyond it. The inductive process does not end in mysticism. Mysticism is something added. If Science can proceed a certain distance and no further, and if it then says, 'Beyond this I cannot go,' it simply owns its own incompetence. It may recognise mystery beyond, but this recognition of an Inscrutable Power beyond it is not an unification of knowledge but a confession of defeat. If induction ends in the vague recognition of an Inscrutable Power, all well and good; it may have a value, but that value certainly is not in the unification of knowledge.

Secondly, it is clear that there can be no deductive process from a proposition the terms of which are uncertain or even positively stated to be inconceivable. What are the corollaries of blank? what are the corollaries of Force or the Persistence thereof if Force is an Unknowable Power?

The deductive problem is from the phrase "Persistence of Force," regarding the latter word as untranslatable into any definite conception, or regarding it as known forces *plus* the attribution of unknowable power, to draw a series of corollaries which correspond to and will be a picture of all the changes of the universe from the commencement, *i.e.*, from undifferentiated Force. This is clearly impossible. It may be said that Mr. Spencer nowhere advances such a proposition. We are unable to decide exactly, yet his language sometimes looks very like it. If he does, then our criticism applies. If he does not, then what he really means will no doubt receive examination in one of the other sections.

There are other unificatory propositions of Mr. Spencer's relating to Matter, Motion, &c., which are apparently of definite meaning, and which we shall so consider later on in our work, but which also he transforms into mystical propositions when the exigencies of criticism force him to do so. They are not only Matter and Motion as we know them, but since they are manifestations of an Unknowable Power they are supposed to possess a value in thought over and above this knowable value, and in this case the same remarks apply. Scientific induction may place them beyond knowledge, but deduction can get nothing out of them.

What shall we say again to the proposition—"All existences and their interrelations are corollaries of the Unknowable"? Only this, that the proposed deductive process would be a sheer impossibility. Not that Mr. Spencer proposes this in clear words, but it is what any universalistic proposition amounts to of which the predicate admits in any form an Unknowable Power as a factor in the process of reasoning.

We come to the conclusion, then, that in Mysticism, that is to say, those methods of the unification of knowledge the terms of which are held not merely to connote the included facts of induction, but something added of an unknowable character, although it may be the final attainment of human research, we do not reach the final goal of Philosophy—the unification of knowledge —but rather an acknowledgment of the futility of the endeavour. We conclude also that any proposition in which the predicate contains some term which is merely a sign or symbol standing for the Unknowable, of which we can form no adequate conception, is a proposition of the mystical order transgressing the limits of true scientific induction, and utterly valueless as the starting-point of a deductive process.

§ 5. *The Psychological Methods of the Unification of Knowledge.*

Mr. Spencer's representation of the means by which the unification of knowledge may be effected varies with the nature of his subject. In the "Psychology" we get quite a special account of it—indeed, several different accounts.

The continuity of our criticism will be best preserved by noting here only the general conclusions of our study of the 'Psychology" so far as they relate to the special object of our present inquiry, namely, the unification of knowledge, leaving the justification of our representations to a more detailed exposition in chap. iv. Here we give merely a summary of that chapter, in order to preserve a proportionate argument.

Therein it will be seen that Part VII. of the "Psychology" furnishes us with an interesting study of the endeavour to unify knowledge by psychological methods, for there are several of them. Apparently Mr. Spencer defeats his own object by proposing so many. Whether he does an injustice to himself or not by failing to show that these various unifications can themselves be unified, we do not know; but holding ourselves that they cannot be fused into a larger intelligible generalisation, we believe them to be mutually destructive inasmuch as there can only be one unification of knowledge. This is a fatal flaw, independent of the failure of each separate unification, taken on its own merits, to answer the requirements of the criterion we hold continually before us, namely, that it must be both a scientific induction including all other scientific inductions, and a proposition from which as corollaries all existences and their interrelations can be deduced.

The first conclusion we come to respecting Mr. Spencer's unification of knowledge as expounded in the "Psychology" is drawn from the reasoning leading up to the following passage, extracted from § 386 :—

"And it was further argued (§ 40), that setting out with these fundamental intuitions provisionally assumed to be true—that is, provisionally assumed to be congruous with all other dicta of consciousness—the process of proving or disproving the congruity becomes the business of Philosophy; and the complete establishment of the congruity becomes the same thing as the complete unification of knowledge in which Philosophy reaches its goal."

We find it, therefore, clearly stated, first, that the goal of

Philosophy is the unification of knowledge; secondly, that this unification is accomplished when certain fundamental intuitions are found to be congruous with all the other dicta of consciousness; thirdly, that the business of proving or disproving this congruity becomes the business of Philosophy.

Taking the passage by itself, one would say that as internal relations are the product of external relations, or the establishment of correspondences between the internal in response to the external;—then the establishment of congruities between the primordial correspondences, with all the other dicta of consciousness, must be a very simple process; for it is only the establishment of congruities between the most general experiences and the details of experiences. The result arrived at would be that the details of which a whole is made up are parts of that whole.

But letting this go by, what are the fundamental intuitions with which all other dicta of consciousness have to be found congruous, thus producing a harmony in which the unification of knowledge is effected? Mr. Spencer does not enumerate them, but the result of his ensuing reasoning is the establishment of another and entirely different goal and method of Philosophy.

"That which Philosophy takes as its datum must be an assertion of some likeness and difference to which all other likenesses and differences are secondary. If knowledge is classifying, or grouping the like and separating the unlike, and if the unification of knowledge proceeds by arranging the smaller classes of experience within the larger, then the proposition by which knowledge is unified must be one specifying the antithesis between two ultimate classes of experiences in which all others merge."

The theory of this second method is: Since knowledge is classification, the more complete the classification the more completely unified is the knowledge, and the nearer we approach a philosophy. When, therefore, we have succeeded in comprehending knowledge in two large classes, we can proceed no further; knowledge is unified and philosophy has reached its goal. What, then, are these two widest of all groups of experiences? They are the self and the non-self—the faint and the vivid aggregates of experience. When these are properly demarcated, knowledge is unified.

But we do not rest here. Another stage of the reasoning carries us up to the Unknowable. From these considerations we reach the datum or "postulate that the manifestations of the Unknowable fall into two separate aggregates, constituting the world of consciousness and the world beyond consciousness." Is this, then, the fundamental proposition which has to be found congruous with every result of experience, direct and indirect, and which shall thereby fulfil the objects of Philosophy? All knowledge can be divided into two classes—that relating to the Ego, and that relating to the Non-ego. When we have come to this conclusion knowledge is unified, and these two classes of knowledge are manifestations of an Unknowable Power. But we have already found that no unification of knowledge is to be found beyond the bounds of knowledge. To look to the Unknowable for it is to produce mysticism, and to transcend knowledge altogether.

These three thoughts are thus summed up by Mr. Spencer, "First Principles," p. 157:—

"In brief, our postulates are:—an Unknowable Power; the existence of knowable likenesses and differences among the manifestations of that Power; and a resulting* segregation of the manifestations into those of subject and object."

This is the organised and consolidated conception, the primordial datum with which all the other dicta of consciousness have to be found congruous, by means of which Philosophy accomplishes its final unificatory process.

Our criticism upon this portion of Mr. Spencer's endeavour to unify knowledge can only be that it is vague and meaningless. That it is of such a wide and general character as to be applicable to all knowledge is true enough, but general descriptions do not give an insight into the relations of sequences, nor do they enable us to form propositions from which the inter-relations of all existences can be deduced. Shall we say that the general description of mankind is that it segregates into two classes, man and woman, and that this is an unification of the

* How and why resulting?

knowledge of humanity? Or shall we add to our knowledge by saying that they are different manifestations of the Unknowable? It is, indeed, the most general description of the human race, surpassing all descriptions of form, feature, colour, language, habits, civilisation; yet, although the largest of possible inductions respecting mankind, how barren of deductions! how little unificatory in its enunciation! how utterly void of instructiveness as to the interrelations constituting the history of the human race!

But again reverting to the requirements of the unification of knowledge, let us inquire how far they are complied with in the scheme before us. We have seen that to effect this unification we must build up inductively till we are able to formulate *one* widest of all propositions, which shall thereupon become the starting-point for a series of deductions, which deductions shall correspond with the actual history of the interrelations of all existences. How is this requirement satisfied by the scheme now under consideration? Let us first try to frame our proposition, as thus—

Subject.	"All existences and their interrelations"
Copula.	"are [corollaries of]" *
Predicate (being the ultimate truth).	"the segregation of the faint and vivid manifestations of the Unknowable."

With respect to it we can only remark, that we are unable to see anything in it or to get anything out of it. And we scarcely know, indeed, how to proceed with our deductive process. It does not seem that we can go direct from it to concrete instances, such as the rise of mercury in the barometer or thermometer, or the union of oxygen and hydrogen into water, or the hatching of an egg. We would therefore have to proceed mediately. But how? Would we first have to deduce matter and motion as corollaries from the ultimate proposition? But these are themselves merely symbolic terms, representing manifestations of the Unknowable of which we can have no definite conception, and presumably of the vivid order of manifestations. Should we next have to deduce the indestructibility of the one manifestation and the continuity of the other? Should we have

* See § 2, p. 8.

to deduce the instability of the homogeneous in order to reach differentiations of matter and motion, and then could we hope to deduce from the unificatory proposition, by a separate and independent process of reasoning, the antagonistic principle of equilibration, which would put them all back into homogeneity again? Thus, it is suggested, we would arrive at the unification of all concrete experiences. We feel compelled, however, to deny the logical connection of these propositions as deductions from the unificatory proposition now under consideration, and require a more distinct explanation.

This criticism would seem to render any further examination of Mr. Spencer's unification of knowledge upon a psychological basis unnecessary. However, we have pursued the inquiry in great detail in Chapter IV., in order to do justice to our author and to prevent the reader from straying from the one fixed object of Philosophy when studying the "Psychology," so that in the midst of multifarious changes he may keep steadfastly in view the one real point and goal of all his studies. By this method we shall see that, however rich Mr. Spencer may be in suggestion, or however satisfactory and profitable may be the minor studies in themselves, still he fails to satisfy the mind in respect of the main object which he sets out to accomplish. We must refer our readers to this chapter for an account of Mr. Spencer's treatment of the so-called Final Question. All we need do here is to say that it falls mainly within the lines of the foregoing criticism. The principal additional thought brought out in it is that the "impression we call resistance . . . . is the primordial, the universal, the ever-present constituent of consciousness;" and this consequently "becomes the mother tongue of thought, in which all the first cognitions are registered, and into which all symbols afterwards learned are interpretable."

It is difficult to know what to make of this in relation to the foregoing proposition. Evidently Mr. Spencer would have us believe that all manifestations of the Unknowable, both faint and vivid, are ultimately resolvable into varieties of the impression we call resistance. These varieties can only be differences of degree, we presume. To be different in kind would be to take them out of the classification. Besides, we know what is meant by differences of degree of resistances, but we could have no conception of different kinds of resistances. Mr. Spencer means to say then, that all our knowledge consists of experiences of aggregates of differences of degrees of resistances, and that all knowledge aggregates itself into two great masses, one consisting of intense resistances (the vivid manifestations), and the other consisting of slighter resistances (the faint manifestations); also that all the manifestations of the Unknowable take the form of the impression we call resistance, even although there were no consciousness to be impressed, and that between these two orders of impressions of resistance there is no series of invisible gradations but a wide gulf fixed.

Are we then to form a new unificatory proposition according to our new lights, and say that

"All existences and their interrelations"
"are [corollaries of]"
"the segregation of faint and vivid manifestations of the Unknowable, manifested in different degrees of the impression we call resistance?"

Or shall we amend the predicate, and say—

"Are the segregation of aggregates of different degrees of resistances or combinations of resistances?"

The former is or would be a subjective unification of knowledge, since it depends upon "the impression" which a conscious being has of resistance; and therefore it does not seem to be capable of forming a proposition from which the history of the existence and interrelations of the objective world and of times anterior to consciousness could be deduced. The deduction would have to be from the *impression* of resistance and this manifestly could not be applied to objective history. This is a fatal objection to all subjective methods for the unification of knowledge. And since knowledge is the establishment of correspondences corresponding to the correspondences of the environment, it is difficult to see how any subjective method is competent to deal with the universe as a whole in respect of the unification of the knowledge of it.

The second or altered form of the proposition would throw it into the class of the physical methods of unification of knowledge, and will hereafter receive due consideration. In the meantime, we must remark that mere resistance by itself would not seem to be very fruitful of result. If each unit had merely the power of self-protection—mere resistance without any power of attraction—there would be no occasion for the resistance, for there would be no encroachment, and we will see in due course that we shall have to consider a system of mutual attractions and resistances.

It is right to say that later on in the discussion of his theme Mr. Spencer enters more minutely into the relations of consciousness to resistance. At the same time we do not see that his subsequent treatment of the question saves him from the criticism.

Mr. Spencer finishes this process of reasoning by a recourse to the Unknowable Power, and thus throws the unification of knowledge by the psychological method upon the mystical method, subjecting it accordingly to the criticism applicable to that form of argument.

We conclude this section by taking the three instances of scientific unification given by Mr. Spencer at the outset to see if they are capable of receiving the philosophical unification there proposed by the method of this section, and by means of the propositions we have found it necessitates. Referring to "First Principles," p. 132 *et seq.*, we find the various motions of a river, the fall of a stone, the action of a fountain, the hydraulic press, the air-pump, and the various laws of movement of solids, are all capable of expression in common laws of dynamics. This is followed by a second series of illustrations, ending in the law of the relation between the amount of heat and the amount of molecular change, and by a third series, drawn from the phenomena of sociology, ending in the law that each man seeks satisfaction for his desires in ways costing the smallest efforts. The question is, can we unify all these wide scientific truths by deducing them as corollaries from the proposition that

"All existences and their interrelations"
"are [corollaries of]"
"the segregation of faint and vivid manifestations of the
Unknowable, manifested in the different degrees of
the impression we call resistance"?

We submit that Mr. Spencer's psychological methods will not bear this severe logical test, nor any other manner of definite and formal statement.

§ 6. *The Metaphysical Methods for the Unification of Knowledge.*

We have next in order to consider one of the most inveterate of the idols of the intellect. There may possibly be a legitimate science of metaphysics, but all those sciences which admit into their system objectivised abstractions are vitiated throughout by the influence of these figments. That student will be wise who, in commencing any philosophical study, provisionally at least repudiates all objectivised abstract terms from his vocabulary. Particular terms representing particular phenomena we know, and terms of totality representing groups or general aspects of phenomena we know, but abstractions we do not know, except as verbalisms for logical convenience.

Abstract terms have two separate origins. They may be, firstly, general terms changed into the singular, or they may be terms of relation or attribute generalised and put in the singular. In every case it is essential to their due impressiveness that they should have an initial capital letter, and sometimes they are accorded the dignity of the definite article—as The Absolute, The Homogeneous, &c.*

We have already seen that if we speak of oxygen or hydrogen we know what we mean; and if we speak of the sum of the chemical elements, it is legitimate and indeed necessary to use a general term or term of totality—Matter; and we prefer designating this class of terms by the name "terms of totality" rather than by the name "general terms," because it more clearly indicates that they derive all their value from the particulars summed up in them, and have no individual value of themselves. We would have it clearly understood that the general term in the singular number does not connote some single existence of which it is the name, but a variety of particulars which are thus represented for convenience. Thus, by

* See "On Mr. Spencer's Formula of Evolution," Part V.

using the word Matter, we can speak of all the various kinds of matter included in the term in so far as a common predicate is applicable. In this use, the term Matter is a well-understood word, having a definite meaning. But another use is made of it. We have already seen that we only know oxygen and hydrogen as differentiated bundles of attributes or properties; that the law by which they are differentiated is inscrutable; that, if there is any substance in which they inhere, we cannot possibly know anything about it; and that, so far as we are concerned, it might practically be non-existent, while as a part of knowledge it is non-existent. Nevertheless the term Matter is applied to this figment of the imagination, and figures accordingly as a factor in various systems of metaphysics. In the same way we know certain specific and particular attractions and repulsions of bodies; and we are not content with framing a general term or term of totality for use when we wish to predicate something which shall be applicable to all of them, but when it is made, we speak of an individual entity which seems to have objective existence—Polarity. In the same way the relations of distance give rise to the abstraction Space, which is thereupon supposed to be an entity—Time following suit; whereas there is no general space, but only special distances, and no general time, but only particular relative intervals of succession. Even the Positivist generalises human beings, and then forms an abstraction called Humanity, which he erects into an object of worship.

In a very singular passage, Mr. Spencer asks us to study the instance of a piano.*

"On thinking of a piano, there first rises in imagination its visual appearance, to which are instantly added (though by separate mental acts) the ideas of its remote side and of its solid substance. A complete conception, however, involves the strings, the hammers, the dampers, the pedals; and while successively adding these to the conception, the attributes first thought of lapse more or less completely out of consciousness. Nevertheless, the whole group constitutes a representation of the piano. Now, as in this case we form a definite concept of

* First Principles, p. 95.

a special existence, by imposing limits and conditions in successive acts; so, in the converse case, by taking away the limits and conditions in successive acts, we form an indefinite notion of general existence. By fusing a series of states of consciousness, in each of which, as it arises, the limitations and conditions are abolished, there is produced a consciousness of something unconditioned. To speak more rigorously:—This consciousness is not the abstract of any one group of thoughts, ideas, or conceptions; but it is the abstract of *all* thoughts, ideas, or conceptions. That which is common to them all, and cannot be got rid of, is what we predicate by the word existence, &c."

It seems to us that the process which Mr. Spencer here proposes is not possible. We cannot put ourselves into that very unscientific frame of mind which is necessary for the purpose. We cannot dissociate the ideas of dampers, pedals, &c., from our conception of a piano. We feel that there is such a correspondence between things and conceptions, that the only way to fuse the various ideas connected with a piano into the required indefiniteness of general existence would be by fusing the piano itself into general existence by grinding it into dust, and then we have no idea of a piano at all.

It is by thus quitting the actual limitations of things, and undertaking impossible mental processes, that philosophers go so far wrong, and lay themselves open to the sneers of men of science. They make science get out of its actual conditions—like a ghost out of a body—and then from the law of this pseudo-science of the abstract they work down to the actual. Dissociating itself from all the inconvenient trammels of concrete conditions, metaphysical philosophy completely ignores chemical and physical science, and sets up in business on its own account. But it thereby becomes merely a manipulation of words which are not representative of any actual existence whatsoever.

Mr. Mill, in his chapter "On the Import of Propositions," says: *—

"The distinction between an abstract term and its corresponding concrete, is no difference in what they are appointed to signify; for the real signification of a concrete general name is,

* System of Logic, vol. i. p. 140.

as we have so often said, its connotation; and what the concrete term connotes, forms the entire meaning of the abstract name. Since there is nothing in the import of an abstract name which is not in the import of the corresponding concrete, it is natural to suppose that neither can there be anything in the import of a proposition of which the terms are abstract, but what there is in some proposition which can be framed of concrete terms. . . . It is impossible to imagine any proposition expressed in abstract terms which cannot be transformed into a precisely equivalent proposition in which the terms are concrete, namely, either the concrete names which connote the attributes themselves, or the names of the *fundamenta* of those attributes, the facts or phenomena on which they are grounded."

All terms are originally concrete and refer to definite objective or subjective existences. In the process of distinguishment and classification which goes on from the first, plurals are introduced, and by and by terms which are inclusive of a great number of individuals come to be used. By and by, also, names are given to those qualities or properties of objects which they severally possess in common. Abstract terms are arrived at by both methods. In the first case, the general term is individualised and spoken of in the singular (for example, Man), as if the sum total of a number of individuals could have an existence as a separate entity, itself capable of being treated as an unity, and taking its part as such in the interrelations of things. In the other case, the property or quality dealt with becomes a power (for example, Humanity or Polarity), taking its place as a factor amongst other similar powers and amongst the objective realities of the universe.

From this we see that there will be a great number of words which have double meanings according as they are used as general terms referring to a great number of individuals concerning which something is predicated, or as they are employed to designate an imaginary entity which has no actual existence in the cosmos. Further, if these terms are used in propositions, any proposition of which they form part must also have a double meaning, and must be susceptible of a twofold interpretation, resulting in a changeful and uncertain import.

In this case, the only resource is to consider the proposition in either sense successively—first as having a concrete general reference, and next as requiring an abstract rendering.

This, then, is what we propose to do in the case of those propositions of Mr. Spencer's which are framed in such terms as may either be representative of general concrete facts or else may be interpretable as pure abstractions. We shall seek clearness of thought by a separate consideration of the ambiguous propositions which Mr. Spencer formulates, and shall inquire whether they are sufficient under either aspect singly to unify knowledge. If so, then the other aspect is superfluous; and if not, then the intermingling of the two does not effect the desired unification.

Let us first, then, consider some of the abstract terms employed by Mr. Spencer in his unification of knowledge—Matter, Motion, Space, Time, Force, Polarity, &c. The survey of Nature which forms the basis of knowledge informs us of a great variety of objects, differing in some respects, and in some respects resembling each other. Advancing Science, by a process of experiment and analysis, resolves these objects into seventy or eighty so-called elements, the properties of each of which it is able to enumerate. What general name is to be given to the sum total of these, so that when it is used we may know that it is applicable to these elements, and that it is these alone which are spoken of as actually existent? The general term so used is "Matter." But since they differ amongst themselves, they can only be designated by this general term in respect of those properties which they possess in common: then, by a strange perversity, those properties which they have in common are abstracted and regarded as an unity or entity; and although this abstract Matter, having extension with resistance, and nothing else, is nowhere to be found, yet it is treated exactly as if it were a real existence.

One of the most curious instances of the hold which an abstraction has upon the human mind as an imagined existence is the term Space. We have referred to it before. If there is one thing of which people are certain, it is the existence of Space as an objective entity, whereas Space is in reality only an abstract term derived from the experience of "distance between." In just the same way the abstract term Time does not represent any reality, but is derived from intervals of successions of changes in the relations of bodies. Some change of relations of objects being taken as a standard—say the relations of movement of the earth and the sun—then other changes of relations are compared therewith, and the term Time becomes a convenient word, but does not represent an objective existence.

Motion is a general term relating to all motions, and expressive of the change of positions of objects or the parts thereof. It is not, and cannot be made to be, representative of any individual objective existence. It is a convenient term to use when treating of all motions, when we predicate something which is applicable to all motions. It is not an objective entity, nor a factor having actual existence.

We may have some difficulty in realising the terms Attraction, Resistance, Polarity, Force, Equilibration, &c., in our minds as general concrete terms, yet it must be still more difficult to assign them any value as abstract terms. As concrete realities, we may be able to understand the relations of various attractions, repulsions, &c., and to make calculations respecting them which shall come out correct, these attractions and repulsions being in operation amongst and being part of the properties of the seventy or eighty so-called elements. When we speak of them in general terms, we are unable to divest our thoughts of these concrete references. The terms ought to be merely sums-total of concrete experiences. As to their being abstract entities, we can have no conception of attractions and repulsions apart from the concrete objects.

Therefore if Mr. Spencer should say (as indeed it would not be unfair for the purposes of study to assume him to say) that

"All existences and their interrelations
are [corollaries of]
the Persistence of Force,"

and the term Force is held not to be a general concrete term but an abstraction, then it could be maintained that as an abstraction it has no existence, neither has it properly any meaning dissociated in this way from all the concrete facts from which it has been extracted.

Again, if we say that

"All existences and their interrelations
are [corollaries of]
the Formula of Evolution and Dissolution,"

apart from the incongruities of thought involved in the statement, there is also this point relevant to the present issue—namely, the principal terms used therein (*i.e.*, Matter and Motion, considered as abstract terms) represent no existence. There is no abstract Matter and no abstract Motion. There are, it is true, the seventy or eighty so-called elements, which have for their term of totality the word "matter;" and they undergo changes of relative position which are called "motions;" the concrete hypotheses concerning both of which will be duly considered in their proper place: but if we choose to undertake a purely mental process having no correspondence with reality, and to manufacture an ideal matter and an entity called Motion, we cannot argue from them as to the actualities of things, nor unify our knowledge of them by means of these invented terms.

It is useless, therefore, to traverse the whole of Mr. Spencer's series of propositions, and examine them in respect of their adequacy as abstract terms to unify knowledge made up of individual concrete experiences. If these terms are to be of any use in such an endeavour, it must be as general terms or terms of totality representing universal concrete facts—never quitting their reliance upon these facts, and never losing their relation thereto. If deductions are to be made from this generalised and abstractly stated knowledge, it must only be as a convenient and mediate mode of deducing conclusions from the vast number of original concrete facts.

We need have no scruple, therefore, in summarily quitting this class of methods for the unification of knowledge, and of proceeding forthwith to the direct method just indicated.

§ 7. *The Physical Methods for the Unification of Knowledge.*

The subject we have now to consider is the endeavour to find the goal of Philosophy within the limits of Science or the actually known. As such a method is very narrow in its scope and very rigid in its limits, we are not likely to be successful. Nor do we apprehend that any philosopher could so limit himself, nor that Mr. Spencer anywhere proposes to confine his speculations within such narrow bounds. Everywhere we have to frame hypotheses which go beyond the known, and this mental reaching out into the unknown but not unknowable region of theoretical science brings before us the considerations treated of in our next section, entitled, the "Supraphysical Methods for the Unification of Knowledge." In actual fact, Mr. Spencer's attempt, when it is not by the methods already discussed, is a mixture of these rigid scientific and theoretical-scientific methods; and it must be admitted that the actual and the theoretic are so closely interwoven that it is difficult to distinguish them; so that in result the actually known gives the weight of its authority to the theoretic, and the latter throws its all-including mantle over the universe in the guise of authentic science. Therefore, without imputing to Mr. Spencer any attempt to unify knowledge within the region of the actually known, it will be useful to see how far the known by itself will carry us on our way; and the inquiry will also prove an advantageous preliminary to the study of the wider hypotheses treated in the next section, which, indeed, derive all their authority, whatever that may be, from the facts and generalisations of actual science.

There are two general remarks to be made as to this class of methods. The first is, that we expect to find strict intelligibility of terms. The physical sciences being built up from observation and experience, the terms employed should always carry with them exactness of expression, so as to be commensurate with the experiences which are to be registered by their means. Physical terms have definite and limited meanings, so that when they are used, they are known to possess an exact value—no more and no less. Their title to become true factors in processes of reasoning is in so far as they represent actual factors in the objective processes.

For example, there is no mistaking a treatise of mechanics, nor the formulas therein contained. So also in the science of chemistry, certain words or signs are symbols representing certain facts or groups of facts actually existent in nature, and the interrelations of groups of properties of a definite and known kind.

Indefiniteness and error creep in when the mental process of generalisation begins, which has no corresponding process in the facts of nature themselves. This process may be a legitimate one to a certain extent and for certain purposes—to the end, that is to say, of ascertaining how far the same predicate can be applied to large classes of facts—but it requires constant verification, and is good only so far as it is commensurate with facts. It is, however, a dangerous process—for general terms when once established in the mind by repetition, and by constant use in arguments and reasonings, are apt to assume a false reality, as representing, not a collection of concretes, but an unit which is an entity itself, and a factor not only in thought but in nature. Thus we get the word "matter," which, from being originally nothing more than a collective term, summing up the seventy or eighty so-called elements (the elements themselves being nothing more than groups of properties), came first to represent them in respect of those properties which they all had in common, namely, extension and resistance, and afterwards to represent a mysterious something which held together these groups of properties—an unknowable entity, active and powerful, but beyond the ken of human sense or insight.

There is, therefore, a twofold way in which Mr. Spencer's physical class of methods for the unification of knowledge may be regarded. We may either take his general physical terms as terms having a definite meaning and a value commensurate with the contained physical or concrete experiences, and reason therefrom, or we may regard them as general symbols. In the one case we have intelligible factors, the interrelations of which are calculable; in the other case we have imaginary entities, things having an unity and powers founded upon these known factors, but including something more than the totality of its contents.

Now it is obvious that according to the way in which we use these terms must be the result of our endeavours towards the unification of knowledge. We venture to submit, with due deference yet with boldness, that if we adopt the latter course and seek our unification of knowledge in the formation of a proposition which expresses the supposed relations of general entities, which are themselves inconceivable and entirely unrepresentable in thought, then we take our unification of knowledge out of the bounds of the intelligible and throw it into the class of the metaphysical methods which we dealt with in the last section.

On the other hand, if we accept the physical terms as having definite, limited, and intelligible meanings, then we have a course of reasoning open before us which we can pursue clearly, and which is open to criticism and intelligent treatment, whether we can succeed in effecting an unification by means of it or not.

If we are asked which course Mr. Spencer actually pursues in his work, we should answer, Both, although perhaps unconsciously. He does not clearly let his readers see firstly what the one can effect and then what the other can effect, but he proceeds in a conjoint fashion, so that when intelligible concrete matters are being dealt with, the one rendering of the terms is given, and when the exigencies of the case surpass intelligibility or the powers of the human reason, then the other aspect of the terms comes in, and is employed with a certain air of conclusiveness, so as to satisfy the eager desires of the hasty reader, if not the critical judgment of the student. It will be our task, having distinguished the different methods, and having pointed out when terms lose their significance, so as to become mystical or metaphysical, and thus to throw the unification into the illegitimate class of methods, to set out in detail the various physical methods proposed by Mr. Spencer, and, after attaching to them every possible intelligible meaning, to work them out fully, in order to see whether they accomplish the object which he has set before our view. This is the task we now propose.

The second general remark we have to make respecting the physical class of unificatory propositions is, that they must express a *process.*

There is nothing upon which Mr. Spencer insists more strongly than that all sequences are parts of one process, and that in the discernment of this process—*i.e.*, in the setting up in the mind of a series of corollaries which shall be the counterpart of the series of sequences which nature presents—is to be found the unification of our knowledge of nature. We would therefore direct attention to the question, what is meant by a process, and what is meant by the recognition of a process?

An artificial process is the treatment of substances by subjecting them to various chemical and mechanical forces, so as to change some of their arrangements of properties, either by adding to or taking from, and thus changing the shape or altering the distribution in such a way as to produce the intended result. A natural process is the change or redistribution of parts effected by the natural relations of bundles of properties under given circumstances, without any intention towards a given end. A natural process works *from* the past, not *to* the future: it is simply the flowing on of one sequence after another as different forces come into relation. From this view of a natural process it follows that if we could trace up the present state of the cosmos to its immediately preceding state, and so backwards, we would discern the history of all sequences. And if, further, we could analyse nature, and be able to ascertain her constitution at any given period, and by preference a period of simplicity of composition and structure, then we would be able to deduce therefrom all her subsequent history as a process consequent upon that constitution at that time. We would no doubt be able to say, There is so much oxygen, so much hydrogen, so much iron, and so forth, and the properties of oxygen are thus, the properties of hydrogen are thus, the properties of iron are thus, and so on. If we could do this, then we would have so many factors to our process, and our knowledge of the history of the universe would be simplified according as we were able to reduce the number of the original factors. At present the number of the factors is the number of the so-called elements, say seventy or eighty, plus ether and the known physical laws. For a complete knowledge it would be requisite to know the quantity and the exact position of each atom at any given time which might be selected as a starting-point. But failing that exact knowledge, even the conception of such a calculation might be supposed to give us a fair notion of its adequacy to explain all the incidents of the process, presuming the requisite knowledge of quantity and position. But even then we should still be very far from an unification of knowledge, in that the number of the factors is so great. It is true that the reduction of all knowledge to the recognition of a process calculable from the relations, positions, quantities, and properties of seventy or eighty factors would be a great simplification; yet it is only a first stage in the process. To show that these factors themselves are but the results of a still smaller number of factors would be a still further simplification; but the real unification of the processes of nature would not be reached until the whole series was interpreted as the relation of two factors.

It would seem from this statement that knowledge never will be unified; and, indeed, that is our belief. At the same time it will be our duty to give our attention to such proposals as are made, and not set up our despair or our scepticism as a test of other men's achievements. And if all the histories of Nature can be understood by means of the recognition of a process dependent upon the interrelations of factors, be these factors numerous or few, then knowledge is so far unified—our explanations are effective,—our knowledge is organised,—Science has become a practically complete Philosophy.

§ 8. *An Enumeration of Mr. Spencer's Physical Methods for the Unification of Knowledge.*

(*a.*) *Hypothesis of the Seventy Factors.*

The first proposition we have to consider is that the history of the solar system, ending in the state of things as we know it now, including the existing facts of animal and vegetable life, is the result of a process due to the constituent factors of a nebula existent in the cosmos some millions of years ago. This nebula consisted of the seventy or eighty so-called elements or bundles of properties, as known to us and as described in books on chemistry. Their interrelations were to some extent influenced and determined by forces not inherent in the mass, such as separative Motion, which, when disengaged from the nebula, allowed these constituent factors to come into relation, with the results indicated. The question thereupon arises, Is such a hypothesis sufficient to explain the results, so that we can understand the whole course of physical and biological history as the inevitable and calculable process due to those primordial factors?

Mr. Spencer has not written a book upon Inorganic Evolution, but he has indicated the method of treatment he would have pursued had he done so in the Appendix to vol. i. of the "Biology," criticised by us in our former volume.*

This Appendix also explains the origin and nature of Organic Matter. Thereupon the student may take up the study of the "Biology," showing how all the forms of life are the resultants of some combinations of the so-called elements in relation to the circumstances of their physical environment. This history affords matter for a more elaborate and detailed examination in Chapter V. of this work. The result of the two criticisms is to show that from the nebula constituted as described the results are not deducible as claimed. The process of development from the nebula to the finished organism, acknowledging it to be a process, is not intelligible as the result of the factors given. In this examination, as already stated, we have not wandered beyond the boundaries of a book on Chemistry, a book on Physics, and a book on Mechanics. As thus limited to actual knowledge, we have found the factors inadequate to produce the known results. Whether they are capable or not of a wider reading remains to be seen in our next section.

In the meantime, it is worth while to inquire if any of the other propositions of Mr. Spencer are capable of a strictly

* See "On Mr. Spencer's Formula of Evolution," p. 33 *et seq.*

scientific statement, and, as preliminary to the next section, it will be well to ascertain their value in this respect. Founded on actual science as these supraphysical methods must be, it will be useful to examine first what truths of science afford them countenance and authority.

(*b.*) *Hypothesis of the One Factor.*

The first scientific generalisation in order of pre-eminence and of most extensive use throughout the work is the Persistence of Force, and the method based upon it ascribes the unification of knowledge to the proposition that

> "All existences and their interrelations
> are [corollaries of]
> the Persistence of Force."

This proposition has already been considered in its abstract interpretation; we have now to consider it in its value as derived from, and being a general expression of, concrete experience. We have to regard the Persistence of Force as an ultimate generalisation built up by ever-increasing generalisations of knowledge as specified in the beginning of this chapter, and from which all changes of the universe can as corollaries be deduced.

Let us take our science first-hand from the exposition of Professor Balfour Stewart, to whose work "On the Conservation of Energy" we now refer. This work strikes us as tentative rather than as conclusive, as an attempt in the right direction rather than as the final expression of scientific investigation. The matters treated of by Professor Stewart do not seem in his hands to acquire complete philosophic form, as will be seen.

In the first place, Professor Stewart gives us a catalogue of the Forces of Nature, and, secondly, a list of the Energies of Nature. What is the difference between Force and Energy is not stated, and has to be gathered from a comparison of the two lists. And even then, when we discover that the former means principally the forces of attraction, the denotative terms might easily be exchanged. Energy is that which "does work" against these attractive forces.

The Forces of Nature are—

1. The Attraction of Gravitation (p. 48).

2. The Attraction of Cohesion (p. 51).

3. The Attraction of Chemical Affinity (p. 53).

4. Electrical Attraction (p. 64) regarded as "peculiarly allied to that force which we call Chemical Affinity."

We have purposely left out "Elastic Forces" (p. 50), as in all probability the cases so termed are compound cases of resistive and attractive forces.

Professor Stewart does not propound any theory of the Conservation of Force similar to that of the Conservation of Energy, which will shortly come under our notice. Nevertheless it would seem to be just as well founded in science as the doctrine of the Conservation of Energy. Neither does he teach us the transmutation of Force according to which the various kinds of Force enumerated above could be changed the one into the other.

Let us now consider—

The List of Energies.

A. Energy of Visible Motion.
B. Visible Energy of Position.
C. Heat Motion.
D. Molecular Separation.
E. Atomic or Chemical Separation.
F. Electrical Separation.
G. Electricity in Motion.
H. Radiant Energy.

We observe that Professor Stewart says nothing about Nerve Force, Muscular Energy, Polarity, &c., which are terms used by Mr. Spencer; nor does he mention Feeling, but proceeds to the—

"*Law of Conservation.*"

"115. Having thus endeavoured, provisionally at least, to catalogue our various energies, we are in a position to state more definitely what is meant by the conservation of energy. For this purpose, let us take the universe as a whole, or, if this be too large, let us conceive, if possible, a small portion of it to be isolated from the rest, as far as force or energy is concerned, forming a sort of microcosm, to which we may conveniently direct attention.

"This portion, then, neither parts with any of its energy to the universe beyond, nor receives any from it. Such an isolation is, of course, unnatural and impossible, but it is conceivable, and will, at least, tend to concentrate our thoughts. Now, whether we regard the great universe or this small microcosm, the principle of the conservation of energy asserts that the sum of all the various energies is a constant quantity, that is to say, adopting the language of Algebra—

$$(A) + (B) + (C) + (D) + (E) + (F) + (G) + (H) = \left\{ \begin{array}{l} \text{a constant} \\ \text{quantity.} \end{array} \right.$$

"116. This does not mean, of course, that (A) is constant in itself, or any other of the left-hand members of this equation, for, in truth, they are always changing about into each other—now, some visible energy being changed into heat or electricity; and, anon, some heat or electricity being changed back again into visible energy—but it only means that the sum of all the energies taken together is constant. We have, in fact, in the left hand, eight variable quantities, and we only assert that their sum is constant, not by any means that they are constant themselves."

We note here that we shall have to quote this exposition of the conservation of energy against Mr. Spencer when we come to controvert his doctrine of the Continuity of Motion; for Motion, according to Professor Stewart, is not a constant quantity, but is interchangeable with energy of position, which is a state of rest.

An element of obscurity remains in respect of the affinities or polarities of the so-called elements. The question arises, Are these constant quantities inherent in these elements? If not, what would they be without them? and if they are, how do they rank with the forces or energies on the list, since they are not then convertible?

And again, if all the modes of energy specified are convertible, is it legitimate to suppose that they could all be converted into one kind? In this case, what would become of the chemical attractions or polarities in question? Generally speaking, what is the relation of the doctrine of the Conservation of Energy to the permanency of the properties of the so-called elements?

With these preliminary provisoes, we are able to understand the doctrine of the Conservation of Energy as held by men of science, namely, that there is a variety of different kinds or modes of manifestations of energy in nature, that these modes are capable of interchange; and that although each mode may vary in quantity, it only does so by becoming another mode, the total quantity of energy remaining constant.

This is the doctrine upon which is founded Mr. Spencer's "Persistence of Force." It would appear in some places of Mr. Spencer's work, though not in others, that he would include in this term the Indestructibility of Matter also; yet as the latter is not a mode of force interchangeable with any other, it would seem illegitimate to do so, and therefore we take it that Mr. Spencer's scientific doctrine is the same as Professor Stewart's. At any rate, it is convenient for the present section so to consider it, reserving for the next section any extension of meaning. It is the scientific statement as arrived at by scientific men that we have under consideration at present, and having fully acquainted ourselves therewith, we have to consider what are the corollaries of the constant quantity of energy. Can we deduce all the interrelations of existences from the knowledge we have that the sum total of all kinds of energy, however they may interchange, remains a constant quantity? To our mind it is a barren proposition. The only corollary from it seems to be that if one kind diminishes another must increase. We may find all the facts of nature in conformity, that is, uncontradictory of this principle and of the Indestructibility of Matter and the attractive Forces, but we shall never be able to deduce the particular and special changes from these principles. We shall never be able to understand the differentiation of the unknown energy into the various modes of its manifestation as set forth by Professor Stewart; and failing in the first corollaries, we fail in all the others. Since we cannot know the nature of the original Force or Energy, we can get no corollaries from it. If we are asked to draw corollaries from the Persistence of Force, and we know not Force, the stress of getting the corollaries is thrown upon the Persistence, and the only corollaries derivable therefrom are merely that *if* one kind of force augments, another will diminish, and *vice versâ*. The only other corollary we could get from the teaching would be that the facts of experience upon which the doctrine is founded will never contradict themselves, but will always be found conformable to the general principle of which they are the warrant. In fact, nearly all Mr. Spencer's corollaries from the Persistence of Force are found to be merely statements that such and such a fact, general or particular, is in harmony with the doctrine of the Persistence of Force. But it will at once be seen that to find facts or circumstances uncontradictory of a proposition is a very different thing from deriving them from it as corollaries. The former is a merely negative result, the latter is what we truly look for as conferring that insight into the connection of sequences which is the unification of knowledge. Bearing in mind that Mr. Spencer proposes to found his most general proposition on actual science, let us take several of the corollaries which he draws from the Persistence of Force and examine them as corollaries from the doctrine of the Conservation of Energy as expounded by Professor Stewart.

Still keeping within the bounds of actual science, let us ask whether the Instability of the Homogeneous is really a corollary from the Conservation of the Attractive Forces or the Conservation of Energy? The proposition is—

"The homogeneous, or any substance or existence that is homogeneous, is unstable."

Viewed as a corollary from the theory of the constant quantity of energy, this proposition does not seem to have any relation to that general principle. If it has, the corollary would seem to be that the homogeneous remains stable if it is in a state of balance, which is, indeed, implied in the term homogeneous. Supposing, however, Mr. Spencer means that if different parts of a homogeneous mass are differently affected by various incident forces, the mass no longer remains homogeneous—then we acknowledge the corollary but quit the proposition under study, and find another one altogether, namely, that incident forces impinging upon another aggregate of forces produce changes. This will be allowed as a corollary, but will be seen to be a very barren one. The kind of change wrought, the nature of the sequences, depends upon the particular incident forces, and upon the particular receptive forces.

We have seen already that the Indestructibility of Matter is not a corollary from the doctrine of the Conservation of Energy. Professor Stewart, though in an imperfect way, disclaims it, nor can it be included in the list, because all that are included in the list are not individually permanent but changeable. And it is not a corollary from exclusion, because by exclusion it cannot stand in the relation of a corollary at all. It is an independent, not a dependent, doctrine. The scientific statement of the Conservation of Energy is thus seen not to warrant as its corollary the doctrine of the Indestructibility of Matter.

Is it, then, a corollary from the Conservation of Force as given by Professor Stewart? If the proof of it is the indestructibility of weight, then by Matter is meant the Attraction of Gravitation, and the theory is a corollary from itself.

Again, the Continuity of Motion is not a corollary from the Conservation of Energy, because motions, being included as some of the energies which are mutually convertible with other energies in a state of balance or rest, are seen not to be continuous.

Neither is any power of the nature of mind, feeling, will power, mental energy, &c., a corollary from the Conservation of Energy, for being excluded from the list, they are not convertible into any of those which compose the constancy of the quantity. On the other hand, it is a corollary from this doctrine that there are no such energies in operation as factors, for they can only act in increasing or decreasing the quantity of energy made up of the kinds mentioned in the list. Whereas energy is a constant quantity, never augmenting nor decreasing.

Are we to say that Equilibration is a corollary from the Persistence of Force, as thus made up of the two forms described by Professor Stewart? We think not. Equilibration is a tendency to a state of rest. All motion is the act of balancing; when balance is reached, rest ensues. But the constancy of the quantity of energy only means that whether in the form of motion or in the form of energy of position the total quantity is the same —the form is indifferent—and the constancy of the quantity does not necessitate either motion or rest. As regards Mr. Spencer's special phases of Equilibration promulgated in the "Principles of Biology," there is no relation apparent.*

We might, again, ask, Is the Formula of Evolution a corollary from the Persistence of Force, as thus considered, or Integration or Dissolution? We would find in each case either contradiction or non-relation. The only corollary from the Persistence of Force is that *if* there is change from one kind of energy, it must be into another kind; but the doctrine is absolutely fruitless of special corollaries. It does not even necessitate change of any kind, only that if there is a change it must be into another kind. The key to special changes must not be looked for in this barren and general proposition, but in the actual kinds and relations of the special forces enumerated, and in the resistive or other forces which are left out of it altogether. When these are brought together and understood in all their relations of quantity and position at any given time, then we can read the sequences, not otherwise.

We find, then, that the scientific doctrine of the Conservation of Energy is useless in itself for the philosophic purpose. Viewed as a corollary from the scientific doctrine of the Conservation of Energy, the only logical conclusion arrived at would be that some change would take place equivalent to the amount of energy changed.

And if we add to this the doctrine of the Conservation of the Attractive Forces, and again the Indestructibility of Matter, whatever that is, we are unable by them to read off the history of the physical cosmos, and much less can we attain to an explanation of biological processes.

We therefore conclude that within the limits of actual science philosophy is not attainable. A more detailed criticism to this end is given in our former work, and in the examination of

* See Chapter V. of this work.

the "Biology," included in the present volume. We now pass on to the Supraphysical Hypotheses.

§ 9. *The Supraphysical Methods for the Unification of Knowledge.*

Since it is seen that the purely physical methods of study carry us out a short distance in our endeavours towards the explanation of the cosmos, while the study of them yet points in various ways towards theories of a more general character, our thoughts naturally take a wider range, and we set ourselves to the task of framing hypotheses which, whether founded on actual knowledge or purely imaginary, aim at one and the same result, namely, the explanation of all the modes of physical combinations and histories and all their associated developments. These theories, for convenience' sake, we call the Supraphysical, on two grounds: in the first place, because they aim at getting behind and explaining the relations of the present ultimately known factors (*i.e.*, the chemical elements); and in the second place, because since they are thus but an extension of the methods and factors of science, we do not transgress beyond the reach of the human intellect, but every idea and every proposition founded upon them is at least conceivable. Thus we are capable of estimating what each hypothesis is able to explain and what it fails to include. Such demarcations of failure are just as useful as the demarcations of success, because they enable the intellect properly to direct its future exertions; and this is far better than the endeavour to slur over deficiencies of explanation under the cover of indefinite thought and confusing verbiage.

We shall have to treat of two classes of hypotheses of the supraphysical order, the legitimate and the illegitimate, the former dealing with definite conceptions and being more nearly related to the actual truths of science, and perhaps consequently of a more limited scope—the latter free from such tiresome restrictions as to meaning and scope, and, from their indefiniteness, apt to delude the mind with the appearance of greater magnificence, and even of greater efficacy for cosmical explanation. Both methods have this in common, that they are founded on generalisations of actual knowledge; but they treat these generalisations in very different ways, the characteristic of the former being that it deals with imagined concretes, that of the latter being that it deals with objectivised abstractions—that is to say, terms of totality conceived as general terms connoting a something which is an unity itself—a special factor—having definite relations with other objectivised abstractions established in the same way.

Let us first treat of those legitimate hypotheses which are most nearly related to actual knowledge. And it is not to be supposed that in this chapter, which is only a mere outline of the study, we intend to traverse the whole field of supraphysical speculation. It is our intention here merely to indicate the chief features, so as to enable the student, in following Mr. Spencer or any other author, properly to locate the particular hypothesis or method he may have under examination, and thus prevent aimless and indefinite wandering.

(*a*.) *Supraphysical Hypotheses Strictly Considered.*

Physical science has done something already, if we endeavour to approach the subject from the safe side of actual accomplishment, towards supraphysical theories. Men of science are working towards such theories year by year. The methods, experimental or logical, by which Science has reduced chemical processes to the interrelations of the seventy or eighty so-called elements, and physics to certain laws of motion, are continually encroaching upon the mysteries of the unknown, and are endeavouring to penetrate still further. Year by year adds to our knowledge of the motions of matter, and of the behaviour of the elementary substances under various physical conditions.

In chemistry we find the hypothesis that the seventy or eighty so-called elements are really not simple, but have complex constitutions, formed of one or two simple original elements differentially aggregated. The properties of these original elements are variously estimated. Some theories would invest them merely with the attributes of attraction and resistance, perhaps also with differentiated shapes and modes and rates of motion.

The theory that the relations of the so-called elements are those of modes and rates of motion, coupled with some theory of shapes produced by the varied aggregation of units having polarities of attraction and repulsion, is supported by implications from various branches of science. The doctrine of chemical combinations supports it; more particularly does it derive support from the very abstruse law formulated by Mendelejeef and Lothar Meyer, termed the "Periodic System." The science of Molecular Physics, to which the late Professor Clerk Maxwell so largely contributed, and which the late Professor Clifford popularised, also tends in the same direction. The science of Spectroscopy likewise indicates the complicated structure of some of the so-called elements in the number and variety of the lines produced in the spectrum, and in the theory that these are caused by the varied motions of different units in a state of incandescence. The behaviour, also, of different substances in a state of tenuity in the radiometer under the application of electricity again tends in the same direction. The physical explanation of heat as molecular motion, of light as ethereal motion, of colour as differentiated rates of ethereal motion, all point towards a theory founded on the relations of differently constituted aggregations of units of attraction and repulsion plus an ether having no property but simple resistance and attraction.

Now it is possible to suppose a physical world thus constituted—it is a reasonable hypothesis—one that we are able to conceive—one coming within what Professor Tyndall would call legitimate scientific imagination. It may be regarded as a possible explanation of the laws of the various sciences of Chemistry, Physics (molar and molecular), Electricity, Light, Heat, Spectroscopy, &c.; and if the special laws were eventually arrived at, it would constitute an actual unification of all these sciences. We are still, it is true, far from such an unification, but science is tending in that direction.

How far Mr. Spencer places his reliance on this intelligible hypothesis is not very clear. Undoubtedly he works with it to a certain extent, and he even, as we shall presently see in the critical study of his work on "Biology," in part uses it; but in his reply to our previous criticism he so decidedly and positively refuses to be tied down to any such definite and precise theories, that it is difficult to know how far and to what extent he relies upon them, and how far he discards them in favour of symbols that stand for things and processes of which we can have no conception.

As just stated, the critical study is that of Biology. We can see very well that the theory just indicated might be supposed to be sufficient for the explanation of the physical constitution of the cosmos, but it would not seem to account for the origin and history of organised living beings. Here, again, notwithstanding very close study of Mr. Spencer's "Biology," we are unable to assign the author's exact position. He very clearly repudiates "feeling" as a factor in biological histories,* and apparently relies wholly upon the properties of some of the so-called elements, including their mutual polarities, and upon their external relations, called equilibrations, with the physical forces and energies included in Professor Stewart's list. In this case Biology itself would have to be included in the ultimate unification of knowledge we have just described; and under these conditions, supposing such to be Mr. Spencer's views, we have examined his theory of Biology very thoroughly in Chapter V. of this book. The result of that examination is that the explanation fails; and if we add to this failure to explain Biology upon merely physical premises, the additional failure to account for and define the mutual relations of physical structure and processes with feeling and mentality, we have the most important and interesting of all studies shut out from the proposed unification of knowledge.

(*b.*) *Hypotheses including Feeling.*

It is of comparatively little moment to us that all physical processes, exclusive of the biological, can be shown to be the result of certain differentiated combinations of original simple units. Such a proof is an intellectual achievement which gives intellectual gratification and no more. What is of vital interest is to know what we ourselves are, whence we came and how,

* See Principles of Biology, vol. i. chap. 8.

whither we tend, and what the law of our conduct—what we are to one another in the long course of our history? Are we anything more than accidents appearing in the cooling of a nebula, and vanishing in the ruins of a dead world?

On these questions the theory just considered throws no light. A rational explanation of feeling and its relations, simple and complex, with physical aggregations and organisations, seems to demand a theory of origin which includes feeling amongst the initial factors—a theory which shall specify a factor of feeling in the most simple of all physical interrelations; which shall assign feeling as an universal concomitant of physical combinations and disintegrations. Several such theories have been propounded, in which physical changes bear assigned relations to feeling, and feeling bears assigned relation to and influence upon physical changes. This introduces us to a very difficult problem; for if feeling is not merely the concomitant of a physical process, but is also a factor in physical processes, how is the theory of the constant quantity of the physical forces to be maintained? Of course it can be replied that the theory need not be maintained; it may be argued that feeling, "psychic force," or whatever it may be termed, may increase or decrease or vary the physical forces of Professor Balfour Stewart's list, and that there may be no fixed relations between physical combinations and feeling. But everything in the history and constitution of living beings points to the existence of such definite relationship of interdependences. Were it otherwise, the unification of knowledge, and indeed science of any sort, would seem to be impossible. But in fact, as justified by experience, we are warranted in our endeavour to assign an explanation—a historic explanation—by which we shall see that all biological structure and function is the result of the interrelations of original factors, including feeling. As a matter of fact, all we can say is, that no adequate explanation on these lines has yet been effected, and we have no inkling of any. At the present time, notwithstanding all our achievements of Science, the relations of physical combinations and changes to feeling, and the influence of feeling upon physical changes, is an impenetrable mystery. Mr. Spencer in some places recognises this mystery to the full. Nevertheless, he professes to have accomplished the task of explaining the origin and development of all living creatures, or at least to have formulated the main lines of such a history of morphological and physiological development; and this theory is founded purely upon physical processes, the factor of feeling being formally excluded.

We think it may fairly be urged that some such theory as the one just indicated may, if not at present, yet at some future time, come within the scope of legitimate hypotheses. We are able to conceive of all the factors requisite for such a hypothesis, although we are not able as yet to frame any notion of their mode of connection or relation. This, however, remains for the future. Mere possibilities we are unable to measure. But if such a conception, however legitimate the hypothesis may be, is not possible at the present time, and yet is necessary for the complete unification of knowledge, then all the more certain is it that at the present time such a unification cannot be effected.

Let us now proceed to put into a proposition the views we have just been discussing, so as to keep our theories within the methods of procedure we deemed to be correct at the commencement of our present study.

Let us first say—

"All existences and their interrelations
are [corollaries of]
conceptions of the relations of original units of attraction
and repulsion."

Our conclusion is, that although this might be a sufficient explanation of all physical processes, it would not afford us an explanation of the origin and development of living beings, even if we consider such development to be unaffected by the factor of feeling; and that if we consider it to be so affected, then, since the factor of feeling is not included, either expressly or implicitly, in the proposition, that proposition fails to recognise one of the essential factors, and is to that extent incomplete. This thesis will be more fully considered in Chapter V., where we treat of the "Biology."

(*c.*) *Other Supraphysical Hypotheses.*

There are other forms into which the supraphysical hypotheses can be thrown, and which are implied in several parts of Mr. Spencer's works. The importance he attaches to Equilibration and Polarity warrants us in giving them special treatment. For clearness of study, let us throw them into the form of a proposition, thus :—

" All existences and their interrelations
are [corollaries of]
Equilibration,"
and
" All existences and their interrelations
are [corollaries of]
Polarity."

We mention these because Mr. Spencer in his " Biology " so largely employs them in effecting his constructive arrangements.

Polarity is a legitimate scientific term ; it is representative of a number of concrete facts, taking its origin in the action of the loadstone and magnetic needle, enlarged by the knowledge of the behaviour of electrified substances, but deriving its special significance in biological construction from the science of crystallography. The special relationships thus characterised are those mutual affections of atoms by which they range themselves into special forms of aggregation. These mutual affections may or may not have to do with what are called chemical affinities, but in any case they have to do with the method of aggregation of similarly constituted molecules.

The form of crystallisation is now universally specified as appertaining to the properties of those bodies which do crystallise, although there are certain bodies called colloids which do not assume that form of aggregation. The manner in which Mr. Spencer employs the powers included in the term Polarity is treated of at great length in Chapter V. of the present work. He assumes that the differences of perceptible crystalloid form are due to differences of size and shape of the atom or molecule—and very reasonably so, for assuming polarity of an atom or molecule to be positive and negative at different points, the arrangement effectuated must be due to the shapes and sizes of the constituent particles. Colloids, he seems also to say, have similar attractions and repulsions, but they either have no constant shape or the shapes are not rectilinear but curvilinear. Mr. Spencer's very clever and ingenious but delusive argument is founded on the attempt to confer on the colloids which constitute organic matter all the formative powers of the crystalloids, so that on the one hand they are so pliant as to receive any and every change of form, and yet, when so required for constructive purposes, they have the methods of aggregation of crystals, with definite shapes and fixed modes of aggregation. The theory is strained still further when, in lieu of the definite homogeneous structure of a mass of crystal, we have it stated that we owe to a similar process the heterogeneous structure of an animal composed of an osseous part, a nervous part, a cuticle, a liver, muscle, &c., made up, it may be, of similar modified units, but not forming a structure *resultant from* the forms and polarities of special physiological units, in the same manner as a mass of crystal is determined by the forms and polarities of its constituent particles. It will be found, we think, from a study of the criticism just referred to, that the proposition explaining the interrelations of all existences by Polarity will not be found of the desired efficiency.

The proposition attributing all existences and the history of their interrelations to Equilibration is a wider and more indefinite explanation, inclusive in all probability of the polarities we have just been considering. It is a supraphysical hypothesis, because it is founded upon experiences with which we are fully acquainted and conveys a more or less definite conception. The hypothesis is in some respects confusing, in that it is not clear what forces can be equilibrated with one another, and what forces stand apart and have no place in a process of mutual balancing. Of course, it can be clearly understood that the forces and energies enumerated in Professor Balfour Stewart's list mutually affect each other, and whether interchangeable or not can be so related to each other as to mutually balance each other in a state of rest or equilibrium. But it is not quite clear what (if any) of the properties we ascribe to the seventy or eighty so-called elements are essential to them and cannot be detached from them, and are therefore not includable in a general equilibration — for instance, Polarity. The whole subject requires a greater thoroughness of treatment than Mr. Spencer has given it, and it is imperative that some one should write that preliminary book on Inorganic Evolution which Mr. Spencer was obliged to omit. Is Polarity a fixed property, for instance, of Oxygen? If so, and if not, how does it take part in a process of Equilibration? Again, if Matter is a special manifestation of Force of an indestructible character and not interchangeable with other modes of Force, in what respect does it so differ from those other modes as to be uninterchangeable, and how does it enter into the general process of Equilibration? Is Matter as a form of force specialised as Attraction or as Resistance? If the latter, is it conditioned as to shape or size, or how otherwise? Is it always associated with Motion or Attraction? Mr. Spencer would perhaps say that all these alternative scientific notions are inconceivable. If so, then all these supraphysical theories must be abandoned as not affording the sought-for universalistic explanation. All we desire to make out now is, that if we are to consider such hypotheses, they must be commensurate with the whole of the facts, and they must be framed in clear language founded on definite notions of actual conditions. If, as we suppose, Equilibration is one of those ill-conceived thoughts of which we have a clear conception with regard to some special instances, and vaguely formed analogies with regard to other processes, together with still more indefinite ideas of application to the whole system of things, it is quite beyond all intelligibility as an universalistic explanation and as a means for the unification of knowledge.

This hypothesis is treated at length in Chapter V. of the present work, forming part of our study of "Biology," and is given in this connection because that study is the most important of Mr. Spencer's series of works, as well as on account of the curious twists and turns which are therein given to the hypothesis of Equilibration. We content ourselves here with showing that until the factors with which Equilibration deals are more clearly set out, as well as the forces which are beyond its scope (if any) and the modes in which they affect each other, the mere term Equilibration as prime mover or as an instrument in development, and more particularly in biological development, especially, again, if feeling is a factor therein, is useless and meaningless; and until all this is done we cannot understand the proposition which assigns Equilibration as the long-sought-for predicate

(*d.*) *The Hypothesis of the Three Factors.*

We have now to consider certain illegitimate supraphysical methods. We characterised these at the outset of the section as being founded on objectivised abstractions. We have already found a condemnation of all such methods of reasoning in a former section of this chapter. But we find it necessary to speak of them here because they have a supposititious authority in physical experiences, and because it is desirable to show in what manner they are actually applied in trying to make use of them as explanations of physical change. For this purpose we shall have to direct attention to the process of reasoning in the earlier chapters of the book on the Knowable in Mr. Spencer's "First Principles."

The course of thought pursued in these earlier chapters of "First Principles" has all the formality of a clear and consistent argument carefully stated. The reader is made to feel that he advances firmly step by step, until he has it clearly impressed upon his mind that all his future work is founded upon the understood relations of *three* original factors, the formulation of which will constitute the desired unification of knowledge. Now, a factor is that which has special properties in relation to other factors, and when we have a given number of related factors, and clearly understand these relations, we can foresee the general character if not the details of their subsequent histories. The factors which Mr. Spencer gives are the Indestructibility of Matter, the Continuity of Motion, and the Persistence of Force. It will be seen that neither Matter, Motion, nor Force are defined. In the special chapters treating of them the conceptions we should attach to these terms are specified, but it is elsewhere stated that they are but symbols standing for modes of the Unknowable. If we confine them to the modes or manifestations as known to us, the consideration of our subject is thrown into the physical section of our study, or into the preceding part of this section. If we take them in the sense implied in each particular sentence in which they occur, we have variable terms, but generally meaning the approach together or separation of bodies having resistance and extension, and implying powers of attraction and combination, and powers of separation. But the real stress of meaning is often put upon the adjective turned into an objectivised abstraction, and we find our minds dwelling more upon the Indestructibility, the Continuity, and the Persistence than upon the intelligent understanding of the objects which are indestructible, continuous, and persistent. How we can speak of these factors, and yet not be able to specify those properties in respect of which they are related factors in a process of physical development, is incomprehensible. A treatise on chemistry we can understand, or a treatise on mechanics, although we have no knowledge at all as to what oxygen is in itself, nor what motion is in itself; howbeit we do know what we mean in every instance when these terms are used in scientific treatises. Mr. Spencer works with the three factors mentioned above, and in the formulation of their relationship he seeks to unify knowledge. This is clearly set out in Chapter XI. of the "First Principles," entitled "Recapitulation, Criticism, and Recommencement."

"§ 90. But now, what parts do these truths play in forming such a conception? Does any one of them singly convey an idea of the cosmos: meaning by this word the totality of the manifestations of the Unknowable? Do all of them taken together yield us an adequate idea of this kind? Do they, even when thought of in combination, compose anything like such an idea? To each of these questions the answer must be—No.

"Neither these truths nor any other such truths, separately or jointly, constitute that integrated knowledge in which only Philosophy finds its goal. It has been supposed by one thinker that when Science has succeeded in reducing all more complex laws to some most simple law, as of molecular action, knowledge will have reached its limit. Another authority has tacitly asserted that all minor facts are so merged in the major fact that the force everywhere in action is nowhere lost, that to express this is to express 'the constitution of the universe.' But either conclusion implies a misapprehension of the problem.

"For these are all analytical truths, and no analytical truth—no number of analytical truths, will make up that synthesis of thought which alone can be an interpretation of the synthesis of things. The decomposition of phenomena into their elements, is but a preparation for understanding phenomena in their state of composition, as actually manifested. To have ascertained the laws of the factors is not at all to have ascertained the laws of their co-operation. The question is, not how any factor, Matter or Motion or Force, behaves by itself, or under some imagined simple conditions; nor is it even how one factor behaves under the complicated conditions of actual existence. *The thing to be expressed is the joint product of the factors under all its various aspects.* Only when we can formulate the total process, have we gained that knowledge of it which Philosophy aspires to. A clear comprehension of this matter is important enough to justify some further exposition." . . . .

"§ 92. To resume, then, we have now to seek a law of composition of phenomena, co-extensive with those laws of their components set forth in the foregoing chapters. Having seen that matter is indestructible, motion continuous, and force persistent—having seen that forces are everywhere undergoing transformation, and that motion, always following the line of least resistance, is invariably rhythmic, it remains to discover the similarly-invariable formula expressing the combined consequences of the actions thus separately formulated."

The problem here proposed is the formulation of the composition of phenomena by the light thrown upon it in the preceding chapters. "The thing to be expressed is the joint product of the factors," and the factors are Matter, Motion, and Force, and the continuity of each. Now it is evident that unless we know precisely what is connoted by these terms, we are unable to understand the formula when expressed. This is the old question which is always reappearing, and it is impossible to tell whether Mr. Spencer thinks it necessary that we should attach any meaning to them or not; but if not, how are we to distinguish between them, so as to know that we are talking about different things? It is not possible to speak about them without attaching some ideas to them. And we can only suppose Matter to refer to the sum-total of the seventy or eighty so-called elements, Motion to their change of relative positions, and Force we do not know to what. Nor does Mr. Spencer appear to be in any more satisfactory position respecting it, for he omits it altogether in the final unificatory formula in which he originally proposed to include it. The difficulty is this: he has already said that Matter is a manifestation of Force, and that Motion is a manifestation of Force; how then can they be three separate factors? Force sometimes seems to be one original factor precedent to the other two, and manifesting itself in them—annihilating its separate existence, if it ever had any, in the two modes of manifestation, so that it loses individuality in the two factors; and yet is put down as one of three co-operating factors. How can it be a third factor in a set of which its own manifestations are the other two? *

Accordingly, when Mr. Spencer asks the question,† "What must be the general character of such a formula?" he replies, "It must be one that specifies the course of the changes undergone by both the Matter and the Motion," leaving the third factor out of account altogether. "The law we seek, therefore," he says, "must be the law of *the continuous redistribution of Matter and Motion*. . . . Philosophy, rightly so called, can come into existence only by solving the problem."

One is surely entitled to ask why all the importance attributed to Force in so many preceding chapters, if all knowledge is to be summed up in terms of Matter and Motion; and why in all the succeeding chapters there is any reference beyond the terms of the formula as so limited to the laws of the redis-

* This difficulty is treated at length in our former criticism "On Mr. Spencer's Formula of Evolution," p. 208.

† "First Principles," p. 276.

tribution of Matter and Motion; and what validity can be attached to the cosmical unificatory explanations in detail when all the work is done in other terms than those of the formula itself? For throughout Mr. Spencer's works there is a constant reference to the harmony of his various explanations with the formulated unification of knowledge because coincident with the laws of Force, which inferred or expressed laws of Force are other than the one particular law expressed in the formula. Thus Force is of great import up to the formulation of the factors; it is then tacitly omitted from the formula without any explanation of the reasons why; and again, when we come to actual work, it is once more quietly resumed as if it were actually included in the formula.

Our problem, therefore, resolves itself into two questions, namely—Is the unification of knowledge to be effected by means of the knowledge of one factor, Force, or by means of the formulation of the relations of two factors, Matter and Motion? And in the ensuing discussion we find ourselves labouring under the great difficulty of having to use language and employ terms of which we disapprove. To use terms appertaining to a particular doctrine in the discussion and criticism of that doctrine is almost an acceptance of it—so much is conceded at the outset, so much is involved in the accuracy or inaccuracy of nomenclature. And first let us consider—

(e.) *The Hypothesis of One Factor.*

The one factor is of course Force. Now Factor is a term of relationship, and implies other factors. Therefore we cannot call one individual existence (if these words have any meaning) a factor at all. The thought we try to form in our minds is that of an activity, simple, homogeneous, unconditioned, and having no relations to any other existence. Any change is one of self-determination. When a man has succeeded in forming this conception, he is capable of writing whole volumes of Philosophy, sprinkled throughout with entities dignified with names having initial capitals; and the ignorant will look up to him with awe. Nothing whatever can be said against him, only that he lives outside the world of actual and practical thought, for none of his thinking is ever applicable to scientific explanations, nor to the conduct of life either in ethics or politics.

From one factor, whether it is called Force, the Absolute, or the Unconditioned, no thinking is ever possible. Yet to one point all thought of the *à priori* kind is forced, and cannot rest till it reaches Unconditioned Being. Mr. Spencer's penultimate is the Homogeneous. He is forced to this by the nature of his argument. If Philosophy is bound to explain all changes, it must go back to a time before changes commenced. If it has to account for all differentiations, it must commence with the Homogeneous. If it has to tell us all about the Conditioned, it must have a background of the Unconditioned. Thus we arrive, as indeed is explained by Mr. Spencer himself, at the Absolute or Unconditioned Being.

We find, indeed, that all philosophies whatever, starting from any point, whether of a subjective nature or of a purely and strictly physical nature, are bound to meet at this focus of thought. All study, whether subjective or objective, is the study of changes and series of changes. The senses are conscious of changes, the volition deals with changes, the intellect perceives changes all around it; the mind wonders at changes, Science tries to understand their connections. We anticipate the future; we endeavour to explain the present by the past. We seek the ultimate cause of all change. In going backwards, as Mr. Spencer correctly points out, we go from the definite, coherent, heterogeneous, to the indefinite, incoherent, homogeneous. We go from the complex to the simple, from greater diversity to greater sameness. In the course of our thought we arrive at a time of least differentiation, and finally to a state of absolute uniformity, where there are no conditions to the ultimate being. From the physical sciences we trace the progressive simplicity and uniformity up to a sphere of units of attraction and repulsion having no differentiation and apparently no cause of any differentiation. Science out of its own materials can assign no beginning of change. Under the philosopher's keenest analysis the specialities of material bodies disappear and resolve themselves into a supposititious force, which as yet is unmanifested in Matter or Motion, and which does not know even Attraction and Resistance. And here he finds himself strangely enough in the company of Hegel and others, the most advanced of the subjective philosophers, who have arrived by another road at the same identical point.

This is the difficulty that presents itself, and is met by various schools in various ways. The Comtists refuse to set out on the speculative journey at all. Mr. Spencer goes nearly to the end, but not quite, and boldly says he has been almost all the way—all the rest is Unknowable; and yet all knowledge is unified by the fact that all its lines converge towards that unknowable centre into which he is unable to penetrate: a statement which is manifestly no explanation. Hegel, again, plunges into the depths of this Homogeneous, this Absolute Being, and from the fact of it producing change out of an apparently unchangeable homogeneity, deduces the principle of Self-Determination. Having established this principle at the beginning, he holds that it has an ever-living right as a factor in the universe, and thus builds up a system which most commends itself to the religious philosophers of the day.

However, the fact remains, that, whether from the religious, the subjective, or the scientific standpoints, all views end in the realisation by the mind of Absolute Being, supreme, unconditioned, and unknowable—whatever afterwards may be made of it by each party.

Mr. Spencer seemingly attacks this problem in his specious argument entitled "The Instability of the Homogeneous." But "the Homogeneous," when pursued to a final analysis, carries us onward by the obliteration of differentiations to a state where all differentiations have disappeared—to a state not merely of uniformity or equal balance of Matter and Motion or of the forces of attraction and resistance, but to a state before even these forces have become differentiated. This impossibility of attaining to a conception of the primordial state and of the grand First Cause of all changes would seem to exclude the possibility of the unification of knowledge. Mr. Spencer's theory of the Instability of the Homogeneous is equivalent to Hegel's Self-Determination. If the history of the cosmos is a single process and the initial cause is due to this or any similar principle, then in the absence of a knowledge of the Unconditioned the nature of the process must for ever remain beyond the grasp of human reason.

Let us, however, say that—

"All Existences and their interrelations
are [corollaries of]
the Instability of the Homogeneous,"

and examine it as a supraphysical method.

Now "the Homogeneous" is merely an adjective turned into a noun. We have to suppose something of which homogeneousness is predicated. We are obliged, in fact, to represent in our minds units of some sort—either units of resistance and attraction or units of some other sort. The figure of equilibrium according to Mr. Spencer is the sphere. If forces are the main element in the ultimate constitution of the universe, then homogeneous units of force must be co-existent in a state of equilibrium—that is to say, in a sphere. Now the proposition is that the homogeneous is unstable, and it is therefore equivalent to the proposition that a state of equilibrium is unstable. It means that the homogeneous of itself changes to something else, and that of two sides of a balance, by and by, one will outweigh the other. This of course is contradictory to the theory of the Persistence of Force, but agrees with the theory of Self-Determination held by some philosophers. But it is evident that although it may be a principle in nature that everything changes into something else, still this principle does not show us the interdependence of sequences, and knowledge could not be unified thereby.

The next proposition we have to consider under this heading is that

"All Existences and their interrelations
are [corollaries of]
the Persistence of Force."

It does not seem that if we are unable to get corollaries from Force itself or from Absolute Being, that we shall be able to get such corollaries from its attribute of Persistence as shall explain its varied manifestations; only that, given these as its modes, there will be corollaries as to some of the general conditions of the relations of these modes.

Thus if Matter, taken as Resistance and Extension, is a mode of Force, and Force is Persistent, and Motion is also a mode of Force, it is not a corollary that each is indestructible and untransformable into the other, for such might be, and the sum or persistence of Force would be unchanged.

But, indeed, there is no warrant in science for the supposition of Force at all, only for Forces.

Professor Stewart does not say that (A) + (B) + (C) + (D) + (E) + (F) + (G) + (H) = Force, or Energy; he does not let them escape from the left-hand side of the equation at all. All he states is that (A), &c., + to (H) = a constant quantity. As a name for this constant quantity, as a term expressive of the sum-total of the individuals of a class, the word Energy may be good; but as representative of an entity it is merely an objectivised abstraction of the illegitimate order.

Apparently (A) never decreases without some one or more of the others in the series increasing; and if all but one were made to disappear, then the constant quantity would be in that one kind of energy; it would not disappear into the other side of the equation. We would have (A) = a constant quantity, say Attraction. This, coupled with the ultimate result of the theory of the indestructibility of matter, viz., Resistance or Repulsion, would give us two ultimate factors.

It may be admitted at once that such a hypothesis, if we had more knowledge, might explain all the physical relations of things. We may grant that from these factors through Polarity, Shape, and Size all the constituents and mutual relations of the seventy or eighty so-called elements might be explained, and a theory of the universe and of its distribution might be made. But, as shown in our previous criticism, it would be open to some grave objections, and would be deficient in explanations of the greatest interest and importance to us. The grave objections would be that we could never picture to our minds any state from which to make a historical start. If we supposed a heterogeneous beginning, our philosophy would be imperfect; if we supposed a state of homogeneity, we could find no starting-point at all; and if we pictured to ourselves a state of great simplicity under the rule of equilibration, we could not imagine anything but a very speedy reversion to a state of homogeneity or complete equilibration. We can only reasonably deduce the complex organised universe from a complex unorganised one. We can understand organisation out of a chaos of complex material, but not the formation of complex material out of the Homogeneous.

The great deficiencies of such an explanation would be, that while possibly it might explain the physical interrelations, it has not within it the possibility of any explanations of feeling or consciousness, and, we make bold to say, of any of the interrelations of matter constituting organised living beings, or of their reproduction and continuance as races of creatures.

The question next arises how far Mr. Spencer's Persistence of Force is equivalent to Professor Balfour Stewart's Conservation of Energy. No doubt Mr. Spencer means more by it than is contained in Professor Stewart's list of Energies, and more than the list of his Forces added, and he may think that we are treating him unjustly in regarding his theory as identical with Professor Stewart's. Let us consider this. We are bound, we think, in the first place, to take Professor Stewart's doctrine of the Conservation of Energy as complete in itself. All the items of the equation are transformable one into the other, and the increment of one implies the decrease of some other. It is not asserted that any other mode of energy beyond the limits of the list can be transformed into any one of them, or *vice versa;* but, on the contrary, the inference is that such a transference is an impossibility, for it would vary the total quantity of energy. The essential point of the theory is that this quantity is invariable—that the circle of interchange of modes is complete in itself, and is unassailable from any quarter.

If, therefore, Mr. Spencer means by the Persistence of Force something more than Professor Stewart means by the Conservation of Energy, plus the Conservation of the Attractive Forces, and plus the Indestructibility of Matter, which are also complete in themselves and unassailable, he must mean that there is a remainder of Force excluded from these classes, and not interchangeable with them, which also is of a constant character. Now we do not know the above modes of Force or Power *in themselves*, but we have a scientific knowledge of them, which is more to the purpose. What do we know of this implied extra Force? We grant at once we do not know it *in itself:* do we know it scientifically, as we know the other modes of Force? do we know its manifestations, and the laws thereof? If we do, let Mr. Spencer express them, and show their relations amongst themselves and their relations to the other modes of Force or Power. If it can be done, we are so much nearer the unification of knowledge. If it has not been done, we so far fail of it. If it is impossible, that unification is impossible too.

The uniformity or parallelism of the characteristics of all changes in the physical world and in the regions of feeling and social action are indeed very suggestive of an identical Power behind them all. This parallelism affords the poet and the orator abundant stores of illustration in their poems and discourses, and has also its philosophic significance. Mr. Spencer's volumes are rich in instances of these apparently overruling Laws of Force, and he very often appeals to them as forming that bond of universal relationship which is to unify knowledge. We acknowledge the full force of the suggestion, but cannot go beyond its bare recognition, and are unable to give it that precise statement or formulation which alone can impress upon it any scientific value. Grateful acknowledgment is due to Mr. Spencer for bringing out so strongly these marked identities of process between the physical world and the facts of biology, including the action of the emotions, of the intellect, and of bodies of men in societies; but granting all this, there is still wanting a definite formulation, and there is still wanting the knowledge of this extra factor and its laws of interrelation with those other factors which we can formulate with scientific precision.

It can, however, be maintained from Mr. Spencer's writings that his Persistence of Force is *not* more than Professor Stewart's Conservation of Energy plus the Conservation of the Attractive Forces and the Indestructibility of Matter. Inorganic Evolution is clearly contained within the assigned limits, and it will be seen from a study of Organic Evolution as explained by Mr. Spencer—so far as regards its first stages in the Appendix to vol. i. of the "Biology," examined in our previous criticism, and so far as regards its more advanced stages in the passages treated of in Chapter V. of the present work—that the supposed explanation never trespasses beyond these limits. Morphological and physiological developments are all shown to be the results of the physical properties of certain elementary substances in equilibration with a physical environment, all governed by purely physical laws. In addition to this we must also bear in mind that Mr. Spencer expressly excludes Feeling from amongst the factors of Biology.*

The conclusion is, that "One Factor" is a contradiction of terms, since the term "Factor" implies other factors in inter-relation; that from the adjective Persistence no corollaries are deducible; that the constancy of quantity amongst modes does not afford any knowledge of their special relations; that to keep any meaning in our studies we have to confine ourselves to concrete experiences or legitimate generalisations therefrom; that any supraphysical theory is only of value so far as it is commensurate with the concrete; and that outside of concrete manifestations the terms Force and Energy have no meaning whatsoever.

(*f.*) *The Hypothesis of the Two Factors.*

The two factors are the two manifestations of Force, namely, Matter and Motion. These are the two factors that ultimately find a place in the formula of evolution and dissolution. The conclusion indicated in Chapter XI. of "First Principles" receives an elaborate treatment in the following six chapters, until the goal of Philosophy is arrived at in the formula referred to. The value of this formula received a varied examination in our former criticism; nevertheless, it will be useful to summarise our views of it here.

In the first place, we desire to know what meaning is to be attached to the terms. We have already seen that if the term Matter is to be taken as indicative of the *nexus* or *substratum* binding together the various bundles of properties constituting

* Principles of Biology, vol. i. chap. 8.

the chemical element, it is a term without any logical value whatever in any formula or process of reasoning. We have also seen that, as an objectivised abstraction, it has no actual existence, and that the only legitimate use of the term is its employment in a proposition which makes a predication common to all the chemical elements. These propositions are very limited in number, and comprise assertions respecting the properties of resistance, extension, attraction, and their spatial derivatives, or their derivatives of motion and time. In our former work we entered into a detailed examination of the possible meanings of this hypothesis, but Mr. Spencer repudiates all of them as not being the expression of his views. We found, of course, that these factors did not afford explanations of the facts of feeling and mind, nor, indeed, of the morphological and physiological histories of animal and vegetable life, even if considered apart from the factor of feeling. A further criticism of the methods by which Mr. Spencer works out these processes will be given in Chapter V. of this work, and will exhibit still more clearly, we think, the failure of Mr. Spencer's reasoning. In this critical portion of his system of Philosophy the formula of evolution and dissolution plays no part whatever in the logical synthesis. The factors from which, as results or consequents, the morphological and physiological histories have to be deduced are not objectivised abstractions called Matter and Motion, but a certain small number of chemical elements, together with certain laws of polarity and equilibration, and certain laws of Force or Motion. These facts are so imperfectly realised in the mind, and their relations are so loosely referred to, that they never receive proper scientific statement. This, of course, renders all the more easy the apparent accomplishment of the process; but immediately strict formulation and definiteness of meaning are insisted upon, its deficiencies become apparent. However, what we wish to point out here is that the formula of evolution and dissolution does *not* represent the working power of the universe, even according to Mr. Spencer's treatment, but that the actual tools by which he endeavour to accomplish his great constructive work are the known elements and their physical laws.

The formula referred to is nothing more than a partial description of the most general characteristics of physical changes, and even in this very limited and comparatively uninteresting portion of the cosmos it does not claim to rank as an explanation showing the sequences from original factors.

This formula is so well known that we need not repeat it. The proposition founded on it would be—

"All Existences and their interrelations
are [corollaries of]
the Formula of Evolution."

We now have to free the term *matter* from the rigid limits we assigned to it in the study of the Physical Methods as merely a name for the sum-total of the whole of the substances known to us as the so-called elements. As a supraphysical term, we have to consider it as relating to units having resistance and therefore extension. We are free to vary our hypothesis by supposing other attributes, such as attraction; and indeed it is difficult to see how we can proceed without some such addition. We may even suppose mutual repulsion. We must not, however, introduce special polarities, for that would increase the number of our factors and spoil our proposition. We are at liberty, however, to suppose varieties of size and shape.

Our proposition includes the term Motion. It is founded upon the joint doctrines of the Indestructibility of Matter and the Continuity of Motion. The latter proposition we shall have occasion to controvert, but for the present purpose provisionally accept. The supposition is that motion never ceases, but is ever continuous; ceasing in one connection, it is only transferred to some visible or invisible motion of other aggregates of matter. What we have to do now is to consider the proposition that Matter and Motion being both indestructible, their interchanges are concomitant, and all the changes of the universe are correctly described, if not explained, by the assertion of a concomitance between the concentration of matter and the transference of motion; as well as between the reception of motion and the separation of matter.

As before pointed out, the causes of these concentrations and separations of matter, which include all the chemical as well as the mechanical combinations and decompositions in nature, are not touched by the hypothesis. Taking the causes for granted, then, the most general characteristic of the phenomena —so says our hypothesis—is the concomitance of the separation of matter with the increase of motion and of the concentration of matter with the decrease of motion. Surely this is not saying very much, and falls conspicuously short of an explanation.

We have, therefore, to throw our proposition into the amended form—

"All Existences and their interrelations
are [corollaries of]
the Concomitance of the

$$\left.\begin{array}{l}\text{integration}\\ \text{dissipation}\end{array}\right\}\text{ of Matter with the }\left\{\begin{array}{l}\text{dissipation}\\ \text{integration}\end{array}\right\}\text{ of Motion.''}$$

Let us see how it is applicable to the construction of the universe out of the raw material postulated.

The furthest point to which Mr. Spencer carries us back is the existence of a nebula or of nebulæ in a medium of ether. These nebulæ have or acquire a rotary movement; also, presumably, they are composed of the seventy or eighty so-called elements in a gaseous condition; but whether or not, whatever the constituents of the nebulæ may be, the cause of differentiation is unassigned. This, as already alleged, constitutes Mr. Spencer's first failure in explanation, and he is under the difficulty either of accepting the elements as we know them and conceive them (which leaves them unexplained), or of carrying us backwards towards universal homogeneity and absolute being, from which they are unexplainable. Now, even if we accept the condition of things thus described, and apply to it the Formula of Evolution, it is impossible to work out from these data the actually existent universe. Evolution is an integration or concentration of matter and a concomitant dissipation of motion. It is necessary that the attention should be fixed upon this concomitance. We cannot have the concentration of matter without the dissipation of motion, and conversely we cannot have the reception of motion without the dissipation of matter. The two things go together. There is always a double process. It is impossible in the nature of things that it can be otherwise. Whenever there is evolution there is dissolution; whenever there is a process of dissolution there is a concomitant process of evolution. There is a measurably equal concentration of matter for all dissolution or separation of matter, and this means exactly the same thing as the concomitant increase and decrease of motion.

We must also remember that the quantity of Matter is always the same and the quantity of Motion is always the same. Yet, notwithstanding the fact that in the cosmical system matter can part with motion to other matter, it cannot part with it wholly so as to remain matter by itself. Mr. Spencer nowhere tells us why this process should not be carried to such an extremity. We must also bear in mind that motion cannot exist by itself, but is always the motion of matter. These considerations all tend to strengthen the theory of concomitance, namely, that matter and motion being constant quantities and always combined, whenever there is a concentration of one there must be a dissipation of the other. We must also bear in mind that the state of concentration means one of greater density of matter and less motion, and that the state of dissipation means one of greater tenuity of matter and increase of motion.

Resuming our study, then, of the original state of scattered nebulæ, we have certain aggregates of relatively concentrated matter with comparatively little motion, surrounded by ether, which is presumably matter in a state of great tenuity, and according to the hypothesis now under consideration, in a state of relatively greater motion. What happens? According to Mr. Spencer, the nebulæ part with their motion and undergo the process of evolution or concentration, while the surrounding ether absorbs their motion and undergoes a process of dissipation. But, according to our view of the matter from the postulates given, the ether, having an excess of motion over the nebulæ, would impart some of its motion to them, and gradually dissolve them till the whole of the nebulæ were amalgamated with ether into one homogeneous mass. On what principle can Mr. Spencer justify the supposition that the nebulæ could part with their motion to matter having already motion in much greater excess?

Motion does not pass away into space and exist by itself apart from matter—it is only transferred to other matter. According to this theory, it is a constant quantity, and cannot go out of existence. In the case given, what becomes of it? Do we not here find an additional failure of Mr. Spencer's physical explanation?

A difficulty here presents itself with which Mr. Spencer does not deal. Either we must conceive of the physical universe as limited or as unlimited. If we conceive of it as unlimited, then universalistic science is impossible. We are, therefore, bound to think of it as limited; and if we are bound to think of it as limited, we are bound to think of motion as quantitatively constant and as contained within definite confines. The effect of motion is to separate units of matter, and the law of its transference can only be that of the *equalisation of motion*, and consequently equal distribution of matter, tending ever to a state of equilibrium or homogeneity; that is to say, an equal distribution of matter and motion—a state, in fact, of perfect equilibrium. From this it would appear that equilibration is the ruling principle under the conduct of which the Formula of Evolution works.

How, then, if all things arose out of a state of homogeneity, could there ever have been any evolution or concentration of the matter of some part of it, with a concomitant dissipation of another part of it? It would be inconsistent with the ruling principle of evolution, namely, equilibration. And even if slightly disturbed by some external power, would it not immediately revert in the most direct manner to its equilibrium?

If the ruling tendency is equilibration considered as the equal distribution of matter and motion, and if all changes have to be accounted for as changes from homogeneity, then since homogeneity is an equal distribution of matter and motion, out of it no changes could ever arise.

It would really appear that Mr. Spencer is so intent upon evolution that he forgets the concomitance of the other half of his formula, and having a nebula in his hands, he unceremoniously throws the superfluous motion overboard into the realms of space, without ever looking to see what becomes of it.

Equilibration is a tendency to the homogeneous, and since equilibration rules evolution and dissolution, it tends to defeat evolution, and it is not clear how any evolution can take place. Therefore, simple mechanical equilibration is not the ruling principle of the universe, nor the ultimate cause of its changes, but there is something else which governs the mutual processes of evolution and dissolution. What that something else is nobody can tell, but evidently the something which rules evolution and dissolution must be the law by which all knowledge is unified, for all knowledge is knowledge of evolutions and dissolutions, and until it is discovered there can be no such unification.

The most simple instances of evolution and dissolution are those which occur under the withdrawal or application of that kind of motion called heat. The application of heat to ice causes a change into liquid water; the further application of heat produces the state of water called steam. The withdrawal of heat causes a series of reverse changes. And in Mr. Spencer's imperfect demonstration this seems to be the principal if not the only view taken of the changes recognised by the Formula of Evolution. Molecular motion is withdrawn by some unknown cause from the nebula, and it concentrates. As before stated, it is not clear whether this nebula is homogeneous matter or not. If it is, it is not shown why concentration does not take place uniformly instead of into diversified forms. The withdrawal of heat, for instance, affects different substances differently. At the same temperature we have different substances in all the different states of solid, liquid, and aëriform. The air, the solids, and the liquids in a room are all about the same temperature. These different states are not examples of different amounts of heat, but of the properties of bodies which defy the uniformity of the concomitance of the concentration of matter with the dissipation of motion—showing again that there must be some law overriding that of the concomitance of the two which is Mr. Spencer's Formula or law of Evolution. According to the formula, the more dense an object the less motion, and the greater tenuity the greater motion. According to the degree cf density the degree of molecular motion.

In Mr. Spencer's chapter on "Dissolution" occurs a curious forgetfulness of the conditions of the formula of Evolution and Dissolution and the course of the previous argument; for he says, § 183 :—

"Apparently the universally co-existent forces of attraction and repulsion, which, as we have seen, necessitate rhythm in all minor changes throughout the Universe, also necessitate rhythm in the totality of its changes—produce now an immeasurable period during which the attractive forces predominating, cause universal concentration, and then an immeasurable period during which the repulsive forces predominating, cause universal diffusion—alternate eras of Evolution and Dissolution."

Here we have the forces of attraction and repulsion set down as causing alternation instead of concomitance. In the place of a concomitance of evolution and dissolution, which is the essence of the formula of Evolution and Dissolution, we have alternate eras of each. Surely this is a plain contradiction of theory.

Another curious inconsistency in the working out of the theory is the doctrine of "locked-up" motion. Nitrogenous compounds specially possess this property of being able to "lock up" motion—gunpowder, gun-cotton, nitro-glycerine, some of the compounds of organic matter, all possess it. It is one of the properties of organic matter which is essential to the higher evolutionary stages; without it, biological development could not take place. Yet it is contradictory to the Formula of Evolution, which is to the effect that the more motion the less integration, and to the theory of the Continuity of Motion, which proclaims that motion is always going on and never stops. So that the Formula and its sustaining doctrine fail us just in the most interesting and important of our studies.

In the argument of this sub-section we have been obliged to attach definite notions to the terms with which we have to deal, namely, Matter and Motion; and we have had to take them, if not as realised abstractions, still as near to that form as possible. This means that we have de-specialised our notions as far as was in our power; nevertheless, all the value or meaning in the whole of the argument lies in whatever remains of concrete connotation. Since Mr. Spencer would repudiate these concrete meanings as far as he could, we cannot suppose that it is in this aspect that he would estimate their value. Yet if we take away their concrete contents there is nothing left to give them any meaning, and therefore, in every respect, we recognise the inutility of this method.

§ 10. *The Supraphysical Methods of the Unification of Knowledge, and Mr. Spencer's Use of them.*

Nevertheless it is to this class of method that Mr. Spencer really looks for the unification of knowledge.

For instance, he regards matter as something more than a mystical and incomprehensible entity, as more than a mere abstract term, as more than a subjective phenomenon, as different from the simple sum-total of the so-called elements. And the same remarks may be made of other terms which he uses, such as Force, Forces, Motion, Attraction, Resistance, Special Polarity, Equilibration, Integration, Dissipation, &c.

The whole aim of the book on "The Knowable" in the "First Principles" is to establish a science of the sciences—a science which is not a mere mysticism or subjective speculation, and which yet goes beyond the limits of the narrow concrete sciences, even though, being founded on them by a process of still higher generalisation, its terms and propositions are not beyond the intelligent comprehension of the human mind. It is true, indeed, that Mr. Spencer denies all this, as will come under our notice in the next section; but we do maintain that such is the intent and general purport of this part of his works, and the impression produced by them upon the mind of the student. We justify our statement by the argument that by such a science of the sciences alone and by such methods alone can physical science be unified, and we are taught to look forward to it from the outset of Mr. Spencer's works. This view of Mr. Spencer's attempt is borne out by a perusal of his chapters on the Indestructibility of Matter, the Continuity of Motion, and the Persistence of Force, in the book on "The Knowable." These terms are thereafter generalised, including, yet being something higher and wider than, the so-called elements and their relations, and are so used in the enunciation of supra-physical truths, such as "The Persistence of Relations among Forces," "The Transformation and Equivalence of Forces," "The Direction of Motion," "The Rhythm of Motion," "The Formula of Evolution," "Segregation," "Equilibration," &c.

It is the duty of the student to see whether the attempt so made by Mr. Spencer is carried out carefully or not, to the exclusion of metaphysical abstractions, which have no meaning and represent no actualities of the processes of the cosmos; whether the result is or is not vitiated by the introduction of the mystical; whether the subjective is properly eliminated; whether the general theory is justified either as a rigid induction from facts or as a deduction corresponding with facts; whether the unification only to be accomplished by one or other of these methods is merely simulated by the applicability of identical descriptions to various classes of processes; whether, in fact, the science of the sciences so attempted is kept free from mixture with all other methods of thought and from obscurities of reasoning, and moreover is made not only clear and intelligible, as all scientific statements should be, but also is shown to be sufficient to account for all the interrelations of existences.

§ 11. *The Method of Cumulative Factors.*

We do not say that Mr. Spencer anywhere teaches the theory of an unification of science by means of cumulative factors, but in several places he speaks of "additional factors" coming in which assist the progress of evolution, and we feel justified in considering the subject specially, in case of any student being misled by the suggestion of such a method.

It is obvious that if we undertake to explain any complicated state of existence as the resultant of the relations of certain original factors, the explanation, if effected, will be held to be complete in itself. If it be a chemical explanation, the results will all be shown as due to the relations of certain of the chemical elements. If it be an arithmetical calculation, the result is involved in the statement of the problem under the laws of the relations of arithmetical combinations. Again, all the intermediate stages, from the commencement to the result, are equally due to the relations of the original factors. We should not say of them, whatever phase they might present, that they constituted "additional factors." Yet this is what Mr. Spencer does in the exposition of his scheme. Each stage of complexity becomes an *additional factor* in the progress of Evolution. Now it can easily be understood that advancement in complexity, when once established, helps forward the general progress of the homogeneous to the heterogeneous, by establishing additional causes of heterogeneity in varied modes of relationship with the new conditions of the environment. But it is misleading to say that any new combination being the direct result of original factors constitutes a new factor. It is an incident in the general process, but nothing new is added so far as the enumeration of the factors of the general process is concerned.

Therefore we cannot suppose that Mr. Spencer seriously advances the general theory of the evolution of the cosmos by means of cumulative factors. At the same time, the exposition of his theory here and there by means of this mode of expression is apt to mislead the student, and should be duly noted in advance. For if the reader of Mr. Spencer's works became impressed with the notion that new or additional factors came into the cosmical process now and again, it is clear that he would not properly understand Mr. Spencer's design of reading its history as one process from first to last, the understanding of which is the unification of knowledge.

It is easy to trace the steps by which he would be misled. For instance, he would suppose that highly complex molecules formed by the natural relationships of elementary atoms should be regarded as additional factors in the relations of things. And again, when these complex molecules by ordinary physical laws or by chance contiguity formed themselves into small masses, he might think that these masses, highly complex, changeable, modifiable, sensitive, formed fresh factors in the cosmical series. And he might then make the mistake of regarding "sensitiveness" as the new factor, and not only so, but he might even suppose that sensitiveness, being a noun, was the name of some entity actually existent in the universe, and a factor in its processes, instead of regarding it as a name for the mechanical instability of certain highly complex compounds of the chemical elements. And if he did so, it is obvious he could make no greater mistake in the pursuit of a strictly logical and deductive procedure. But if he did make such an error, the step would be easy to the supposition of feeling or consciousness, and by very easy gradations he could arrive at organised consciousness. The new factor expressed by the term "sensitiveness," although expressive of delicate mechanical relations, easily lends itself to subjective applications, and through the verbal tie of association, a new factor of Feeling might make its appearance in the cosmical sequences. And although Mr. Spencer may be careful to explain that Feeling is not a factor in biological actions and development, yet the student finds great difficulty in bearing this in mind.

In one sense, each new combination is a new individual factor in its environment, as each man or woman taking his or her place in the world is a new factor in society; and in any account of a partial history, the advent of such a new individual may be regarded as the addition of a new factor. But in a cosmical explanation there can be no new factors; all has to be accounted for as from resultant original factors—as the product of the original constituents; and it is misleading to speak of additional factors unless it is well understood that it is a mere mode of convenience of expression. At the same time, it conveys a dangerous suggestion in a system of which the essential thought is the logical explanation of all things as a single process due to the relations of a small number of original factors.

Again, the danger is enhanced if the student, believing in the possibility of new or additional factors appearing in the progress of evolution, believes also in similar accretions to the physical laws. For instance, after mastering the meaning of the term "equilibration" in dynamic, he might admit a new factor in that class of physical changes called biological in Mr. Spencer's special law of biological equilibration, by which animals and plants endeavour to preserve their existence by the adaptation of inner forces to meet destructive forces in the present or prospective environment. His mind having been weakened and his logical faculty rendered less acute by previous familiarity with the admission of additional factors, he might be ready to admit new and additional laws of dynamics, and in this complexity of confusion he might lose the logical connection with his original conception of a single and continuous process of the cosmos resulting from certain understood primordial agencies.

This section is inserted not on the supposition that Mr. Spencer anywhere teaches the theory of cumulative factors except as incidents in the consequents of original general factors, but by way of guarding the student from mistakes he might make in the interpretation of the author's language.

§ 12. *The Symbolic Method for the Unification of Knowledge.*

We think that if charged with any of the foregoing methods of the unification of knowledge, Mr. Spencer would deny the imputation, and say that his critic misunderstood him. It would appear to be the peculiarity of Mr. Spencer's system that his unification of knowledge is effected by means of the discernment of the relation of unknowable entities, which entities cannot be represented in thought, and have to be symbolised by certain signs. It seems that unknowable powers, although manifested as such and such, cannot be regarded as known, even although their relationship to one another can be known. It appears that this knowledge of relationship between them is in one sense sufficient for the unification of knowledge, yet in another sense it is insufficient, in that the entities of which we know the relationship are unknowable. It appears that we are not allowed to unify knowledge within the bounds of these knowable relationships, but must introduce symbols standing for the Unknowable Powers. We are not allowed to use symbols standing for known factors, but are obliged to use symbols standing for unknowable entities. These entities can only be represented by symbols, and when we say that Matter, Motion, and Force are the entities in question, and are unknowable in themselves, but yet are fully known in their interrelationships, insomuch that knowledge can be unified by means of a proposition or formula expressive of their relationship, the knowledge of what they are "in themselves" would seem not to be necessary at all, and any reference to them by means of symbols to be quite out of place. We are fully satisfied if we can unify knowledge by means of the proposition specifying the mutual relationship. But according to Mr. Spencer, Matter, Motion, and Force are terms that are not allowed to stand for known factors, but must stand for the unknowable, yet differentiated factors, and mean no more than x, y, and z. In another place this subject is fully considered. Symbols as a rule stand for something that is known, and are supposed to have no value unless they stand for something. But according to Mr. Spencer's peculiar and unique position, they stand for something or somethings that we do not know, but which are yet of such a nature that when the relationship between them is expressed, the proposition in which they occur has a meaning. Thus, for instance, if we say that the integration of x is concomitant with the dissipation of y, the proposition has a meaning, although we do not know what x and y stand for. Evidently the meaning is to be gathered from the relationship of x and y as expressed in the terms integration and dissipation. Now the only meaning we can attach to integration is "mutual approach," and the only meaning we can attach to dissipation is the transference of the dispartive power. These seem to imply units which have extension, for how otherwise can we attach any meaning to "approach together"? and since dissipation of x means retrocession, we also get our meaning only by supposing units having extension being further separated from each other. Therefore we are forced by the necessities of the case to make x stand for the units of extension and y stand for the separative power which is transferred. We cannot, in a general description of changes, use the terms integration and dissipation without supposing an extended something which integrates or dissipates. To say, then, that x and y have no definite meaning is not correct. If they symbolise more than the mere extension and dissipation, whatever more they symbolise is of no value or account whatsoever. What they do symbolise of the knowable is all that we have to do with, and is all that is expressed in a proposition in which they occur.

"The inmost nature or essence of a Thing is apt to be regarded as something unknown, which, if we knew it, would explain and account for all the phenomena which the thing exhibits to us. But this unknown something is a supposition without evidence. We have no ground for supposing that there is anything which, if known to us, would afford to our intellect this satisfaction; would sum up, as it were, the knowable attributes of the object in a single sentence. Moreover, if there were such a central property, it would not answer to the idea of an 'inmost nature;' for if knowable by any intelligence, it must, like other properties, be relative to the intelligence which knows it, that is, it must consist in impressing that intelligence in some specific way; for this is the only idea we have of knowing; the only sense in which the verb 'to know' means anything.

"It would, no doubt, be absurd to assume that our words exhaust the possibilities of Being. There may be innumerable modes of it which are inaccessible to our faculties, and which consequently we are unable to name. But we ought not to speak of these modes of Being by any of the names we possess. These are all inexplicable, because they all stand for known modes of Being. We might invent new names for the unknown modes; but the new names would have no more meaning than the x, y, z of Algebra."*

* Mill on Hamilton, p. 14.

According to this, Mr. Spencer is unwise in using the terms Matter, Motion, and Force to represent the unknowable yet differentiated Powers, because they stand for known modes of Being, and if he wishes words to stand for the unknown modes he ought to use the symbols x, y, and z, and then they have no more meaning than when used in Algebra as blank forms of equations, of no value until a meaning is put into them. But Mr. Spencer could not afford to translate the term Matter wherever he uses it into the sign x, Motion into y, and Force into z. Let the student try it, and he will find in every case that he either means nothing at all, or that he has concrete implications, as in the case considered above. Mr. Mill considers the resort to x, y, and z a resort to blankness, the *ne plus ultra* of speculative absurdity. Mr. Spencer considers it the highest attainment of philosophical research.

Mr. Spencer's repudiation of special and limited meanings for his principal terms when hard pressed by criticism is a mere evasion. It is a means by which, when any definite meaning attached to his terms is found to embarrass the unification of knowledge in any given proposition, the proposition may be held to be good on the understanding that the principal terms mean something, but we do not know what. In this way they may take, one after the other, all the definite meanings that can be assigned to them, plus something else which shall make up for their deficiencies; and the unification of knowledge is then effected by terms which include every meaning that can be placed upon them.

The final unification of knowledge is effected through an amalgamation of all the methods by means of symbols which will receive any and all meanings. We beg to submit that this is not the method of unification which Science has a right to demand. Science requires that the ultimate truth of induction should be clearly and intelligibly expressed. Logic requires that the ultimate truth from which all others are deducible should be an intelligible proposition having definite terms. What Mr. Spencer has given us is changeful, incoherent, unintelligible as a whole, and in any of its intelligible forms is insufficiently founded on induction, and incapable deductively of reproducing the universe and its history.

§ 13. *Simulations of Unification.*

This review of Mr. Spencer's methods for the unification of knowledge would not be complete without a notice of several simulations of unification which present themselves throughout his works, sometimes in most important conjunctures, and which give the appearance of unity of process without the reality and without the logical continuity required. These methods and the effect upon the mind do not depend upon the formulation of an all-embracing proposition at all, but upon the common applicability of descriptive terms. A certain parallelism between different processes is discerned, and without attempting to identify these processes in their relations of historical dependence, or to explain them as outcomes of some common original factors, it is deemed sufficient to generalise their common characteristics, so that by composing a description which is applicable to them in common, a false and delusive unification of knowledge is thereby effected. If we have to describe the history of a complex physical world, we have to describe a history of change in which the raw material, by a process (let us say) of cooling, was enabled gradually to enter into relations of mutual combination. Again, if we have to describe the history of organisms, we have to recount a history of gradual differentiation and insensible development. We find that the general characteristics of these two histories is an advance by insensible gradations from a state of incoherent, indefinite, simple homogeneity to a state of coherent, definite, complex heterogeneity. A study of mental history exhibits the same characteristics, and this identity of the characteristics of these histories gives an outside semblance of unity that is made to pass for the unity itself. But so long as the whole of the three processes are not shown to be the results of the same comprehendable original factors, this unity is in reality not effected.

The persistent manner in which this similarity of characteristic is presented to us throughout Mr. Spencer's works, and his continual assertion of the harmony or conformability of various processes to these characteristics of "evolution in general," produces in the mind the desired effect. Moreover, it produces the effect of throwing the attention on the Formula of Evolution in which these general characteristics are formally expressed, thus raising the conviction of the effectiveness of that formula in the unification of knowledge. Yet, when examined, this constant reference to the Formula of Evolution will be found to be of a very superficial character. For it is not the application of the formula in its entirety to any case under consideration; it is only the taking out of a part of the formula and seeing that it applies. The formula was expressly stated in advance to be the formulation of the relations of *three* original factors, but one of them has been omitted altogether. The two factors left were Matter and Motion, and the essence of the formula was the concomitance of the integration of the one with the dissipation of the other. But in the instances referred to, this concomitant process is utterly ignored, as are also the two factors themselves; and the applicability of the formula is held to be good, and the unification of knowledge is held to be valid, if it be found merely that the histories of all combinations present an advance from a state of incoherent indefinite homogeneity to a state of coherent definite heterogeneity. If the unification of knowledge is effected by means of the Formula of Evolution, it is because that Formula is taken to pieces, and part of it applied here and part there. It is not universally applied in its integrity.

The second simulation of unification is effected by the frequent use of an important word which occurs in the Formula of Evolution,—a word which in like manner is dissociated from the factors the law of the interrelation of which the formula is supposed to express. This word is then set up in business for itself and is very effective. It is "Integration." If the history of all processes includes a progress from a state of incoherent, indefinite homogeneity to a state of coherent, definite heterogeneity, it is a history of the mutual combinations of various original factors, whether these factors be ultimate units of attraction and resistance, or atoms of the so-called elements, or of physiological units, or feelings, or sounds, or men, or what not. It is a history of combinations of units, of combinations of compounds, of combinations of aggregates, of combinations of complex aggregates. It is evident that whether these are interdependent or not, whether they are all results of two or of many original factors, or whether there be new factors and accessions of forces in the course of their histories, the history of the whole of them is still one of combinations and continuous combinations; or let us call the process one of continuous "integration." Then integration is expressive of the principal characteristic of this history, and any theory of combination or series of combinations to which the term "integration" can be applied is found to conform to "evolution in general;" for is it not one of the principal terms in the Formula of Evolution? Yet when we come to examine its place in the formula, we find that its application is confined to the integration of matter, and is made strictly concomitant, as the very essence of the formula, with the dissipation of motion.

But how does Mr. Spencer apply it in the course of his works? Language is integrated, feelings are integrated, experiences are integrated, the whole intellectual and moral history of man in society is a series of integrations. The question is, are they integrations of Matter accompanied by dissipations of Motion? There is no pretence that they are. The Formula of Evolution, then, is straightway abandoned, and the unification of knowledge is simulated by the word "integration," which expresses a general characteristic of all evolutions, without disclosing its factors, nor the nature of their interrelations by which the steps and interdependence of the actual events in their history could be understood.

In our previous criticism we referred to several instances, and we now refer the student to the "Psychology," Part iii. chap. x., for further illustrations of this deceptive method of treatment. Here Mr. Spencer speaks of the integrations of correspondences of the inner organism with complex circumstances of the environment, and through this progressive integration suggests the unity of intellectual evolution with evolution in general. Yet there is no explanation of integration of correspondences, nor how it is comprised within the Formula of Evolution, which treats of the integration of Matter and the concomitant dissipation of Motion. This is a simulation of unity, but not the unity that is only to be effected by means of a general truth from which all the changes of the universe are deducible.

Again, in considering "the substance of mind," Mr. Spencer says *—

"It is possible, then—may we not even say probable?—that something of the same order as that which we call a nervous shock is *the ultimate unit of consciousness;* and that all the unlikenesses among our feelings *result from* unlike modes of *integration* of this ultimate unit."

Thus the word "integration," being capable of expressing combinations and associations in all the sciences, is able to give the appearance of unificatory efficiency to any formula in which it is used when the particular limitations of it and the specified conditions attached to it are ignored.

And again †—

"Possible answers are at once supplied if we assume that diverse feelings are produced by diverse modes, and degrees, and complexities, of integration of the alleged ultimate unit of consciousness."

It cannot be pretended that the integration here referred to is identical with the integration of the Formula of Evolution.

14. *General Summary.*

As before observed, the course of this criticism has not been the examination of one distinct theory for the unification of knowledge clearly stated by Mr. Spencer, nor even of several conflicting methods set out in definite language. It has been the examination of several sets of propositions, each of which might be justifiably represented as *the* one which Mr. Spencer advances, in all the various meanings of which they are capable. Each separate proposition or examination, under the heads of Mystical, Metaphysical, Physical, Supraphysical, or Symbolical, has proved inadequate either on the ground of indefiniteness of meaning or on the ground of inadequacy of effect, in affording us the requisite means of unifying knowledge. And our argu-

* Principles of Psychology, vol. i. p. 151. † Ibid., p 154.

ment is, that since each in itself is insufficient for our purpose, so are all taken together. The ordinary reader is apt to suppose, in the vast and diverse fields of knowledge through which he passes, that if words and phrases suitable to the processes of a special science have other meanings applicable to the processes of other sciences, then in this verbal and accidental similarity there exists essential identity; but careful examination will show that no such identity of the processes under study really exists, and that the supposed unification of knowledge is a trick of words only.

It has been our duty to define in what the unification of knowledge would really consist, and to insist upon a rigid and inflexible method of procedure and statement. We have shown that the goal must be worked up to by processes of induction from the knowledge embodied in actual science, and that if hypotheses are framed, they must be intelligible, and must be capable of verification deductively by a process of drawing corollaries, which corollaries shall represent the actual processes of nature. We have also expressed our doubt as to the possibility of such an attainment, and have reserved for treatment in another volume the attitude of the mind with regard to the Unknowable Power as a factor in Ethics and Sociology generally.

The reader may perhaps think that in the foregoing examination we have insisted too rigidly upon the logical consistency and conclusiveness of the philosophic attempt, and that after all, although Mr. Spencer's theory may be wanting in logical consistency, yet that he really has constructed a philosophical system which only wants a clearer and more consistent statement. He may think that the work has been done in the rough, and only wants going over again. We would willingly think so, but cannot see our way to this conclusion. We think that the attempt is so ambitious, so immensely beyond the reach of knowledge, that it is an impossible attainment now, if not for ever. We will consider in another place the true merits of Mr. Spencer's work, which we have no wish to disparage; but as a system of philosophy pitched in the high aim which Mr. Spencer expressly claims for it, his or any other system must be a failure. We think this will be the more apparent when we have completed this work by the criticism of the "Principles of Biology."

It may, again, be thought that the identity of methods of development and the apparent universality of the Laws of Force throughout all the activities of Physics, Biology, and Sociology afford the requisite unification of knowledge. These are, as before remarked, very suggestive of community of origin and of identity of process; but in the absence of a complete knowledge of the original factors in their relations, and more particularly in the absence of knowledge of the place and relation of "Feeling" in respect to the physical factors, it is quite impossible to understand the history of the cosmos, including organisms, as a series of sequences from these original factors, yet this is requisite in order to put meaning into a theory of identity of methods of development and universality of Laws of Force.

Again, it may be said that the unification of knowledge and the goal of Philosophy may not be attained perhaps by Mr. Spencer in the deduction of corollaries from one ultimate truth, and that he is too severe upon himself when he imposes it upon his system, but that it may be attained, and has been effected by him, in the statement of a body of truths, related and consistent, and together affording a full explanation of the history of the cosmos, including Biology. We admit that the unification of knowledge and the construction of a cosmical theory might theoretically be effected in this way, and the requirements of the logical faculty be fully satisfied; but again we venture to submit that Mr. Spencer has not stated any such connected and complete theory. He has formulated a number of truths, some of them valuable, and others of them very crude, as in the "Biology," but they do not cohere in that organic and scientific interdependence which is requisite; nor are they stated in that scientific and intelligible language which is essential to true philosophy.

The remainder of this book will be occupied by the consideration in Chapter II. of Mr. Spencer's re-statement of his position contained in the recently published Appendix to "First Principles;" by a study in Chapter III. of various related subjects; by a detailed study in Chapter IV. of the "Principles of Psychology," so far as regards the unification of knowledge; and by a criticism in Chapter V. of Mr. Spencer's very interesting and ambitious attempt to deduce the histories of biological development from certain original factors. We shall find, we believe, in all these studies that Mr. Spencer does not keep the one clear aim before him with which he sets out—that he does not keep to a single intelligible method—but that his ends and methods are of that uncertain and changeful character with which we have charged him in this introductory chapter. We believe that these detailed studies will be found to justify the criticisms now made, and to show that Mr. Spencer has failed to produce a consistent and complete work. At the same time we testify our admiration for the attempt, and still more for some grand generalisations in special departments, and we do not regard his failure as due to any other cause than the impossibility of the attainment of the end proposed. Fortunately for the sake of continued intellectual activity, there still remains a vast Unknown and an impenetrable Unknowable.

CHAPTER II.

REPLY TO MR. SPENCER'S CRITICISM.

§ 1. *Justification of our Previous Criticism.*

OUR former examination of Mr. Spencer's "First Principles" was undertaken on the supposition that the object sought after was the unification of knowledge, and the methods by which this unification is to be effected have now been more fully considered. At the same time we then clearly recognised that such unification was only to be accomplished when all processes could be recognised as corollaries of some primordial truth or set of factors. These factors we took to be the Indestructibility of Matter, the Continuity of Motion, and the Persistence of Force. Our first course of criticism was to the effect that, if we attached any definite meanings to the terms employed, we would find our ultimate factors insufficient to explain many processes, more especially the processes of Biology and the processes of Feeling and Intelligence. Seeing that Mr. Spencer advanced the Formula of Evolution as the formula of the interrelation of the three factors, we took that as the main subject of investigation, and found that, whatever definite meaning we attached to the terms therein employed, we were unable to work out our deductive process in the respects just specified.

In this conclusion it would appear we are quite justified, for Mr. Spencer says in his reply that any definite conception of them involves alternative impossibilities of thought. These definite conceptions—of a materialistic and mechanical character—were the subjects of our previous criticism. Taken on its own merits, such an investigation is useful, and by bringing it out into a clear statement, helps to disillusionise the mind of any one who would be inclined to suppose that these materialistic explanations were sufficient to account for biological and psychical histories. Taken as a piece of criticism of Mr. Spencer, it may or may not be judged applicable. We distinguished in our own minds between the chapters in the book *on the Unknowable* dealing with ultimate scientific ideas, as treating of these ideas "in their ultimate nature" or what they are "in themselves," and the chapters explaining Matter, Motion, and Force in the book *on the Knowable*, as defining them for future use in the attempt at the unification of knowledge. It did not occur to us that we could unify knowledge by means of terms that had no definite meanings. This theory we shall therefore discuss separately. In the meantime we justify our criticism of Mr. Spencer from the point of view of having definite meanings by references to chapters treating of them in the book on the Knowable.

And first as to "Matter." At page 167 we find:—

"We may therefore deliver ourselves over without hesitation to those terms of thought which experience has organised in us. We need not, in our physical, chemical, or other researches, refrain from dealing with Matter as made up of extended and resistant atoms; for this conception, necessarily resulting from our experiences of Matter, is not less legitimate than the conception of aggregate masses as extended and resistant. The atomic hypothesis, as well as the kindred hypothesis of an all-pervading ether consisting of molecules, is simply a necessary development of those universal forms which the actions of the Unknowable have wrought in us. The conclusions logically worked out by the aid of these hypotheses are sure to be in harmony with all others which these same forms involve, and will have a relative truth that is equally complete."

A further justification may be found in the fact that Mr. Spencer, adopting the nebular hypothesis, which regards all changes as incidents in the cooling of a primordial nebula, must consider that all changes are resultants of the properties and relative quantities and positions of its constituent elements, which are described in treatises of chemistry.

Yet another justification can be drawn from the actual treatment of the processes of biology by Mr. Spencer himself, in which, starting with the factors from which they are all merely *resultants*, he enumerates these as oxygen, hydrogen, nitrogen, carbon, &c., for internal factors; and heat, light, motion, &c., for external factors. It is true that Mr. Spencer does not explain the cause of the differentiations of the so-called elements oxygen, hydrogen, &c., and so much the worse for the unification of knowledge. But heat, light, motion, &c., he professes to be knowable, like the properties of oxygen, &c., while even the all-potent "polarities" are merely regulative attractions and repulsions dependent in some manner upon sizes and shapes. In fact, it is due to our having definite notions of these that his science of biological interpretation is at all justifiable in its very first inception. As a matter of fact, Mr. Spencer throughout his works uses the terms Matter, Motion, &c., in their ordinary or vulgar meanings. In the "Biology" he never supposes we do not know what he means by them, and never tells us that all he refers to is x, y, and z: we do not think he even once uses these symbols.

We are further justified by a study of Dissolution; for if we are to reason from aggregates to constituents, following Mr. Spencer, we have to argue the properties of the atoms of the so-called elements from what we know of the aggregates; and the unification of knowledge is not complete, according to the requirements of "First Principles," p. 548, until this is done.

The definition of "Motion" is less precise;* indeed, it is so obscure that it does not seem capable of scientific or logical use. The conception of Motion involves conceptions of Space, Time, and Matter. A something (*i.e.*, Matter) that moves, a series of positions (*i.e.*, positions relative to other things) occupied in succession, and a group of constant positions (*i.e.*, of other things) united in thought with the successive (*i.e.*, relative) ones—these are the constituents of the idea. Mr. Spencer proceeds to trace up the conception of Motion to experiences of Force, but what we require to know is the precise sense in which Motion is to be used in the formulas, scientific generalisations, and logical uses of the book on the Knowable.

* First Principles, p. 168.

The definition of "Force" as it is to be used in the book on the Knowable, as distinguished from its use in the book on the Unknowable, is still more indefinite and confusing. Surely, as one of those factors in the formulation of the relations of which is to be found the unification of knowledge, and which is to be a constituent in the proposition by which is to be explained all the processes of the physical and biological sciences, we are entitled to look for a precise definition. How otherwise are we to understand our propositions, or how can they be real and not pretentious generalisations of knowledge?

What do we find? We find ourselves at once plunged into confusion. Instead of Force being a co-equal factor with two other factors, making a total of three, the interrelations of which have to be formulated—it is at once stated to be that from which Matter and Motion are built up. "Matter and Motion, as we know them, are differently conditioned manifestations of Force." We are permitted to know Matter and Motion, the first as "extended and resistant atoms," having the chemical and physical properties ascribed to them in scientific treatises; and we are permitted to know Motion, but scarcely *as a factor*, only as a phenomenal result—a relative series of positions; and then we find that the third factor, Force, is nothing but as manifested in the other two—namely, Matter and Motion—Force itself being inscrutable. These are the scientific definitions upon which we are to base our formulas and propositions of the Knowable, and by which its sequences and relations are to be explained. This attempt is made to the best of our ability in our previous work—keeping within the bounds of intelligibility —and we found it to fail. We attempted to work it out by means of every intelligible meaning that could be attached to the terms, and Mr. Spencer's reply to it is that these were not the meanings he attached to them, and thinks we were unjust in attributing such meanings to him. Let him then give us his own intelligible and precise definitions, and we shall be glad to do our work over again.

However, to resume the statement of our previous criticism, we have to remind the reader that, on the failure of the materialistic explanations, we called his attention to the fact that although Mr. Spencer stated his intention of including *three* essential factors in his formula, all of which were necessary in the explanation of things, yet he had omitted the one from which we had been led to expect the most—namely, the term "Force." Here we found (like Mr. Spencer, no doubt) that we could not include it, and also we found, like him, that it had no definite meaning. This seemed to show that the unification of knowledge could not be effected by the aid of this term. At the same time, we now know from Mr. Spencer that this unification can be accomplished by terms of which we do not know the meaning; and we shall resume the consideration of the value of this term in this aspect, and of the method of unification by means of symbolism, in a special section of this chapter.

Part IV. of the previous criticism consisted of a study of Mr. Spencer's exposition with the view of framing a formula which should be a general expression of it. Here we found that the most general characteristic of all processes was to be found not in the "nouns" but in the "verbs"—not in matter and motion, force and mind, feeling, &c., but in "integrate," "dissipate," &c. This would most likely be found to agree with Mr. Spencer's theory that knowledge can be unified by a formula expressive of the most general relations of factors, the factors themselves being unknowable. This theory is the same as the one just referred to as unification by means of symbolism, hereafter to be specially considered. In our previous criticism we framed a formula in the sense indicated, endeavouring to make the factors indefinite and their relations precise. It was as follows:—

"Evolution is integration, during which every existence passes from an indefinite, incoherent homogeneity, to a definite, coherent heterogeneity, and during which the activities undergo a parallel transformation."

The fault of this formula is that it is not a proposition from which corollaries can be made, so as to deduce the whole process of the universe, but a merely outside description of the process. A second defect lies in the fact that the concomitance of the dissipation of something else as a correlative of integration would have to be abandoned. Of course it could be said—

"Dissolution is disintegration, during which" the converse happens; and it could be added—"Evolution and dissolution are necessarily concomitant."

But even then the formula would fail, taken simply as an universal description; for there are some integrations which do not seem to have any concomitant dissipations—such as the integrations of languages, of music, of biological correspondences in general, of psychological correspondences in general, or again the integrations of machinery, of trades, of professions, and of sociology generally.

And then, in any case, it is only a mode of definition of words; it explains the meaning of the words evolution and dissolution by means of other words, integration and disintegration; these in their turn are only varied expressions for combinations and decombinations, which are the very things we wish to have explained; and to translate them into the mysterious words evolution and dissolution is not doing anything at all, unless they disclose the interdependence of sequences, and the final dependence upon some original calculable factors. The only gain is that the word evolution has the meaning of development by gradual natural processes, and we are made to slip into a theory unawares, notwithstanding the strictly limited definition of concentration which Mr. Spencer gives to it when propounding his formula.

It may be, indeed, that the word "integration" is merely "symbolical," and represents some process of which we have no conception; and, if we attempt to attach to it any definite meaning, we shall be landed in alternative impossibilities of thought; but in every view we take of it, it seems to fail as an unification of knowledge.

The result of this criticism was to show that any materialistic and mechanical explanation of the universe was inadequate, and in these terms is comprised all the properties of the so-called elements as described in books on chemistry, and all the laws of the physical relations of bodies, including Polarities, Equilibrations, Motions, &c. This was the clear and definite result of our study. We do not say that Mr. Spencer is antagonistic to it. He probably agrees with it. At the same time we assert that whenever he does attempt explanations, they are all of this materialistic and mechanical character. In the surpassingly interesting study of Biology his constructive process is purely materialistic, as exhibited in our criticism of his exposition of the origin of organic matter in our former volume, and in our examination of the Biology in Chapter V. of the present work. Therefore we hold, despite Mr. Spencer's general admissions of its insufficiency, nevertheless the most important part of his work is attempted on the lines of materialistic and mechanical explanations, and are open to the criticisms we have advanced. Does he, or does he not, formally abandon these materialistic explanations? If he abandons them, his two volumes on "Biology" go for nothing. If he does not, then let the objections made be fairly met and replied to in detail.

There are only two modes of escape from this position of dilemma. One is by adopting a theory of "symbolism," which we have already partially considered, and which is the position taken up by Mr. Spencer in his reply to our criticism, and which we shall proceed immediately to consider. The other is by way of the so-called "double-aspect" theory, which we shall take next in order.

§ 2. *Considerations leading up to a study of Mr. Spencer's position as re-stated by him in the Appendix to "First Principles."*

(*a.*) *On Theories of Knowledge.*

The endeavour to accomplish an unification of knowledge appears to necessitate a theory of knowledge, and this again implies a theory of the origin of Psychology. We do not wish to undertake a treatise upon this science; yet it is necessary to give it some consideration in order to understand what Mr. Spencer means by the summary of his system of Philosophy, stated in reply to our former criticism at page 579 of his "First Principles."

For our part, we do not see that such a perfect science of the origin of Psychology is yet possible. Until the fundamental relationship of the chemical elements towards consciousness is capable of being formulated, we do not think that any theory either of the historic origin of Psychology, as part of one universal process, or of the Unification of Knowledge, is possible.

Mr. Spencer's system of Psychology, as regards its genesis and organic development, is one of chemical and mechanical origin. It forms part of the processes of his Biology, from which Feeling as a factor is expressly excluded. In biological development, as will be shown in Chapter V. of this work, Mr. Spencer relies entirely upon the properties of certain chemical elements and of the environment, for the most part expressed in terms of the laws of motion, equilibration, and polarity. From these result structure and function of organisms and their parts. The theory of the "double-aspect" merely gives a second or subjective side to events and effects determined by these mechanical agencies, without allowing that the processes are in any way the results of any feeling or consciousness, so that in a history of origin and development they may be altogether excluded.

Founded upon this system of Biology, which may be more fully studied in the chapters referred to, is Mr. Spencer's system of Psychology. In his eyes Psychology, regarded historically, is merely the physiological function of the nervous system. This system, produced by way of equilibration in response to forces of the environment, becomes ever more complex and integrated; and since it is accompanied by a subjective aspect, emotions, feelings, intelligence, and knowledge become more organised and integrated at the same time. We must confess we do not see under this system (whatever rough justification we may find for it in what is called "automatic response" to environment) how abstract and general ideas and memories can be localised in structure. But this and many other points of criticism have to be passed over.

The great principle of the "Psychology" is the establishment of "correspondences" between the inner organism and the complex environment. In pursuance of this process, the nervous system is differentiated so as to cognise different modes of the environment: the eye is developed in correspondence with the ethereal undulations having the subjective aspect of sight and the colour sense, &c.; the ear is formed in response to undulations of the air having the subjective aspect of the sense of sound; and the organs of taste and smell are also similarly specialised from the rest of the nervous tissue. Why these different motions or chemical actions should be correlated with these various subjective affections we do not know, and is beyond the scope of the mechanical and chemical system under our consideration.

What we particularly wish to point out in this system is the fact that according to it there is nothing in the organism save what has been produced in it directly or indirectly by the environment, acting in some unknown way upon the chemical elements of which it consists, such organism being itself, so to speak, but a part of the external environment in the first instance. The conclusion we would draw from this is, that we are able to place full reliance upon the actual experiences supplied us by our senses. The very organs of sense themselves, being produced by the environment, have nothing else to justify their existence: their presence implies the action of the environment upon the organism. On this hypothesis knowledge is found to be fundamentally trustworthy and to be specifically differentiated according to the particular modes of action of the external world upon us. This is direct knowledge, and it consists of a countless number of individual experiences, extending over every moment of our lives.

But in addition to this direct knowledge, there exists—whether capable of a physical interpretation or not, and without considering the question as to whether Feeling is a factor in organic development—a cognition of these cognitions, a memory of them, and a discriminating power by which likenesses and differences are determined, and the order and relations of events are discerned. What, therefore, results from the exercise of this faculty within the organism of the race is an interior growth, and may or may not be a "correspondence" with external actualities.

Again, we have to leave out of account the question as to how these secondary products are registered in the actual organism of the brain and nervous system, so as to render memory and reasoning functions of some organ. But granted this, we see how these, not being in direct response to the action of the environment, may not always be in true correspondence with it, errors and false notions being the result. The history of knowledge will then be the history of the endeavours to form a system of correspondences within this portion of the nervous system with the vastness and complexity of the external world. In the attempt to grasp this vastness and complexity within the purview of a limited intellect, various devices have been resorted to, of which the principal ones have been generalisation and abstraction. General terms have been formed to sum up groups of objects of which similar predicates can be asserted; but in the common and ordinary use of them they have often been transformed from mere terms of totality into unitative general existences expressed in the singular, though they have evidently come at last to be regarded as actual individual entities; and thus a mere idea becomes objectivised, and treated of as if it actually existed in the environment. The same thing has happened with abstractions. The attributes of bodies, being shared more or less by other bodies, could be spoken of in the same terms; and the effect produced upon the consciousness by similarities of action came for convenience to be spoken of by the same word. These abstractions being named in the singular number, assumed the character of individual existences, and being thus objectivised, played a part in thought as if they had an individual objective existence in the surrounding universe. These objectivised generals and abstractions becoming thus objects of thought, have played an important part in philosophy and speculation, giving rise to much error and confusion. Witness how difficult it is to learn that there is no objectivity answering to the terms Time and Space—that Matter and Motion have no existence as generals modified into particular modes. This is a hard lesson.

But, on the other hand, the intellect has the power to learn this lesson, and to correct error and confusion by a recourse to actual contact with the environment, and a reconstitution of the internal mental organism. It is able in the development of a race to move more and more towards establishing a system of internal correspondences in accord with the system of external correspondences. It is able, in the first place, to discern between the nature of the external action and the nature of the resulting subjective feeling. It can state the differences of colour in terms of reflected ethereal undulations, and thus separate the objective action from the sensational result. The same process takes place with respect to the differences of sound. We distinguish between the subjective sensations and the objective undulations of the air. The probability is that we shall also be able eventually to discern the varied chemical action of substances upon the organs of the mouth and nose, and thus objectively to describe the differences of taste and smell.

Hereupon arises the question how we know things. Do we know them as they are in themselves, or only as they appear to us and affect us? Is knowledge actual or phenomenal?

It must be granted at once that fundamental knowledge is only of the modes by which outward bodies affect us. It will be true, then, to say that all knowledge is phenomenal; and it therefore follows that we can have no absolute knowledge; and again, that we cannot know things in themselves or out of relation to us.

In such statements there is a great mixture of truth and error. It appears to us that in a great many philosophical studies at the present time we should commence our thinking *de novo*. It has been usual to enter upon philosophical study in continuance of previous theories. Thus the old questions remain and the old controversies continue to be beaten out. But during the last twenty-five years science has made such immense progress, more particularly in the abstruse studies of light, heat, molecular physics, and the relations of the energies of nature, that the whole groundwork of thought is changed. Moreover, the doctrine of development, and more particularly of biological evolution, has completely changed the nature of the problems to be solved and the modes of solving them. These, taken together, constitute no less than a revolution in philosophic thought; and it seems to us that to pursue the new studies weighted with the old ideas is a very cumbrous method of procedure. It is best to bid good-bye for a while to Berkeley, Hume, Kant, and the others, though coming back to them respectfully afterwards, it may be, to correct and compare. Even Mill—one of the most clear and satisfactory of writers—since he wrote anterior to this revolution of thought, is now in some respects out of date.

Mr. Mill's favourite object of study is an orange. Let us take it and ask ourselves what we know of it. In the first place, we know that it is yellow and has a recognisable odour and flavour. It affects the senses of sight, smell, and taste. In the next place, it has shape, size, and relative position. In the third place, it has weight or attraction towards the centre of the earth.

Various questions have arisen as to what we know of this orange. Do we only know it as it affects our senses, or do we know it as it is in itself? Is the orange yellow, scented, and sweet or acid in itself, or has it only the properties of affecting sentient beings in such a manner as to produce in them these feelings? It has been decided that colour, taste, and smell are not properties of the object, but affections of the senses produced by the object. The orange is not yellow, odorous, nor sapid to the table upon which it lies. Science has penetrated the secret of colour, and is able to assign a physical explanation to the various colours. The length of a wave of red light is

Red,	. . . .	$\frac{1}{39180}$ of an inch.
Yellow,	. . . .	$\frac{1}{44000}$ " "
Violet,	. . . .	$\frac{1}{57500}$ " "

So, speaking of yellow, we mean objectively waves of $\frac{1}{44000}$ of an inch and the rate of impingement on the retina of the eye; or subjectively the feeling produced by these motions upon a sentient being fitted to cognise them. So again sound has been explained as undulations of air. Science has not yet been able in a similar manner to formulate tastes and odours, but there is every reason to suppose that this will be accomplished some day. When it has been done, then, in a similar manner, each taste and smell will have a physical explanation and a subjective accompaniment, the correlation of the subjective and the objective aspect, however, remaining as yet beyond prospect of explanation.

The conclusion drawn from this dependence upon the senses for knowledge has been that all knowledge is phenomenal, and cannot be freed from the subjective aspect attached to every cognisance of objectivities. The further conclusion has followed, that we cannot know things in themselves.

Another mode of stating this conclusion is, that all knowledge is relative, and that we cannot know things absolutely or as they exist independently of the cogniser. The discussion of these theories has been very subtle, and when it has been complicated by the recognition of objectivised abstractions as amongst the things-in-themselves which have been considered, has led to labyrinthine verbiage.

We desire to study the question whether, granting all knowledge to be relative or phenomenal, we are nevertheless able to understand and know the objective world in the relations of things to one another independent of consciousness? Whether there is not within consciousness a fundamental fact which corresponds with the fundamental fact of the environment by which the history of the objective universe anterior to the emergence of consciousness can be understood, and by which the present objective universe can be understood as it acts within itself independent of the observant consciousness, and which constitutes it an independent active external world, and not mere phantasmagoria of the mind?

Let us return to our orange and ask what it is in itself? Well, it is not a thing-in-itself at all; it is an aggregate,—it is composed of a certain number of atoms of certain of the chemical elements. We have already considered the question what these are in themselves, and the orange is but a certain combination of them.

Moreover, the orange does not exist by itself; it has relations to the objects around it, not merely of relative position, but of actual force. It presses upon the table on which it rests,—it will weigh down one side of a balance,—it will break an insufficient support. Nothing exists by itself, and therefore nothing can be studied in itself.

We are accordingly forced, with whatever object we start, to a consideration of the chemical elements; and these we have already found to be merely bundles of properties in relation to each other.

The question whether these properties are the actual relationships of things amongst themselves, and whether our knowledge of them is affected by our subjective consciousness, as is the case with the effects of external actions of objects upon our senses of colour, taste, and smell, is a very interesting one. The fact that there is no colour, no light or dark, no sound, no taste, no smell, in the objective universe is difficult for any sentient being to realise; and when it is realised, it acts with such impressive force, and affects such a vast extent of knowledge, that an universal scepticism sets in, and everything seems to be unreal. The question suggests itself, Is the cognition of the universe as reconstituted of differential relative attractions, resistances, modes and rates of motion, shapes, sizes, &c., &c., only known to us relatively to our senses, or do these factors indeed form a cosmos interacting thus independently of our senses, yet truly cognisable by us? Is there a common ground upon which the objective and the subjective meet?

Science so far seems to say Yes; and although we cannot say that we know a thing (*i.e.*, a chemical element) in itself, we can know things amongst themselves, expressible in terms of attraction, resistance, repulsion, shape, size, modes and rates of motion.

Philosophy in the hands of Mr. Spencer corroborates this view, as we see in Part VII. of the "Psychology." This part is valuable in its mode as well as in its results. It is a vindication of reason as overriding the reliability or non-reliability of the senses, and indeed is a vindication and rectification of the senses themselves.

We hold that those properties of objects which are known to us by attractions or resistances in relation to our muscular sense are known to us as they are amongst themselves, or rather as they are to that material portion of ourselves which forms our physical frame; and that all the senses of colour, sound, &c., are interpretable in terms of relations of resistance; that our bodies and the external world possess a community of attributes which gives us a knowledge of the relations of things amongst one another—a knowledge not of nature, but only of relation—not of original properties, so as to afford knowledge of actions and sequences, but of the general nature of objective relationships, independent of subjective impressions.

We can understand by processes of reasoning that the relations of external objects to ourselves through the organs of sight and hearing are relations of muscular resistance; and although the nature of the action of odorous and sapid bodies upon the organs of the nose and mouth is not yet understood, yet in the end, no doubt, it will receive a similar explanation. Mr. Spencer himself argues that this impression of resistance is the mother-tongue of thought, into which all language has to be translated. If he had said attraction and resistance, it would have been a more perfect statement.

Thus we find a physical history long anterior to ourselves, of which we can take cognisance. Natural operations of physics, chemistry, &c., which we can cognise, although not witnesses of their occurrence; chemical processes which from their minuteness or gaseous invisibility we cannot perceive; operations of physical forces which escape our senses;—all these we can ideally grasp, although beyond sentiency, by means of the intellectual imagination, which, abjuring all feelings but those of attraction and resistance and their derivatives, is able to interpret all the present in these terms, and picture all the past.

So also we have sciences called abstract or exact, which are universal in their application and precise in their statement, because they are general truths of these all-constituent factors of the cosmos. We refer to mechanics, geometry, and mathematics. These are sciences of the universal relations of things amongst themselves, cognisable in the first instance by those primordial feelings of attraction and resistance of which we have spoken. They consist of the knowledge of relations of shape, size, attraction, resistance, and aggregation: into these, in all probability, all physical knowledge will ultimately be resolved. Here we have a knowledge of "things amongst themselves" independent of the superficial senses.

Hence it will be found that while we hold all knowledge to be relative, yet since we are part of the objective, we can understand the interrelations of things amongst themselves independent of sentiency; that in this sense we can have absolute knowledge; but that this absolute knowledge is also in a sense relative knowledge; that knowledge is only partly phenomenal in respect of the superficial senses; that there is a common ground on which the phenomenal and the absolute meet, namely, in the fundamental sense of muscular resistance. This is the same as Mr. Spencer's teaching that all terms have to be translated in the end into terms of the feeling we call resistance.

This language may seem paradoxical; but that only shows the necessity for repudiating a good deal of the old language which has been used in Philosophy, and indicates why there is so much discussion about terms, and so much misunderstanding. If "absolute" means non-relative, there is no absolute knowledge. If "absolute" means knowledge of things amongst themselves independently of sentiency, there can be no knowledge without a sentient being capable of knowing; but yet sentient beings having fundamental experiences of the bodies with which they are correlated can have such a knowledge of things amongst themselves. If "absolute" means knowledge of things in themselves, since objects only exist in relation, we cannot know each object individually in itself. All knowledge is Relative in the double sense of being the relation of things to the knower; and of being concerned with objects interrelated to each other. In a sense all knowledge is phenomenal; but in respect of the expression of knowledge in terms of attraction, resistance, shape, size, &c., it is a real knowledge of the actual relations of things amongst themselves.

Our general conclusion is, then, that in so far as our knowledge consists of colours, light and shade, sounds, smells, odours, it is phenomenal, and does not represent objectivities, except in so far as they are the special effects wrought by the attractions, repulsions, and motions of objectivities upon the senses, but that these objective actions are not represented by the subjective terms, which terms are only applicable to the feelings of the receptive sentient organism.

Again, we hold that we do not know things in themselves, but that we only know the chemical elements as bundles of properties in relation to each other, aggregated into simple and complex objects called things, which things are related to each other as results of their constituents and their interrelations; that we are therefore capable of forming a science of things amongst themselves independent of sense, anterior to and subsequent to the existence of sentient organisms, which science can be expressed in terms of attraction, repulsion, resistance, shape, size, modes and rates of motion.

So far we have treated only of objective science. As regards subjective knowledge, the knowledge of emotions, thoughts, ideas, and feelings generally, we are not prepared to treat. Nor are we in a position to speak of the interrelation and mutual dependence of subjective and objective. It is still an open question in our mind how far each is a factor in any action of an organism, and the question remains over for future study.

As regards the study of "things among themselves," it may be divided as follows:—

Primary—

Attractions.

Resistances or Repulsions.

Derivative—

a. Relations of Space:

Size, Shape, Distance, Position, Aggregation.

b. Relations of Time:

Co-existence, Succession.

These may all be regarded as fundamental knowledge, in terms of which all objective knowledge may be expressed; and if Feeling is not a factor in biological development, then the history of biological development, as of all other developments, may be described in these terms, and its causes and conditions can all be contained within these terms. And inasmuch as the subjective aspect of these terms corresponds with the actual interrelationships of external, present, and anterior existences, the knowledge so expressed is not only phenomenal and relative, but is also—obliterating the word "absolute" from all future philosophic use—a true picture of the history of things amongst themselves independent of subjective cognisability.

(*b.*) *Digression: being an Examination of the Second Chapter of Mill's "Examination of Sir W. Hamilton's Philosophy," entitled "The Relativity of Human Knowledge."*

The doctrine of the Relativity of Knowledge is variously accepted by different philosophers. We might understand it, as—

"All our knowledge is relative to us, inasmuch as it is we that know it;" or,

"We can only know what we have the power of knowing."

But these, Mr. Mill says, are trivialities, insignificant truisms, which no one ever did or could call in question, and which apparently are of no value when expressed.

Again, there is an acceptation of the doctrine in which it means that we only know anything by knowing it as distinguished from something else; that all consciousness is of difference. But this view, although valuable, may be put aside as not appropriate to our present purpose.

"All language," says Mr. Mill,* "recognises a distinction between myself, the Ego, and a world either material or spiritual, or both, external to me, but of which I can, in some mode or measure, take cognisance. The most fundamental questions in Philosophy are those which seek to determine what we are able to know of these external objects, and by what evidence we know it."

Mr. Mill then proceeds to take an object—an orange—and study what we know of it. We have already given our study of it. The conclusion which he comes to is this †—

"When thus analysed, it is affirmed that all the attributes which we ascribe to objects consist in their having the power of exciting one or another variety of sensation in our minds; that to us the properties of an object have this and no other meaning; that an object is to us nothing else than that which affects our senses in a certain manner; that we are incapable of attaching to the word 'object' any other meaning. . . . This is the doctrine of the Relativity of Knowledge in the simplest,

* Mill on Hamilton, p. 6, second paragraph.

† Ibid., p. 7, bottom.

purest, and, as I think, the most proper acceptation of the words."

Mr. Mill then goes on to consider two forms of this doctrine.

Before proceeding with them, let us remark upon the exceedingly narrow view of the subject as taken by Mr. Mill, as, indeed, by most metaphysicians. The circumstance that always strikes the reader is the absence of reference to the *general results* of science and of large scientific generalisations. Mr. Mill says, "Let us take an object." This object is not considered as an aggregate of chemical elements, but as "an object," an individual existence.

Again, most metaphysicians, as in this case, content themselves with a statical view of an object. They do not take objects in visible action or sensible relation to each other, but take a single object, as Mr. Spencer does the piano. They isolate one aggregate, and then study it as far as possible statically; whereas dynamics is the great natural study. Mr. Mill says nothing about light and the undulatory motions which impinge upon the eye, nor about the chemical action of the material particles which affect the nose and the mouth. Nor does he speak of the attraction of the orange to the centre of the earth, nor of the resistance of the table upon which it rests.

By some philosophers it is held, he says, "that the attributes which we ascribe to objects consist in their having the power of exciting one or another variety of sensation *in our minds;* that *to us* the properties of an object have this and no other meaning; that an object is *to us* nothing else than that which affects *our senses* in a certain manner."

In considering this, we are not disposed to deny that objects are *to us* as stated when they are in actual relation with our senses, and when we take them in both their subjective and objective aspects. In such a case an orange is yellow, odorous, and sapid. Suppose, again, a heavy object falls upon it and crushes it, and the juice stains the white cloth of the table. The objects are still *to us* as they affect us, and our knowledge of them is as our senses inform us. The study is correct as far as it goes, but it does not go far enough; it does not recognise the relations between the aggregate called an orange, and the falling object, the table, and the tablecloth. These objects have relations amongst themselves. To one another they are not coloured, sapid, or odorous, nor do they hear the noise of the catastrophe; but they have relations of attraction and resistance, of shape, size, relative position, and consequent change, as well as (in the case of the stained tablecloth) of chemical or molecular combination. All these changes take place quite independently of the sentient onlooker, and are capable of being expressed in terms non-connotative of sentiency. Yet Mr. Mill says that the only properties of an object are its powers of exciting *in us* certain sensations. Certainly he limits the assertion in respect as they are cognisable "*to us*," but then these are not all the properties of objects, but only their properties in regard to us. They have properties in regard to one another; they interact independently of our volition; their laws are not laws of thought. The different sciences are studies of external processes, not laws of mental associations. We interfere volitionally, but only in the application of external powers, and our mental associations are produced by actual external associations of independent objects. We follow, we do not lead.

Mr. Mill then goes on to describe the most extreme form of the doctrine of the relativity of knowledge as held by the Idealists and Sceptics, including Berkeley and Hume and all their followers, which schools we are inclined to think should now, for reasons previously stated, be reckoned out of date.

This, however, is far from being the shape in which the doctrine is usually held. To most of those who hold it, the difference between the Ego and the Non-ego is not one of language only, nor a formal distinction between two aspects of the same reality, but denotes two realities, each self-existent, and neither dependent on the other. They believe that there is a real universe of "things-in-themselves," and that whenever there is an impression on our senses, there is a "thing-in-itself" which is behind the phenomenon and is the cause of it. But as to what the thing *is* "in itself," we, having no organ except our senses for communicating with it, can only know what our senses tell us; and as they tell us nothing except the impression which the thing makes upon *us*, we do not know what it is *in itself* at all. It is supposed that it must be something *in itself.* External things exist and have an inmost nature, but their inmost nature is inaccessible to our faculties. We know it not, and can assert nothing of it with a meaning. But the representations generated in our minds by the action of the things themselves, these we may know, and these are all that we can know respecting them. Let us take for consideration, for example, the chemical element oxygen and the chemical element iron. We know all about the properties of these substances. The properties are two-fold: firstly, their objective relation to the other elements, to the earth, and the rest of the physical universe; and, secondly, their relations to our subjectivity. The whole of their properties are relations with other things. Out of this relationship we do not know them at all. All that we know of them is that they are bundles of properties, and these properties are relationships. We also know that such of these properties as are cognised by the superficial senses are explainable by the fundamental senses, and can be set down in mathematical and chemical formulæ. It may be argued there must be something which differentiates the substratum or nexus which holds these various distinguishing properties of oxygen and iron together, and which constitutes oxygen and iron in themselves. If so, let those who argue for it make what practical use they can of it. It does not concern us until these elements can be decomposed and we add to our actual knowledge. It seems strange to us that when philosophers have once decided that this kind of knowledge is inaccessible to us, there should be so much discussion about it. Why not let it drop altogether? It is unwise to discuss things in themselves too much, for men may talk about them till they believe in them.

It is in the form just considered that the doctrine of the Relativity of Knowledge is held by the greater number of those who profess to hold it, attaching any definite idea to the term. A great deal of importance has been attached to the doctrine, but we are inclined to think its importance has been overestimated. It seems to have merely a negative value in shutting out useless discussion as to the ultimate causes of physical and subjective processes, and to be useful principally in causing us to limit our attention to the actual sequences in nature, and to confine our explanations, so far as they will go, within the bounds of the knowable; and if they will not go far enough, to let them remain incomplete. As a doctrine of positive value, we think that logically it is deceptive; for if an orange is known to us only relatively, it is yellow; whereas we know that it is not—*in itself*—yellow. The impression yellow is a subjective fact—an incident in the relativity of knowledge, and not a property of the orange in respect of non-sentient physical bodies. This falsifying influence of the relativity of knowledge is shown in that form of the doctrine next explained by Mr. Mill. This is the form in which it is held by Kant and his followers. Beyond the immediate sensations and their unknown outward cause it is held that the mind adds something of its own. These additional elements do not belong to the objects themselves, but to our perceptions and conceptions of them. The attributes of filling Space and occupying a portion of Time result from the nature of mind itself, which is so constituted that it cannot take any impressions from objects except in those particular modes. Time and Space are only modes of our perceptions, not modes of existence. These and others are not properties of the things, but of our mode of conceiving them.

Merely referring by the way to our belief that Space and Time are relations of "distance between" and contemporaneous or successive action, which are experiences of objective relations, we observe that, firstly, they have no existences as objective entities; and, secondly, as Mr. Spencer has pointed out, if they are forms of thought, it is because they are correspondences with universal objectivities. The universality of the experience has evolved the fundamental thought. The fundamental facts of physical interrelations named attraction and resistance, and their derivative relationships, correspond with that universal language of the feeling of resistance to which Mr. Spencer refers; and if we are obliged by the laws of our mentality to conceive of objects as thus and thus, it is owing to the laws of biological evolution, by which the actual universality of these external facts is registered organically in the physical constitution of the race as the primordial "correspondence" between organism and environment.

A modification of the doctrine is that by which it is held that Place, Extension, Substance, Cause, and the rest, are conceptions put together out of ideas of sensation by the known laws of association. It is not stated whether this "putting together" is done by the individual or the race, but probably it was supposed to be done by the individual, as the doctrine is ante-Darwinian. The fact of placing the origin of these notions in the laws of mental association without going farther, and assigning an exterior cause in the direct relations of things amongst themselves, should be sufficient to condemn it under the new philosophy. The doctrine of the association of ideas depends upon the association of the things which they represent, and has been produced by them.

Mr. Mill proceeds to say that the Relativity of Knowledge means the inaccessibility to our faculties of any other knowledge of things than that of the impressions they produce on our mental consciousness. We have already shown that even the impressions produced upon our mental consciousness are not knowledge, such as the yellowness of the orange, the rising and setting of the sun, &c. These impressions have to be rectified by reason. On the other hand, we maintain that some of the impressions produced upon our mental consciousness are true notions of the properties of things amongst themselves, and in this respect differ from the impressions produced through the superficial senses. If the doctrine of relativity has any value at all, it is in the validification of the existence of a true relation between the knower and the known, and in giving us confidence in the reasoned results of this relation, as against the sceptical results of a mere phenomenalism.

Again, Mr. Mill remarks: "It is obvious that what has been said respecting the unknowableness of Things 'in Themselves' forms no obstacle to our ascribing attributes or properties to them, provided these are always conceived as relative to us." On this we remark that, clearly, if all knowledge be a relation between an action of things-amongst-one-another and a knower, all knowledge must be conceived as described; but inasmuch as no action takes place except between two or more things, there must be a relation between these things of which we become cognisant. The generalisation of these relationships is the triumphs of modern science. Mr. Mill proceeds: "If a thing produces effects of which our sight, hearing, or touch can take cognisance, it follows, and indeed is but the same statement in other words, that the thing has *power* to produce these effects. The various powers are its properties, and of such, an indefinite multitude is open to our knowledge. But this knowledge is merely phenomenal. The object is known to us only in one special relation, namely, as that which produces, or is capable of producing, certain impressions on our senses; and all that we really know is these impressions." On this we would remark, that a thing never produces effects by itself, but only in relation to other things, and that the only things to which the word "thing" can be philosophically applied are the atoms of the chemical elements; all other objects are merely aggregates of them in relation. The question is, are their powers or properties in relation to one another, or only to us? We do not see how it can be supposed to be otherwise than the former. Then the question arises, can we know what these relations are; as, for instance, when we speak of chemical affinities? We certainly do, as they are set forth in books on chemistry, although we do not know the nature of these affinities. Now, if this is all that is meant by saying that all knowledge is phenomenal, and that we do not know the inmost motive and essence of the things—oxygen, hydrogen, &c.—then all knowledge is phenomenal, but it is none the less actual knowledge. Reason is still at liberty to penetrate as far as it can into the constitution of these elementary substances, and we need not even despair of acquiring that knowledge which would explain and account for all the phenomena which the thing exhibits to us in relation to other things, notwithstanding that, when so discovered, the new truth would also be relative to us, the knowers, and more might remain behind. They would then become known modes of Being. Mr. Mill adds: "We might invent new names for the unknown modes;

but the new names would have no more meaning than the x, y, and z, of algebra." He might have added, " or apply old ones."

The question is to what the term " knowledge " is applicable. Is chemistry a body of knowledge, or mechanics, or the other sciences? Apparently so, for in practical life there are immense and widespread organisations for teaching them. The question whether such knowledge is to be called phenomenal or absolute is of little importance.

(c.) *On Conceptions.*

Conceptions are mental representations of experiences relating to the subjective purely, or mediately to the objective. We have only to consider the latter for our present purposes. Conceptions differ greatly in their character. They may be very simple, as that of an individual simple object, such as my tea-cup; or they may be rather more complex, as that of my watch. In fact, it may be doubted if I have a clear conception of my watch, as I have of my tea-cup. I have never thoroughly examined my watch, so as to understand its construction. I have a very indefinite knowledge of the relations of its springs, wheels, and check actions. So that complexity is very often accompanied by indefiniteness of conception. Here we find another characteristic of conceptions in that they vary in definiteness.

A very important distinction between conceptions is whether they are of individual objects or of a class of similar objects. I have a distinct conception of my dog, but when I speak of dogs, the conception I have is very indistinct on account of the great variety of breeds. So that in this respect also we have definite and indefinite conceptions.

Again, with regard to objects of great magnitude, the intellect fails to grasp them, more particularly if they are at the same time complex in their contents. The mind is able to form but a very uncertain and changeful concept.

Once more, if we go beyond those aggregates of things called objects and consider their mutual actions, we again are able to form but very imperfect conceptions. If I say, "I bought a dog," the conception produced in the mind of the hearer is of a very indefinite character. He has his conception of me, he has a conception of a dog, but not of the particular dog which was purchased; and he has a conception of "buying," but not of this particular transaction. Yet he has in result received some specific information, and notwithstanding the want of all this definiteness of conception, he knows that an event has taken place, and is able to estimate the import and essential character intended to be conveyed by the words employed.

The consideration of conceptions always leads to a consideration of the words which are employed to denote them, and by which we are able to make our thoughts and wishes known to one another. Words differ from conceptions in being, instead of mental representations of objects, only the marks or symbols, verbal or written, by which those mental representations are denoted. They are a system of symbolisation.

We have already called attention to the fact that the intercourse of the mind with the objective universe is simply between the individual concretes and the individual mind; and that whatever thereafter ensues is a mental process merely. In this manner we justified the original experiences, and claimed the right to rectify the working of the subsequent inner growth. We required that the error of using mere terms of totality as generals having an unitative objective existence should be rectified, as has often previously been urged.

We have now to consider another class of so-called conceptions, namely, those known as abstract. These are altogether bad, and, like ill weeds, grow apace. They arise from a comparison of similars. We experience similar effects, such as that of the sensation red, and form a conception of redness; and then the mind having formed a noun, straightway imagines an objective existence answering to it. These are called objectivised abstractions, and represent no concrete existences whatever. On this subject, also, we have already had occasion to remark.

The difficulty arises in this way. In order to cope with the vast numbers, bulk, variety, and complexity of individual experiences, and with the vast results of scientific investigation, the mind is obliged, in the first place, to form indefinite conceptions, to generalise, and to abstract, and then to express itself with respect to such conceptions in words of still more indefinite and variable meaning on account of the rough and imperfect, changeable and individual imports of the terms employed. This evil is so great that except by the greatest care men do not clearly understand one another when they go beyond very simple and concrete language.

The object of this sub-section is to lead up to a consideration of Mr. Spencer's theory of symbolism, and the question is, Are conceptions symbols? A symbol, according to Webster's Dictionary, is a sign by which one knows or infers a thing. Now we cannot make out that a conception is a sign at all. Symbols are accepted signs between two or more people for the purpose of indicating what conceptions are desired to be understood—conceptions themselves being the mental representation of external objects or events, definite or indefinite, simple or complex, perfect or incomplete, coincident or non-coincident, or however they may exist in the minds of each. Of these the words are symbols. Mr. Spencer maintains that conceptions or some classes of them are symbols. Now the merit of a symbol is in proportion to its definiteness, but conceptions, according to Mr. Spencer, are symbolic proportionately to their indefiniteness. In proportion as our conceptions of a thing are obscure, indefinite, and incomplete, do they become symbolic; so that in the end the most obscure, indefinite, and incomplete conception is the most symbolic. He goes on further to hold, that only when the most symbolical, and therefore the most indefinite, obscure, and incomplete conceptions are reached, are we able to propound philosophical formulas which shall unify knowledge, and make clear the order of the universe.

Mr. Spencer does not call all conceptions symbolic, only those which are obscure, indefinite, and incomplete—those which the mind fails fully and completely to picture to itself, as, for instance, "The World." Now the symbol here is the word, written or spoken, "World." This word is the sign or symbol by which we make known to one another the subject of our discourse. It calls up to our minds, when we are asked to think about it without a limiting context, a number of indefinite, varying, complex, and incomplete conceptions, which in any two minds are not likely wholly to coincide. But again, if we are asked to limit our conception to that of the earth as a member of the solar system, or by itself as a sphere variously exhibiting oceans and continents, or again merely as an oblate spheroid of certain dimensions—it is held that since we are unable to form a representation of it in our minds commensurate with the object, our conception, in proportion to our inability so to realise it, is symbolic. Well, philosophers are entitled to use words as they please, but we fail to see the utility of thus transferring the signification of a written or verbal sign to a conception. Suppose we call the conception of the earth as a planet a symbolic conception, it does not in the least alter the value of the word or of the conception—it does not add to our notion of the earth, nor vary the value of any proposition in which it occurs. In the same way the notion of a watch is symbolic, as are the conceptions of all animals and vegetables—as are, indeed, the conceptions of all the chemical elements. There are no conceptions, or very few, that are not symbolic. The only use of the suggestion is, so to speak, a misuse of it, as leading us to suppose that those abstract and general conceptions which are most symbolic in respect of their indefiniteness have a value for logical purposes which they really do not possess.

These are the conceptions symbolised by the terms Matter, Motion, Force, Space, Time, &c., with perhaps Integration, Polarity, and Equilibration. As these are very obscure, indefinite, incomplete, if not indeed unpicturable conceptions, it is held that they are symbolical. We have already shown these terms to be the expression of some general laws of relationship of the chemical elements, which are themselves only bundles of properties in relation to each other. They are not entities at all, nor factors; as such they have no existence; they are mere abstractions—fictions of the imagination. The mind has no conceptions of abstractions and generals; the terms, as thus used, only connote concrete experiences of the relationships of the chemical elements, and are only of value in proportion as they are representations of those relationships, and are only useful in logic in their power of expressing large classes of individual facts or events.

We do not need to enforce our position by a consideration of the import of each of the terms referred to at the commencement of the last paragraph. We are not engaged in writing a treatise on logic, and do not wish to say more than is sufficient for the purposes of this particular criticism. We characterise the term Matter as a term of totality including all the chemical elements in the universe, and therefore as a general concrete term of particular meaning in any proposition as specifically defined or as indicated by the context. As a conception, we hold that we have no conception of it otherwise than in response to some one of the meanings just indicated, namely, either as a conception of the sum-total of the chemical elements in the universe, or in the solar system, or in the world; or as a conception of each unit, or all units, in relation to each other in terms of attraction and resistance; or as a conception of resistance only; or as resistance in relation to our muscular energy, &c. And if it be urged that these are imperfect conceptions, and that the facts transcend the conceptive powers of the mind, so be it. But again, if it is held that nevertheless we can grasp the scientific value of them, and by regarding our conceptions as symbols, can reason about them with intelligence and scientific security, again well and good; but it must be on the understanding that we can comprehend with definiteness what we are talking about. Granted the chemical elements, we have merely to classify their properties of attraction, resistance, position, aggregation, cohesion, affinity, polarity, equilibration, &c., and with these concrete applications we can go far in scientific generalisation; but we can make no progress whatever when we quit the concrete reference.

(*d.*) *Mr. Spencer's Scheme as Re-stated in his Appendix to "First Principles."*

We are now in a position to judge of Mr. Spencer's scheme for the unification of knowledge as re-stated by him in reply to our criticism. It is to be effected indeed by the terms Matter, Motion, and Force, but Mr. Spencer repudiates as insufficient for his purpose any of the specific or general concrete meanings of these words—notwithstanding that in various places, and more especially in the "Biology," the attempts actually made to work out the processes of the universe are from the concrete factors of the chemical elements in response to a concrete environment. The terms referred to are to be taken as "symbols" standing for symbolic concepts, and they are symbolic concepts, not because, like the term "The World," they can take their places in a proposition in some definite and limited meaning as representative of a concrete reality understood but not fully and perfectly conceived by the mind; but because they neither represent any such concrete reality, nor are capable of having any definite meaning, so as to be of any intelligible value in a proposition or in processes of reasoning. They are of the class of symbolic concepts which are symbolic not on account of vastness of number or bulk, but because they are obscure. Whereas the term "The World" has a concrete value in any of its meanings, notwithstanding our inability to form an adequate conception of it; the terms Matter, Motion, and Force are abstractions, and the fact that the mind fails to make any conception of them, does not put them upon the same footing as those other symbolic concepts which can have a value in a process of reasoning. As abstractions, they can have no place as factors in the actual universe, and can have no value as symbolic concepts. They can only be of value as symbolic concepts when they represent sum-totals of concrete experiences, expressing the general facts of the actual individual relationships of the objective world.

Now it is evident that the unification of knowledge, taken as the understanding of the sequences of the cosmos from the interrelations of original factors, requires that we should know these original interrelations, and is not to be effected by means of our want of knowledge of them, no matter what artifice of symbolism we may resort to. It will be observed that we speak of a knowledge of the *interrelations* and not of the *nature* of these original factors; for, as already observed in sub-section (*a*), the knowledge of the interrelations or properties of things is a knowledge of things amongst themselves, and it is futile to look beyond these.

We therefore come to the conclusion that if Mr. Spencer has framed his system on a scheme of terms which are symbols of symbolic conceptions, and symbolic because of our mental incapacity to grasp their meaning, he empties out of his scheme every vestige of intelligibility, and gives us only pale ghosts of thoughts in a shadowy world.

But in actual practice we find that this method is only used to fill up the blanks in a scheme mainly worked out by means of concrete factors. Whenever and wherever the processes are actually or presumably capable of definite explanation, that course has been pursued (as mainly in the "Biology"), but where this plan has been found inefficient, we have been put off with the other shadowy and intangible method.

This is the more easy because the two methods are pursued under the same guise. We have already seen that the set of terms employed by Mr. Spencer is used by him in the two senses. Matter, and Motion, and Force, while correctly meaning the sum totals of certain contained definite meanings, are also employed to represent impossible abstractions and still more impossible symbolic conceptions. By this inclusion of the definite and the incomprehensible in a single set of terms, we are prepared to attack a universe which is partly known and partly unknowable, and somehow or another surely we have unified knowledge!

It is true that whenever we venture upon a definite statement of doctrine, such as the universal concomitancy of the concentration of Matter with the dissipation or transference of Motion, it is difficult to keep to it as soon as we come to changes where the Motion is retained or locked up, and to changes which are not concentration of Matter nor dissipation of Motion, such as the integrations of language and the psychical correspondences generally; but then, when we begin to reflect that Matter, and Motion, and Force are only symbolic conceptions, and that by attaching definite meanings to them we land ourselves in alternative impossibilities of thought, it is clear that we ought not to attach definite meanings to them where those definite meanings do not work.

The whole process is very succinctly summarised by Mr.

Spencer in a single page of his reply ("First Principles," Appendix, p. 578).

Firstly, lines 29 to 31—"Over and over again it has been shown in various ways that *the deepest truths we can reach* are simply statements of *the widest uniformities in our experience* of the relations of Matter, Motion, and Force."

Here the foundation of knowledge is very properly put *within* our experience. Now, our experience is very varied, and is generalised in the various sciences, more particularly in the sciences of Mechanics, Physics, and Chemistry. Here are presented some very wide uniformities of nature, which we naturally formulate; and the formulations arrived at are the deepest truths we can reach.

At this point we part company with Mr. Spencer in two directions. Firstly, because he uses the terms Matter, Motion, and Force, not as terms of totality commensurate with the whole of our concrete knowledge—not as general terms summing up what we actually know—but as abstract terms representing entities that have no existence. Secondly, because he describes the uniformities of nature, in that whatever the factors, the history of the interrelations of those factors is a history of the progress from an indefinite, incoherent homogeneity to a definite, coherent heterogeneity. This universal *characteristic* is very much relied upon throughout his works as constituting the unification of knowledge, and although the truth is admitted, its efficacy in this respect is denied by us, and is not consistent with that requirement of Mr. Spencer's which looks for the unification of knowledge in the ability to *deduce all processes as corollaries from some ultimate truth.*

The next step which Mr. Spencer takes in this re-statement of his position is in his treatment of these terms, Matter, Motion, and Force. And on this same page, one of his principal confusions of thought is very neatly presented. In the first place, he speaks of Matter and Motion as being dependent upon Force; and then again he puts all three upon a level as equally dependent upon an Unknowable Power. Thus we find (line 7), "There is one ultimate component of thought into which our conceptions of external existences are resolvable;" and again (line 17), "The truths that Matter is indestructible and Motion continuous can be known to us only as corollaries from the truth that Force is persistent—that Force is that 'out of which our conceptions of Matter and Motion are built.' I have gone on to say that 'by the Persistence of Force we really mean the persistence of some power which transcends our knowledge and conception.' Throughout all which arguments the implication is that I hold Matter and Motion to be conditioned manifestations of this unknown power."

Here we have a series of dependent terms:—

(1.) The Persistence of Force, which means some power which transcends our knowledge, and which is a constant quantity:

(2.) Corollaries therefrom: namely—

The Indestructibility of Matter.
The Continuity of Motion.*

Now either the two latter are the authority in experience for the former, of which it is the sum-total; or the former is known independently to be a constant quantity, *having only two modes of manifestation*, in which case the latter are corollaries of the former. But we do not know that Force or the Unknowable Power has only two modes of manifestation, for it is not knowable. We may only know two, but really there may be many more. The question is, What is our authority for the assumption that Force is a constant quantity, and that it only has two modes of manifestation? If our authority is the Indestructibility of Matter and the Continuity of Motion, these are independent truths, and the Persistence of Force is the corollary.

But Mr. Spencer next proceeds to put Matter, Motion, and Force all upon the same level.

Line 33—"A Power of which the nature remains for ever inconceivable, and to which no limits in Time or Space can be imagined, works in us certain effects. These effects have certain likenesses of kind, the most general of which we class together under the names of Matter, Motion, and Force."

* The logic is much confused if the Continuity of Motion proves not to be a truth at all. See § 1 of Chapter III.

Here we find that we have three classes of experience; not one—viz., Force: nor two, which we often make dependent upon that one—viz., Matter and Motion—but *three* which are distinguished and classified in separate and distinct categories; and all three are made dependent upon a fourth—viz., the Unknowable Power. Here Force and its persistence are not identified, as above, with this Unknowable Power, but, along with the other two classes of experience, are made dependent upon it. All this results from the first fault of manufacturing abstractions which have no corresponding entities—from the error of changing general terms from mere expressions of sums-total into terms representative of actual existences; for when we come to use these objectivised generals or objectivised abstractions in reasoning, since they are so very shadowy, we can use them almost any way we like, and in return they can use us any way they like, if such an expression can be pardoned. Witness, for instance, the fault so often referred to of Mr. Spencer's attempt, after elaborate preparation, to formulate the interrelation of three factors in the Formula of Evolution, when one is dropped out in the process, and only two find a place there—these two themselves becoming mere shadows, and the interrelation of concomitance being so attenuated that it is completely forgotten by the time we arrive at psychological correspondences. This confirms the view that Mr. Spencer has no well-defined opinion in his own mind of the order of dependence between

The Unknowable Power,
Force;
Matter;
Motion.

It is an inconsistency to state that Matter, Motion, and Force are conditioned manifestations of the Unknowable Power, and again, that Matter and Motion are the conditioned manifestations of Force. Mr. Spencer confuses the two statements thus:—

Line 24—"Throughout all which arguments the implication is that I hold Matter and Motion to be *conditioned manifestations* of this unknown Power."

Line 33—"A Power of which the nature for ever remains inconceivable . . . works in us certain effects . . . Matter, Motion, and Force."

Matter is further on spoken of as "a certain conditioned effect wrought in us by the Unknown Power;" and on p. 579 we are told, "Matter and Motion are both regarded by me as modes of manifestation of Force."

Now suppose for the sake of the theory we admit that Matter and Motion are conditioned manifestations of Force, or that Matter, Motion, and Force are conditioned manifestations of the Unknowable Power; and suppose, too, we regard those conditions as permanent. It is evident that the conditions have the superior power over the Unknowable: the Unknowable is in bonds, and is not at liberty to uncondition itself, or change about from one condition to another; and it is as thus conditioned, and only by means of its conditions, that it is known to us. The conditions appear in our experience, and not *à priori*, to be constant; and it is this constancy of the conditions of the seventy or eighty so-called elements that is our warrant for the constant quantities of their properties in detail, and in their sums-total as expressed in the terms Matter, Motion, and Force.

We have to consider, what right have we to go beyond the manifestations as conditioned, and therefore as known to us? The Unknowable Power works in us certain definite effects, and we cannot go beyond these effects. Mr. Spencer wants to convert the totalities of certain classes of effects into actual existences making them into entities which are acting factors in the universe. But this is a very different process from the legitimate although perhaps impossible intellectual endeavour so to analyse the actual working factors of the universe into their simplest constituents that we may understand all processes as the resultants of certain simple original factors.

The fourth position is the introduction of subjectivity.

"Matter and Motion are both regarded by me as modes of manifestation of Force, and that Force, as we are conscious of it when by our own efforts we produce changes, is the correlative of that Universal Power which transcends consciousness."

Now this is a hard thing to understand. Matter and Motion are manifestations of Force. Does this mean a manifestation to us, or that Matter and Motion are conditions of Force independently of us? The question arises—Can we know anything as independent of us? I and We are evidently forces, for we produce changes; yet consciousness is not a mode of Force, for it is not included in Balfour Stewart's list of Forces and Energies, and is not interchangeable with members of the series. Presumably Mr. Spencer does not mean that consciousness produces changes, but only that the forces of the organism (in response to the environment), of which we are merely conscious, produce the changes in question; and that this force (or forces) is the correlative of that Universal Power. Yet this cannot be, because the forces of the organism are manifestations of, and therefore cannot be the correlative of, that Unknowable Power. But what is the meaning of correlative? Must a correlative of an Unknowable Power be itself a force or power? If so, that force or power is not all-inclusive. What, then, is consciousness, and what is effort, and what is the Ego which exercises them and produces changes?

Then, again, can we speak of the physical universe as independent of us, as antecedent to us, and so treat of it that we are corollaries of its original factors? Either we can do so, and we are able to elaborate organisms from purely physical factors, as attempted in Mr. Spencer's "Biology," consciousness coming in mysteriously and unaccountably as the subjective aspect of a physical event over which it has no controlling influence, and in which the biological function of feeling is not a factor—or else we cannot do so, but must recognise consciousness as a factor, requiring a position to be assigned to it in the scheme of things. Is it a factor or is it not? If so, when and where did it come in? At the beginning, or at some subsequent stage of physical development?

But what we have more particularly to point out is that in Mr. Spencer's scheme, as thus announced by him, we have the whole treatment of knowledge made dependent upon subjective experiences, without recognising an objectivity independent of us, of which we have but a kind of picture. Yet in his exposition the objectivity is treated as antecedent and independent—

a universe of whose interrelations we are but incidents. In the latter case we must recognise physical factors independent of us; and if, as Mr. Spencer says, we are unable to do this, but only know force in our own consciousness, and can have no notion of external force, even knowledge itself, and much more its unification, is impossible.

But if Mr. Spencer means only that our consciousness is correlative with the externality in the sense of corresponding with it, and enabling us to recognise it and its changes, he only means that consciousness is consciousness of forces independent of itself, and amongst which it has no place, and its connection with which cannot be understood. All which considerations throw no light upon the unification of knowledge, but rather the reverse, and do not make Mr. Spencer's scheme any more intelligible.

We now come to the last position, which is the theory that all knowledge can be unified by a statement of the relations of factors, the factors themselves being unknown. Our previous exposition as to the nature of abstractions (Chap. i. § 6 and Chap. ii. § 2) shows conclusively, we think, that everything is its relations and nothing more—everything is nothing "in itself"—every entity consists of its properties, and its properties are nothing but relations. Therefore to consider a thing "in itself" is an impossible proceeding. Each factor is a factor in relation to other factors, and its properties are properties in relation to other factors. Each factor is a bundle of relations. It is all very well to say that it must be something in itself, and that this self must be differentiated in order to produce the differentiated relations; but it amounts to nothing; for it is only in the actual intercourse or relations of things that any changes take place, and this is all that we know and all that takes place in the actual physical universe. If Science is ever able to recognise things in themselves, all well and good; it will not add anything to knowledge; for even if all things were reduced to two factors, knowledge will refer to the interrelations of these two factors, for there can be no interrelations of one factor. When we come to that position, Science ceases, and only speculation proceeds to dream about self-determination or the instability of the homogeneous.

But when Mr. Spencer speaks of unifying knowledge by means of formulas expressing the relations of factors, the factors themselves being unknown or even unknowable, we reply,—If the relations of the factors are known, the factors themselves are known. The interrelations constitute the factors. We seek for Mr. Spencer to state where he formulates these relations and thereby accomplishes the unification of knowledge. Does he do so in the Formula of Evolution or does he not? If so, does he mean to say that we can have a conception of concentration and dissipation without having a notion of units of resistance and therefore of extension? Or can we have a conception of motion without the same? To throw the stress upon integration and dissipation, and ignore the limitations of Matter and Motion, is simply to say that all changes of every combination are either changes of combination or changes of decombination, which is only a change of words, and to say that the change is from homogeneity to heterogeneity is merely descriptive. The addition that the contained motion undergoes parallel transformation is either descriptive also, or involves a specific definition of motion, which Mr. Spencer repudiates.

The question really is whether Mr. Spencer shall be kept to definite meanings when he speaks of the interrelations of factors, or shall he be allowed sometimes to use them in their definite meanings (which are all that come into our calculations), and sometimes run away from them behind the scenes, letting them come out again in definite shapes when they have to do concrete work. This brings us to the end of the first stage of Mr. Spencer's reply and to his algebraical illustration of the theory we have just been considering.

(*e*.) *On the Algebraical Illustration of the Theory that Knowledge can be unified by means of the Formulation of the Relations of Factors, the Factors themselves being Unknown.*

Mr. Spencer says (p. 578, line 32)—"Matter, Motion, and Force are but symbols of the Unknown Reality."

Line 40—"The interpretation of all phenomena in terms of Matter, Motion, and Force is nothing more than the reduction of our complex symbols of thought to the simplest symbols; and when the equation has been brought to its lowest terms, the symbols remain symbols still."

The question hence arises, what does Mr. Spencer mean by a symbol? Does he mean a sign which stands for something known, or a sign which stands for something unknown? Evidently the latter, if we may judge from the expression that "symbols remain symbols still," more particularly as he has just said that "our idea of a unit of matter or atom is regarded by me simply as a symbol which the form of our thought obliges us to use, but which we cannot suppose answers to the reality without committing ourselves to alternative impossibilities of thought." What, then, is the use of a symbol if symbols remain symbols still and are not convertible into definite knowledge? and how can actual knowledge be unified by means of symbols which do not answer to anything definite? How can knowledge be unified by means of propositions framed of symbols that are merely symbols, and which, if we attach definite meanings to them, land us in alternative impossibilities of thought? How can an ultimate truth be expressed in mere untranslatable symbols, from which all other truths are deducible as corollaries? As long as symbols remain symbols, the formula in which they are employed is utterly useless for the unification of knowledge. Mr. Spencer says that his method consists in the reduction of our complex symbols of thought to the simplest, but this process of reduction to simplicity is in reality the illegitimate process of abstraction, followed by the objectivising of these abstractions.

Mr. Spencer proceeds to illustrate his position algebraically. He says—

"I have repeatedly made it clear that our ideas of Matter, Motion, and Force are but the x, y, and z with which we work our equations, and formulate the various relations among phenomena in such way as to express their order in terms of x, y, and z."

We fail to see that Mr. Spencer is justified in the use of this illustration, and we have examined his works in order to inquire whether he has anywhere thrown his doctrines into proper algebraical form. Of course, when a science such as that of mechanics or chemistry can be couched in rigid mathematical language, it has attained the highest point of certitude and unification. But we think it must be the opinion of every candid reader that Mr. Spencer has not worked out his scheme by means of equations at all, and we do not know what Mr. Spencer could have been thinking of when he says he has done so. Would he specify where the equations are?

We also ask, is it really the fact that Mr. Spencer has treated Matter, Motion, and Force as x, y, and z? The "Principles of Biology" is the most important of his works, and in it his factors are the well-known properties of oxygen, hydrogen, nitrogen, carbon, and other elements, as internal factors; together with incident molecular motion, ethereal motion, &c., as external factors. He advances all these as if his readers would be able to assign to them all definite values, and as if they would understand him when he spoke about them. He did not tell us that they were only symbols standing for something we did not know, and that at the end we knew as little about them as at the beginning—that the symbols were but symbols still. Of course, if Mr. Spencer means that we do not know what oxygen is "in itself," and that we can only speak of its relations with the relations of other unknowable things "in themselves," we quite understand that, and are quite aware that we have to deal with the relations or properties of the factors alone. We perfectly apprehended the nature of the calculation, but found ourselves unable to arrive at Mr. Spencer's results. It seems quite beside the question and outside this calculation altogether to speak of x, y, and z as having anything to do with it, either as representing the specific differentiations of oxygen, nitrogen, &c., "in themselves," or as representing the differentiations of some shadowy abstractions of absolute Matter, Motion, or Force. We really do not see that they had anything to do with it. Most certainly if they had, the calculation was vitiated for us. It is absolutely impossible for us to draw out the *resultants* of a mixed quantity of known and of unknowable factors. If we have known factors *plus* an unknowable reality, we cannot do our work. Then as to equations in anything like algebraical form, there are none of them in the "Biology." Mr. Spencer is under a delusion when he thinks he has been working equations.

As to Inorganic Evolution, surely we ought to be able to express the process of equilibration—by which the union of oxygen and hydrogen (forming water) is effected—in terms of x, y, and z; and similarly with some of the other processes of the biological factors; so that we might mount up gradually to the equation of a moving equilibrium, and afterwards of a dependent moving equilibrium. Such a task would be difficult, no doubt, but possibly some future philosopher might be able to furnish us with equations of the manner in which the adjustments of direct and indirect equilibration of dependent moving equilibria are effected, and explain by means of an algebraical formula the law of the redistribution and redirection of the interior forces of an organism in antagonism to incident forces which would otherwise destroy it. And might we not, indeed, look for an algebraical explanation of genesis and reproduction, and of the need for the continuance of species? In the meantime, we venture to submit that although Mr. Spencer may think he has given us equations, he really has not done so.

Mr. Spencer seems to say that the unification of knowledge is effected if we can "formulate the various relations of phenomena in such way as to express their order in terms of x, y, and z," although the realities for which x, y, and z stand cannot be conceived by us.

We know the properties (*i.e.*, the mutual relations) of the chemical elements, and we know the laws of physics. The problem is first to classify them, to ascertain their most general relations, and then to express their order. When we express their order, we must do so in those general terms which are commensurate with the facts to be expressed. If we symbolise them by means of names, these names are symbols of those most general relations, and have definite values. Each term implies an appreciable differentiation of meaning. We do not say that much can be effected in this way—probably not; for we do not believe in the possibility of the unification of knowledge. But evidently, if it is to be done at all, it is to be done in this way.

Mr. Spencer says, make the terms indefinite—make them symbols which do not mean anything so definite as to embarrass you when you are required to bring them into actual application with the phenomena you wish to unify. Do not allow them to be retranslatable, but let them remain symbols still. But is anything accomplished? An obvious criticism would be that unless x, y, and z have definite meanings attached to them, there is no differentiation which justifies them—what then is the cause of their being distinguished at all? Why should there not be two only? or why, on the other hand, should there not be ten or twenty? Evidently they have been arrived at by a process of analysis, generalising, and distinguishment of difference; and in order to justify us in distinguishing x from y, and both from z, they must have had previous histories and some differentiation of meaning. Nay, what is more, this meaning and this value must be strictly dependent upon such previous history. We cannot use experience to mount as by a ladder to abstractions, and then, despising the foundations, allow abstractions from their high position to lord it over obedient concretes. Therefore we utterly dispute the truth of Mr. Spencer's dictum that x, y, and z can be used without definite meanings, and that the order of phenomena can then be expressed by their means.

Such a method is a parody upon algebra. It would seem that although reasoning by means of symbols, as in algebra, is very abstract, still it is reliable and useful when its empty forms are filled in with concrete things. It starts from the concrete, it symbolises concretes, it reasons about them, it comes to conclusions about them, it retranslates itself into the concrete, and the result can be tested by practical application. Reasoning like this is only a leap into the air of abstraction. It starts from actual facts and it ends in concrete knowledge. Symbols are signs that stand for something—symbols that do not symbolise lose their functions. To say that we can reason about the relations of symbols, while the symbols themselves do not mean anything definite, is most unphilosophical.

Relation implies knowledge; we cannot say anything about the relations of symbols without knowing something about the things symbolised, namely, their relations or properties by which they are distinguished from one another and by which they are related to one another; in fact, that is all we know about them. If we can generalise these relations in such a way as to be able to express them all in a general formula, that is well: the problem is how to do it. Even then our result will only be a general description, and will not be the unification of knowledge, which requires all phenomena to be deduced as corollaries from an ultimate truth corresponding to processes resultant from the properties of primordial factors.

And after all, the argument comes to the same thing, whether we use the terms x, y, and z, as Mr. Spencer proposes, or the terms Matter, Motion, and Force. If the latter mean no more than the former, they are mere symbols, although they are more to look at, and their employment seems to give more satisfaction to the mind of the reader than would the actual replacement of them in the text by the symbols x, y, and z.

If the unification of knowledge is effectible by means of the relations of x, y, and z, we naturally ask what these relations are. We should have a list of them. Is it, for instance, a relation of x that it manifests resistance? If so, what is it in relation with when it manifests resistance? Some other x? X then is in relation to x in manifesting resistance. Is x in relation to x in mutual attraction also? Has it also the relation of extension? Is x related to x in respect of polarity? Are there varieties of these relationships consequent upon diversities and correspondences of Resistance, Attraction, Extension, and Polarity? We suppose we are not going beyond the terms of the hypothesis in taking these to be the relationships of x.

Then as to the relationships of y. Has y any relationships in respect of other y's? Has it any relationship to x? or, again, is it only a manifestation of x? Or still again, is it a result of the relationship of x's consequent on the Attractions, Resistances, Extensions, and Polarities of x's? And again, can we speak of x's in the plural at all, implying a differentiation of x's? Yet how can we deal with it in the singular?

According to the Formula of Evolution, the approach together of some x's implies the retrocession of some other x's, so that the measurements apart of all x's in their totality is constant. This means that y is constant—so much y one way, so much y another way. But note how difficult it is to speak of y without having one eye on Motion, so as to speak of it in an intelligible manner. It does not seem possible to speak of the integration of x and the dissipation of y without bringing in the notions of Resistances, Attractions, Extension, Polarity, and consequent Motion. Does Mr. Spencer allow these terms to come into account in his hypothesis that all knowledge is to be unified in terms of the relations of x, y, and z? If not, then he should show us how it is to be algebraically worked out. But if so, then we submit that we did not trespass beyond these in our former criticism, which his reply does not in the least respect touch.

The matter is still more complicated if we go beyond this and speak of the relations of z to $x + y$. Can Mr. Spencer express the relations of z to $x + y$ in terms of any of them? Is $z = x + y$? Is it ever z by itself? Is $z = x + y +$ something else? Is it z singular or z's plural? What are the special relations of z to x, or of z to y? Can Mr. Spencer tell us what are the relations of z to the special relations of x called Attraction, Resistance, Extension, and Polarity?

Then, again, is there any other factor beyond the end of the alphabet altogether, say $<$? and how is that related to x, y, and z?

To us it seems illogical to speak of the relations of terms having no meaning. We think it is due that some pains should be taken to explain the unification of knowledge when some or all of the so-called factors are merely symbols, having no definite meaning.

It appears, then, that if we change the terms Matter, Motion, and Force into x, y, and z, it does not make the least difference either in Mr. Spencer's reasoning or in our criticism. The actual conceptions involved remain the same, and whether we speak of Matter, Motion, and Force, or of x, y, and z, the argument remains the same. In either case we are actually dealing with Attractions, Resistances, Extensions, Polarities, and Motions, of specific chemical elements, and *their* inter-relations. It is impossible, if we are to make anything of our doctrine at all, to treat it otherwise than as having definite factors. We cannot deal with concrete changes except from the properties of concrete factors.

At the same time there still remains the question whether by either of these sets of terms Mr. Spencer could treat each mode of manifestation as pre-existing or co-existing. But these notions seem to be so very abstract as not only to transcend actual experience, but also the power of "scientific imagination." One might perhaps imagine ultimate units having equal properties, Attraction, Resistance, Extension, Polarity, and Motion, but it is difficult to see of what use such a supposition would be; and it would be impossible to suppose Matter and Motion as independent and unrelated factors.

On the other hand, are we to consider these Attractions, Resistances, Extensions, Polarities, and Motions as combined into bundles indecomposable, as we know them in the seventy or eighty so-called elements, so that what we have to deal with would be not x, y, and z in the abstract and impossible manner of Mr. Spencer, but so many diverse bundles of x, y, and z?

§ 3. *The Double-Aspect Theory.*

The only other method of escape from the effect of our criticism is by means of what is known as the Double-Aspect Theory. Mr. Spencer maintains that his theory is neither materialistic nor spiritualistic. The school of thought to which he belongs holds that all knowledge has two aspects. All events are both objective and subjective, and are stateable in two different ways, in two different sets of terms, according as the fact or event is regarded. In a great many cases the subjective language is used when the main interest is in regard to its subjective importance. In other cases objective terms are employed because the main import is in regard to physical interrelations. But as a matter of fact, any event may be described in language drawn from either department. It will be our duty later on to discuss this theory in detail. At present it is sufficient for our purpose to ascertain how it affects the unification of knowledge upon the lines we have been pursuing.

The criterion of accomplishment which we have kept steadily in view throughout all our studies is that passage from Mr. Spencer's Summary of "First Principles," which will be found quoted *in extenso* at page 9 of this work. Therein the task propounded was the formulation of the whole series of changes passed through by every existence, both anterior and subsequent to their having concrete forms, and in their passage from the imperceptible state to the perceptible state. Presumably this task is identical with that by which we look for the philosophic unification in the formulation of one primordial truth or fact from which cosmical histories can be deduced by a series of corollaries. It is no doubt identical also with the statement that the unification of knowledge is effected in the recognition of these histories as one process, being resultants of the relations of primordial factors.

How then does the theory of the Double Aspect assist in the solution of the cosmical problem, and how are Mr. Spencer's detailed explanations of developmental histories facilitated by its aid?

We recall the account given in Appendix to vol. i. of the "Biology" of the development of organic molecules from inorganic, and we recall the history of biological evolution which takes up the study of the process from that point. In this latter we recollect that all morphological and functional developments were accounted for as due firstly to the nature and peculiarities of the chemical compounds in relation with a certain physical environment, and afterwards to the polarities and equilibrations of physiological units and masses.

These explanations are all effected in purely objective terms. Feeling, or the subjective, is excluded as not having anything to do with the organised result. If the explanation were good and sufficient (which it is not), then that explanation which Mr.

Spencer deems sufficient would be accomplished in the objective aspect purely. Let us see how (feeling being excluded as a factor) the explanation is assisted by an attempt to give the objective terms used in the explanation a subjective aspect also. Take, to begin with, the building-up process by which crystallisation is effected. This natural process is ascribed to the mutual attractions and repulsions of atoms or molecules, which, having special sizes and shapes, produce when thus ranged together definite structural forms of aggregation. What is the subjective aspect of the process? The subjective aspect of this independent natural event is simply the mode in which it affects us, and which we have to take into account in our description of the observed combinations, but it is not at all an element in the actual changes which have taken place. The subjective is of course present in all statements of knowledge. Knowledge implies both the subjective and the objective, and therefore all knowledge may be supposed to have a double aspect, namely, the aspect of how the objective affects the subjective, as, for instance, the manner in which ethereal undulations $\frac{1}{44000}$ of an inch affect the consciousness; and an objective aspect, for instance, the independent relations of the chemical elements and their changes amongst themselves. But when we come to introducing the subjective aspect into such objective explanations, we can only mean one of two things—firstly, either that the subjective is a factor in the combinations, a theory which could not be maintained; or, secondly, that in order to understand explanations in objective processes we must have some common element in the objective and the subjective, some simple standard of knowledge common to both. This would be found, as Mr. Spencer partly suggests, in the objective fact and the subjective impression of resistance, and in the objective fact and the subjective impression of attraction (weight). Here, truly, we have a double aspect of fundamental terms, but even thus the series of events is determined by the objective, and the subjective aspect merely follows. The cosmical explanation as given by Mr. Spencer in physical terms is full and complete in itself; it is double-aspected because the knowledge of it by the subjective adds to it the feelings of the subjective. Hence all knowledge has a double aspect. But the series of sequences which make up the cosmical history, as given by Mr. Spencer, is independent of the subjective.

From this it may be asserted, that since all knowledge implies the subjective, there can be no unification of knowledge without the subjective. Be it so. Is there any unification of knowledge with it? Suppose that the fundamental knowledge of attraction and resistance is true knowledge, and that the subjective is implied in all the objective processes described by Mr. Spencer in objective language as resultants from these fundamental conceptions which have the double aspect. Suppose, even, that we add to them the conception of Force, which is a term capable of a double aspect, and try to effect our explanations by means of Attractive Force and Resistive Force. Still, in working out the cosmical history, including biological evolution, we should have to follow Mr. Spencer, and never stray beyond the bounds of the objective aspect. The whole series of determining causes would be found to be in the objective aspect of the problem. The explanations would be effected in the language of Attraction and Repulsion and their derivatives, size, shape, distance, approach, retrocession, aggregation, disintegration, polarity, equilibration, &c. Although essential to the knowledge of these processes, still by no means could we introduce the subjective as a factor, even if it is included in our appreciation of the original factors. Nor can we even introduce it as an accompaniment until most unaccountably it introduces itself gradually into the objective processes, some will think as a factor, although Mr. Spencer repudiates it. This growth of self-consciousness amongst factors which we only recognised as unconscious is most unaccountable, and is a difficulty not to be got over by mere nomenclature. Surely there was no double aspect anterior to organised living beings? Whence then came the double aspect? Knowledge is not to be unified until this explanation can be given.

As the unification of knowledge is only to be accomplished in the formulation of a syllogism which is to explain every differentiation, every structure, every organism, and which shall be the key to long and intricate series of sequences, including the origin and development of organised consciousness, as *resultants* from the relations of some simple factors, then that original simple state of things from which all these complicated results ensued must be expressible in terms which specify the relations of the two aspects; and if the original relations and the subsequent developments are expressed and worked out in terms of one only of these aspects, then such an exposition is imperfect as a representation of the actual course of things and fails of being a complete and true picture of the history of the cosmos.

This is what Mr. Spencer has done; he has worked out his scheme by means of one aspect only, by means of the objective set of terms only. And when he has done that, it is not fair to say, "After all, things have a double aspect, and this explanation is not complete if you take the terms in the limited meanings of materialistic and mechanical interpretations," when all the while he has so employed them apparently to his own full satisfaction, without at the same time making a completion of his work by specifying the relationship between the two aspects which would accomplish it. If he cannot do this he must abandon as impossible the claim of unifying knowledge.

If all knowledge has a double aspect, then knowledge cannot be unified until the relation of the two aspects is understood; until we know the value of the terms we use in both aspects; and until the whole series of cosmical events is capable of being formulated in two corresponding sets of terms parallel and without break of continuity nor interchangeableness. To employ one set of terms to commence with, and another set of terms to end with in a history of cosmical evolution, is not a conformity with the requisite conditions. To begin with oxygen, hydrogen, and a cooling nebula, and to end with emotions and thoughts, is not a concomitant "double aspect,' but a revolution. We do not get at the sequences of events as "resultants" of the original state, but find ourselves turned round and occupying a different position altogether from the deductive intentions with which we started.

This kind of Double-Aspect Theory is a looking at a series of sequences from two ends. We mentally stand at the beginning of things, looking down the long vista of physical change, and again we stand in this modern age—an ego—looking back through the ages. We recognise from each point of view long lines of sequences merging into each other in the misty mid distance, but there they intermingle, and the nature of their connection we cannot discern.

The Double-Aspect Theory is of no use for the comprehension of cosmical history. It is at best but another method of stating the doctrine of the Relativity of Knowledge. There is no knowledge without a knower, and no knowledge of the objective but as the knower is capable of knowing it. But if fundamental knowledge is the impression of resistance and attraction, and fundamental objective facts are resistances and attractions, the objective can be known as it is. Here the Double-Aspect Theory is a key to knowledge by the subjective of the objective, but it is merely a key to the sequences of the objective; it does not aid us in accounting for consciousness making its appearance in the series of physical events, nor does it assist us in the failure of the physical explanations of biology.

The most plausible ground on which this theory is maintained is in the fact of the concomitance of feeling with some of the processes and actions of the physical organisms of living creatures. It is a favourite method of representing it to say—Here we have a certain nervous change in the optic nerve, and a concomitant feeling of yellow. This is not two events, but one event, and we speak of it in either mode according to the point of view from which we regard it. It is one fact with a double aspect. On this we would observe, that, in regard to the unification of knowledge, it is all quite beside the mark. We are engaged in investigating a series of consequences; at one time there was no double aspect—now there is. Whence came the double aspect? It may be quite true now that physiological phenomena have double aspects, but this does not afford an answer to the question of origin, and the advancement of it does not assist in the solution of the problem of the unification of knowledge as propounded by Mr. Spencer in the passage quoted. Unless, indeed, the unification of knowledge is abandoned in this view of it, and is sought to be effected by those other separate and independent sets of methods treated of in our criticism of Mr. Spencer's psychological methods. But these we have seen to be of no value or interest, as not being of a kind to give us insight into the sequences of the universe.

§ 4. *Criticism to which Mr. Spencer has not Replied.*

It is desirable to call attention to some of the detailed criticism of our former work to which Mr. Spencer has not replied, but which he holds has been answered by implication in his general reply. This general reply is to the effect that if we had correctly understood his terms Matter, Motion, and Force as merely symbols, and borne in mind his position, that by attaching definite notions to them any argument founded thereupon landed us in contradictions of thought, then we could not have written the book at all. Our work, however, would seem to enforce Mr. Spencer's dictum and to exhibit the truth of his remarks. And indeed his own great works do but bear out the truth of the same proposition, for whenever Mr. Spencer attaches any definite meanings to his terms, although we may proceed safely for some distance, yet in the end we are landed in alternative impossibilities of thought. In our criticism we did but illustrate the truth of Mr. Spencer's views against himself, and his own work is but a vindication of the mysticism or scepticism—which is it? to which he gives expression in his reply to criticism.

Let us ask in detail what efficacy there is in this vague reply to our definite charges of want of logical continuity of exposition in the omission from the Formula of Evolution of one of the three factors proposed at the outset as essential to its formulation? What answer is it to the charge of inapplicability of the formula to the differentiations of feelings, to the integrations of society, language, æsthetics, and superorganic evolution generally, in respect of the universality of the concomitance of integration of matter and dissipation of motion? What reply does it afford to the criticism as to the Instability of the Homogeneous? How does it help to explain the passage of the inorganic to the organic which we found impossible?

§ 5. *Summary.*

Our previous criticism of Mr. Spencer's work was to the effect that he could not escape choosing between two alternatives, namely—

> Definiteness with Insufficiency, or
> Indefiniteness with Incomprehensibility;

in either of which cases the unification of knowledge is not effected; for this unification requires that the whole operation should be within the sphere of the known and knowable, otherwise it is beyond the bounds of science, and is not knowledge at all. The partial unifications of knowledge which constitute the sciences are definite and comprehensible, so much so as to give us the power of prevision. Philosophy at the outset of our studies was set forth as merely the extension of this kind of knowledge, and therefore should be, although more general, yet just as definite, comprehensible, and precise, conferring the same power of prevision, which is the same thing as the calculation of sequences from known factors. This is the same thing also as the deduction of corollaries from ultimate truths.

Mr. Spencer's reply amounts to this, that he does not accept the alternative of Definiteness with Insufficiency, but that he accepts the alternative of Indefiniteness with Incomprehensibility. We therefore deny that he has effected the unification of knowledge. It is for the student to judge for himself.

It is true Mr. Spencer may maintain that he holds a clear and definite theory. But we believe that he has failed to make himself generally understood in regard to his main point as to the unification of knowledge; and if so, then it is his duty to set himself right with the thinking world, as otherwise he has failed in the main object he has in view in writing at all, namely, to get people to understand and intelligently accept his doctrines.

CHAPTER III.

MISCELLANEOUS.

§ 1. *The Continuity of Motion.*

We have seen in our endeavour to understand Force that we have been obliged to recognise it as manifesting itself in two ways, and two ways only, namely, the way in which it presses and the way in which it resists, otherwise stated as attraction and repulsion.

This view meets with a singular confirmation in "First Principles," p. 514, where Mr. Spencer says—

"We have seen (§ 74) that phenomena are interpretable only as the results of universally coexistent forces of attraction and repulsion. These universally coexistent forces of attraction and repulsion are, indeed, the complementary aspects of that absolutely persistent force which is the ultimate datum of consciousness. . . . And from this necessary correlation results our inability, before pointed out, of interpreting any phenomena, save in terms of those correlations."

We now wish to compare several statements of Mr. Spencer's with the results thus arrived at, and more particularly his theory of the "Continuity of Motion."

This theory is explained in chap. v. of "First Principles," p. 180:—

"The Continuity of Motion, like the Indestructibility of Matter, is clearly a proposition on the truth of which depends the possibility of exact science, and therefore of a Philosophy which unifies the results of exact Science. Motions of masses and of molecules, exhibited by bodies both organic and inorganic, form the larger half of the phenomena to be interpreted; and if such motions might either proceed from nothing or lapse into nothing, there would be an end to scientific interpretation of them. Each constituent change might as well as not be supposed to begin and end of itself."

Page 182—"Whether that absolute reality which produces in us the consciousness we call Motion, be or be not an eternal mode of the Unknowable, it is impossible for us to say; but that the relative reality which we call Motion never can come into existence, or cease to exist, is a truth involved in the very nature of our consciousness. To think of Motion as either being created or annihilated—to think of nothing becoming something, or something becoming nothing—is to establish in consciousness a relation between two terms, of which one is absent from consciousness, which is impossible. The very nature of intelligence, negatives the supposition that Motion can be conceived (much less known) to either commence or cease."

We will compare these statements with "Lessons in Elementary Mechanics," by Magnus, afterwards with Mr. Spencer's chapter on "Equilibration," and finally with Professor Balfour Stewart's "Conservation of Energy."

Magnus divides his treatise into three parts—1st, Kinematics or Motion; 2d, Dynamics or Force; 3d, Statics or Rest.

We find (p. 6)—

"We thus see that bodies themselves and their molecules are constantly in motion or tending to move; that absolute rest nowhere exists; and that what we call rest, which is really rest relatively to us, can be analysed into counteracted tendencies to motion."

It will be convenient for us to commence with the second part, and consider the nature of Dynamics, or the science which deals with the cause of motion—that is to say, Force.

Page 61—"The principal properties of matter, with which we are concerned, are, that it moves and offers resistance to the motion of other bodies. Now, force is the name given to the unknown causes of all the various phenomena which matter exhibits: and as all these phenomena are accompanied by motion or the tendency to motion, we shall understand *by force whatever produces or tends to produce motion or change of motion.* . . . We shall find it convenient and desirable to consider force as the cause of motion, and wherever we find motion or change of motion we shall assume the existence of force."

It would appear from this that Force is the tendency to move (*i.e.*, Attraction). Motion is the result of that tendency when not opposed. It would also appear that the tendency or Force does not result in Motion when counteracted by other tendencies or Forces, and that the relation of equilibrium between the tendency or Force and the opposing Force is a state of rest or equilibrium. A study of Mechanics would also show that there are cases of the pure acceleration and retardation of Motion, thus proving the variability of the quantity of Motion.

Mr. Spencer says it is impossible for us to say that "motion can ever come into existence or cease to exist." "To think of Motion as either being created or annihilated—to think of nothing becoming something, or something becoming nothing . . . is impossible." But surely this is an erroneous way of putting the case, for Motion is not a thing at all. It is not an existence —that is to say, it is not a mode of Force. It is neither a force of attraction, nor a force of repulsion,—the only two modes of Force known to us—but simply one of the results of the interaction of these modes of Force, the modes of Force themselves remaining quantitatively the same whether resulting in actual motion or not. Thus when a motion begins it does not come into existence or get created, and when it ceases it does not go out of existence or become annihilated. The fact is simply this: that quantums of attractive or repulsive forces become related to each other in a different manner—*i.e.*, the manner of rest or equilibrium—instead of the manner of motion.

Magnus clearly recognises this fact of the commencement and the ending of motion. (See pp. 2 and 3.) The picture on the wall tends to fall, and

"Let a window or fireplace be opened, let the air be freed in some direction from restraint, and it will at once obey its tendency and *begin to move*. . . . All that observation teaches us is that bodies tend to move."

It is singular that Mr. Spencer takes all his instances in proof of the continuity of Motion from cases of the retardation of Motion. Bodies in motion come to rest not so much in consequence of the attraction of the earth or counteracting forces, as in consequence of the resistance of the atmosphere, of friction, and of actual contact with other bodies, which all cause so many subtractions from the motion of the moving body until none is left, so that finally all the motion in the moving body is transferred to other bodies. Even amongst cases of the retardation of motion, the most simple case of a body projected upward is not taken notice of, but only the more complicated and obscure instances are adduced, in which the influence of gravitation is small and obscure, and the influences of resistance and friction are conspicuous.

Cases of acceleration of motion are not even alluded to. The case of the acceleration in motion of a falling body is not mentioned, nor is it easy to see how the doctrine of constant quantums of motion could be maintained if these accumulated accelerations were taken into account, without any means of predicating a corresponding decrement of motions elsewhere, which indeed in the case of a rock falling from a state of rest on a precipice cannot be discerned.

If we consider the case of a body projected upwards—say a cannon-ball—we find that it imparts some of its motion to the air, and finally it comes to a state of rest, having expended all its motion: and yet in its immediate descent it imparts just as much motion as before to the atmosphere, and finally on its impact with the ground originates a certain amount of heat therein as well as in itself. The motion imparted to the air in its ascent, according to Mr. Spencer's theory, is continuous for ever, and is not received back again by the cannon-ball in the course of its descent, but instead thereof it imparts another modicum of motion to the air, which motion also continues for ever. And it must be borne in mind that we are now discussing not the constancy of the quantity of force, but of actual motion.

It will be worth our while again to consider the case of an ex plosion of gunpowder or dynamite. Here there is no evidence of a vast amount of motion actually going on unseen in the solid particles of the substance. The substances are as quiescent as sugar or salt. Their ignition causes a vast amount of motion. Yet the inference that a corresponding amount of motion was actually in existence in the molecules of gunpowder or dynamite is not justifiable. Here is a commencement of motion, an enormous increment of motion consequent upon the small amount of motion used in the ignition of the substance.

The theory of "Continuity of Motion" implies that motion is always and necessarily caused or produced by an equivalent antecedent motion transferred from one body to another, and not by a Force.

It will be noted that in this argument we do not take account of the quantum of force or energy, which remains the same, but question merely the quantum of actual motion. And the difficulty is not disposed of by Mr. Spencer's device of "locked-up motion." Motion is not intermittent. It must be continuous. It is this continuity that is the point of the discussion. If Motion is locked up, it means that it is intermitted; it is not going on—it is not Motion. The locking up of Motion is a denial of the continuity of Motion. Motion stops and begins again. Motion, therefore, is not continuous. In various parts of Mr. Spencer's works occur references to "locked-up motion," as in coal and nitrogenous compounds. Is motion "locked up" in a stone upon the edge of a precipice?

Having now considered the case of the beginnings and endings of motions, and the consequent increments and decrements of the sum-total of motion, let us next view the matter from the point of view of Statics, Rest, and Equilibrium, as set out by Magnus and by Mr. Spencer himself. We begin by quoting Magnus (p. 167):—

"Problem of Statics.—The problem of Statics is to determine the conditions under which several forces acting on a body produce equilibrium."

Page 168.—"Forces in Statics are supposed to be prevented by some kind of resistance from producing motion."

"If two forces act upon a body, it is clear that, in order that they should produce no effect, they must act (1) at the same point; (2) in opposite directions; and (3) they must be equal in magnitude."

Page 169.—"When the forces produce equilibrium, their joint effect equals zero, or the resultant vanishes."

"If any number of forces acting at a point be in equilibrium, and one of them be removed, the resultant of all the rest is equal in magnitude, but opposite in direction to the removed force; for, since the forces were originally in equilibrium, the removal of one force must destroy the equilibrium, since all the other forces served to counteract the effect of this one."

This view of equilibrium is recognised by Mr. Spencer in his chapter (First Principles, chap. xxii.) on Equilibration.

Page 484.—"In all cases there is a progress towards equilibration. That universal co-existence of antagonist forces which, as we before saw, necessitates the universality of rhythm, and which, as we before saw, necessitates the decomposition of every force into divergent forces . . . at the same time necessitates the ultimate establishment of a balance. Every motion being motion under resistance is continually suffering deductions, and these unceasing deductions finally result in the cessation of the motion."

As usual, this conclusion, according to Mr. Spencer, is deducible from the Persistence of Force.

Page 515.—"But the forces of attraction and repulsion being universally co-existent, it follows, as before shown, that all motion is motion under resistance. . . . This being the condition under which all motion occurs, two corollaries result. The first is, that the deductions perpetually made by the communication of motion to the resisting medium, *cannot but bring the motion of the body to an end* in a longer or shorter time. The second is, that the motion of the body cannot cease until these deductions destroy it. In other words, movement must continue till equilibration takes place; and equilibration must eventually take place. Both these are manifest deductions from the persistence of force. . . . Hence this primordial truth is our immediate warrant for the conclusions, that the changes which Evolution presents cannot end until equilibrium is reached; and that equilibrium must at last be reached."

This passage is open to two or three interpretations. Firstly, it may mean that all forces eventually counteract each other, and all motions cease, which seems a reasonable proposition. In this case, the theory of the Continuity of Motion comes to an abrupt end. Secondly, it may mean that "the changes which evolution* presents," must finally result in an equilibrium. In this case it would be equivalent to saying that all matter will have been integrated and all motion dissipated, and that there can be no more changes. This is the ultimate equilibrium. But this statement is utterly incomprehensible. Such an utter separation of matter and motion is impossible to conceive. Thirdly, it may mean that we arrive ultimately at an *equilibrium mobile*—an universal alternation of motion—a dissolution of the cosmos into its ultimate units, having equal alternate motions: either that or no motion at all; for if there be an universal counteraction of forces there will be an universal quiescence.

But even if there is not the assertion of such an universal quiescence, there is in Mr. Spencer's statement an acknowledgment of the fact of the combination of forces resulting in absence of motion. He recognises the state of rest described by Magnus, and this recognition of a state of rest is an admission of the possibility that forces tending to motion may not effect that result on account of the counteracting tendency of other forces. The theory of a statical equilibrium is inconsistent with the theory of the Continuity of Motion.

We argue, therefore, that whether we consider the matter from the point of view of the beginnings and endings of motion, causing occasional increments and decrements of motion, or whether we consider it in relation to the theory of equilibrium, we find the theory of the Continuity of Motion to be untenable. We also find that it is not a deduction from the Persistence of Force, since different manifestations of force can counteract each other. And we do not find it justified negatively from the suggested difficulty as to the creation or annihilation of motion.

This view of the case is corroborated by a reference to Professor Balfour Stewart's "Conservation of Energy." Throughout this book a broad distinction is recognised between energy in actual motion and energy in a state of rest, or potentiality, or equilibrium. There is energy of actual motion and energy of position. These are capable of change, the one into the

* Considered in its rigid definitions as per formula.

other. The sum-total of energy remains constant. The sum-total of energy of position is not constant, nor is the sum-total of the energy of actual motion. For this see § 34 at p. 23 on the Energy of Position. In § 64 we find the case succinctly stated.

"Here it is well to bear in mind that all energy consists of two kinds, that of *position* and that of *actual motion*, and also that this distinction holds for invisible molecular energy just as truly as for that which is visible."

Professor Stewart gives us two lists—one of the Forces of Nature, and one of the Energies of Nature, including both classes of energies, commencing with the Energy of Visible Motion, and proceeding to the Visible Energy of Position, such as in a stone on the top of a cliff, in a head of water, in a rain-cloud, in a crossbow bent, in a clock or watch wound up, and in various other instances.

This list seems to us a little defective, in that it does not fully describe each case in the two states of motion and position of advantage.

The enumeration of energies is followed up by a statement of the law of conservation, according to which (A) + (B) + (C) + (D) + (E) + (F) + (G) + (H) = a constant quantity, and then comes a list of the transmutations of these different kinds of energies, the one into the other, in the course of which it is shown that energy of actual motion and energy of position are interchangeable, the conclusion being against the theory that there is a constant quantity of either kind, and therefore against Mr. Spencer's theory of the Continuity of Motion.

The question then arises, how does this overthrow of the Continuity of Motion affect the working out of Mr. Spencer's arguments? He advances it in the "First Principles" as one of the three factors the formulation of whose interrelations is to unify knowledge. Clearly it ought to find no place in the Formula; and the relation specified in the Formula of Evolution and Dissolution of concomitance with the integration of Matter does not hold good—indeed, as a matter of fact, we found in our previous criticism, when we came to apply it, that it did not prove satisfactory. Practically also we found that this theory landed us in all sorts of confusions, notably in the foundations of Biology, with respect to the vast quantity of "locked-up" Motion in nitrogenous compounds. So also it is the cause of Mr. Spencer's indefiniteness of expression in all those cases of latent and retained Motion which abound so plentifully in his "First Principles." With respect to the Formula of Evolution, its essential point—namely, the concomitance of the integration of Matter and the dissipation of Motion—disappears. The processes are not *pari passu;* Evolution and Dissolution need not be concomitant.

With respect to the formula which was to unify knowledge, we now come to this rather absurd position, that of the *three* factors which Mr. Spencer proposed to formulate, one (*Force*) is quietly ignored, another (*The Continuity of Motion*) is proved to be erroneous, and the third contains a term, "matter," to which Mr. Spencer refuses to attach any definite meaning. And we shall see that in practice, as applied to biological and psychical phenomena, this formula is wholly inapplicable, except as a description of the advance from an indefinite incoherent homogeneity to a definite coherent heterogeneity. All it amounts to is merely an assertion of the natural gradual development of changes, and we get no insight whatever into those relations of original factors and their necessary sequences which constitute an intelligent history of the cosmos.

It seems to us that the whole subject of the Persistence of Force, the Conservation of Energy, and the continuance or non-continuance of Motion, should be re-stated by scientists.

§ 2. *The Ultimate Problem.*

Already in Chap. I. § 1 we have stated the nature of the problem to be solved in attempting the unification of knowledge. We have to frame a proposition which, specifying certain factors, shall enable us by a series of deductions to form a continuous picture representing the sequences of the objective universe as they have actually occurred. The ideally perfect unification would consist in the specification of every incident in the entire series of sequences; but the unification might be regarded as practically effected if the general nature of all incidents could be deduced from the sum-total of certain generalised (not abstracted) factors. This would be reached (if at all) in the natural course of discovery by means of an alternative series of analyses and deductions, of hypotheses and verifications; but each hypothesis requires clear statement, and each testing a rigid exactness. Now Mr. Spencer does not clearly tell us the state from which he starts. If he starts from the state of a nebula consisting of the seventy or eighty so-called elements in a gaseous condition in known quantities, and irregularly distributed, we have a starting-point with definite factors. If also there is an environment of ether with which this nebula is in relation, we can so define the interrelation that it shall not be a cause of uncertainty to us. Then within the limitation of space and factors so defined we can set out on our deductive process, which is also a process of construction.

But clearly this is not the unification of knowledge; for we have here seventy or eighty factors, whose differentiations have to be accounted for. These seventy or eighty factors have what we call properties—properties of special attractions, relative size, shape, weight, &c., and until these differentiations are explained, no generalised factors can be used in the explanations of their subsequent interrelations of combination, disintegration, &c. We are tied down strictly to the specific properties of our seventy or eighty factors. We cannot talk of Matter as a general factor, nor of Force, nor of Polarity, nor of Equilibration, for we do not know anything about them. All we know are specific resistances, extensions, attractions, repulsions, feelings (?), &c. We are only entitled to speak of a general Matter, Force, Polarity, &c., when we know their fundamental relations, and when we know them in such a way that we are able to reason from them to the so-called elements, and *through* them to the following sequences.

It is perhaps to expect too much of Philosophy to require that it should reduce its ultimate factors to two. But all philosophers of a very speculative character endeavour to start with a state of the simplest possible constitution—a state containing as few factors as possible, and these in the simplest and most uniform mode of relation.

Mr. Spencer, in his chapter on Dissolution, would seem to resolve the universe ultimately into forces of attraction and repulsion, and would seek to impose upon it the state of homogeneity, or equal and symmetrical distribution. Both at p. 542 of "First Principles" and in the Formula of Evolution we find a possible homogeneity stated, and the general tenor of Mr. Spencer's process is from a state of homogeneity. To this meeting-point the studies of all philosophers seem to tend. The religious philosopher finds an original Divine Mind, the subjective philosopher finds Absolute Unconditioned Being, the physical philosopher finds a homogeneity of attractive and repulsive forces or Absolute Force. All unite in saying that this primordial factor is Unknowable. How, then, to make a beginning? Mr. Spencer seemingly attacks the problem in his theory of the Instability of the Homogeneous, but when we examine it, we find he only means that the Homogeneous is unstable when attacked by external forces, but when not so attacked it is stable. Hegel propounds the theory of Self-Determination. It would seem that this, being contrary (as it is) to experience and incomprehensible in its statement, has no warrant save in the necessity we feel for assigning a cause in our own minds to the commencement of changes, in order to justify our onward course of thought.

The problem is made more complex from the necessity we are under of including in our original factors not only such as will account for the seventy or eighty so-called elements in their purely physical combinations, but also such as will account for feelings and their combinations, which constitute also psychical life, and which affect biological changes.

§ 3. *Mr. Spencer's Admissions of his Failure to Account for Consciousness.*

There is one principal difficulty in Mr. Spencer's scheme. As we have so often observed, Mr. Spencer defines the scope of Philosophy as the accounting for every existence. Among existences are those of organisms; and if by existence we mean every fact relating to material existences, then we have the facts of consciousness and mind, and these have to be explained. Surely the facts of feeling have had some influence upon the morphological and physiological development of organisms. Yet Mr. Spencer distinctly states that the facts of feeling, and therefore of mind, though exhibiting a parallelism with those of Matter and Motion, cannot, nevertheless, be comprehended in the Formula of Evolution. How, then, is knowledge unified? how is the end of Philosophy fulfilled? Mr. Spencer says ("Psychology," § 62, p. 157):—"So far from helping us to think of them as of one kind, analysis serves but to render more manifest the impossibility of finding for them a common concept—a thought under which they can be united. Let it be granted that all existence distinguished as objective, may be resolved into the existence of units of one kind. Let it be granted that every species of objective activity may be understood as due to the rhythmical motions of such ultimate units; and that among the objective activities so understood, are the waves of molecular motion propagated through nerves and nerve-centres. And let it further be granted that all existence distinguished as subjective, is resolvable into units of consciousness similar in nature to those which we know as nervous shocks; each of which is the correlative of a rhythmical motion of a material unit, or group of such units. Can we then think of the subjective and objective activities as the same? Can the oscillation of a molecule be represented in consciousness side by side with a nervous shock, and the two be recognised as one? No effort enables us to assimilate them. That a unit of feeling has nothing in common with a unit of motion, becomes more than ever manifest when we bring the two into juxtaposition. And the immediate verdict of consciousness thus given, might be analytically justified were this a fit place for the needful analysis."

And again on p. 508 he says:—"Specifically stated, the problem is to interpret (*Q. explain?*) mental (*Q. subjective?*) evolution in terms of the redistribution of Matter and Motion. (*Q. do Matter and Motion here mean the relations of attractive and repulsive forces, or do they mean X and Y?*) Though under its subjective aspect Mind is known only as an aggregate of states of consciousness, which cannot be conceived as forms of Matter and Motion, (*Q. repeated*) and do not therefore necessarily conform to the same laws of re-distribution; (*Q. is not this a denial of the all-comprehensiveness of the Formula of Evolution?*) yet under its objective aspect, Mind is known as an aggregate of activities (*Q. Motions?*) manifested by an organism—is the correlative (*Q. antecedent cause or co-existing fact?*), therefore, of certain material transformations (*Q. of attractive and repulsive forces or of X and Y?*) which must come within the general process (*Q. formula?*) of material (*Q. X and Y?*) evolution (*Q. concentration of X and dissipation of Y?*), if that process is truly universal. THOUGH THE DEVELOPMENT OF MIND ITSELF (*Q. subjective?*) CANNOT BE EXPLAINED BY A SERIES OF DEDUCTIONS FROM THE PERSISTENCE OF FORCE, yet it remains possible that its obverse (*Q. antecedent cause?*), the development (*Q. combination?*) of physical changes in a physical (*Q. the combination of attractive and repulsive forces, or of X and Y, and the recombination of combinations of these attractive and repulsive forces, or of X and Y?*) organ (*Q. aggregate?*), may be so explained; and until it is so explained, the conception of MENTAL EVOLUTION (*Q. and even when it is so explained?*), as a part of Evolution in general, remains incomplete."

Mr. Spencer speaks in a language that we do not understand. We formed our notions of the meaning of the terms he employs from the analysis of his doctrines, but when we come to read his more advanced doctrines, we find they have undergone an evolution; hence all the difficulties we experience, as indicated above, in understanding his meaning in many important passages. As we understand the above, Mr. Spencer maintains that by a series of deductions from the Persistence of Force and by means of the Formula of Evolution the causes of the production of an organism such as a man can be explained, although his feelings and his mind cannot thereby be explained. There are several inferences from this. Firstly, there is more in the results of the Persistence of Force and the Formula of Evolution than the results of attractive and repulsive forces; and that since we are unable to understand this plus, or its relations to the attractive and repulsive forces which we do understand, therefore, although we may be able to recognise a regular process of development due to the permanence and regular order of these relations, yet we cannot unify our knowledge. Secondly, we infer that Mr. Spencer maintains the proposition that feeling and mind have not been factors in any morphological and physiological development; for he says that an organism is explainable on physical grounds only, which means that we can deduce and build up an organism from the relations of the chemical elements and the laws of physics alone. An organism is thus physically explainable up to the most complex development. The result is feeling and mind: but the organisation would be the same were there no such result as feeling and mind. It may be that feeling and mind are necessary results of these relations of the original factors, although we cannot conceive it; but, nevertheless, they are nothing more than such results, and it is deducible from these premises that there might be complex organisms without feeling and without mind. Thirdly, if we allow that feeling and mind have had any influence as factors in morphological and physiological development, then we admit as factors in that development more than the factors recognised in a physical explanation—*i.e.*, attractive and repulsive forces. If feeling cannot be explained from physical antecedents, and yet feeling is a factor in the structural and functional development of physical organisms, then a physical explanation of organisms is not possible, and organisms escape altogether from the Formula of Evolution and the unification of knowledge. It is true there is one last resource, namely, to abandon to the chemical elements the definite terms of attractive and repulsive forces having definite results, and to deal only with *x*, *y*, and *z*. That, indeed, releases us from our dilemma, for we can make *x* mean sometimes one thing and sometimes another; and surely a protean world requires protean words to represent it.

§ 4. *Does Mr. Spencer Profess to Explain the Universe?*

In reply to our previous volume, some critics have said that Mr. Spencer does not profess to explain the universe, and that, therefore, our criticism in this respect is not applicable. Let us consider this point. We advance this as Mr. Spencer's object for the following reasons, viz. :—

Firstly, Because he recognises it at the outset of his work, in the chapter on the "Scope of Philosophy," from which we have already quoted. Here he looks for the unification of knowledge in the gradual advance of Science, which in various departments unifies great diversities of individual facts by means of some wide proposition, and we seek the goal of Philosophy in some widest of all propositions, which shall include everything in its organic explanations.

Secondly, We justify this view of Mr. Spencer's object from his summing up at the end of "First Principles," when he has finished all his work, and says to himself, "It is good." This passage is very precise; it is almost legal in its phraseology.

It runs as follows (p. 541):—"In commencing our search, . . . it was shown that a Philosophy stands self-convicted of inadequacy, if it does not formulate the whole series of changes passed through by every existence in its passage from the imperceptible to the perceptible, and again from the perceptible to the imperceptible. If it begins its explanations with existences that already have concrete forms; or leaves off while they still retain concrete forms; then, manifestly, they had preceding histories, or will have succeeding histories, or both, of which no account is given. And as such preceding and succeeding histories are subjects of possible knowledge, a Philosophy which says nothing about them, falls short of the required unification. Whence we saw it to follow that the formula sought, equally applicable to existences taken singly and in their totality, must be applicable to the whole history of each and to the whole history of all."

From this it would seem that the unification of knowledge is to be found in the formulation of "the whole series of changes passed through by every existence." Here, of course, there is the obscurity of the term *formulate;* but we take it that that word must refer to the dependence of change upon anterior conditions, these anterior conditions being fewer and more simple the farther we go back, until we discern in one or two simple conditions the then future sequences.

Thirdly, We hold this to be Mr. Spencer's theory because his work is mainly a process of construction. Starting from the comparatively simple and undifferentiated, he proceeds by gradual steps to the more complex. In his actual work, and in its effect upon our minds, Mr. Spencer undertakes a process of building up. We see before our eyes the formation of a solar system out of a nebula. The world cools, the geological strata are formed, oceans and continents appear. Plants and animals creep into life, till in their gigantic strength they rise superior to the elements and defy their brute creators. Man is developed as the resultant of oxygen, nitrogen, carbon, &c. in relation with external factors of heat, light, &c. Strange sciences of Ethics, Politics, and Esthetics supervene. Intelligence and emotion have come out of physical arrangement of the chemical elements. We see it all before our eyes. Is it not unfolded by Mr. Spencer in his series of works?

Fourthly, Mr. Spencer states distinctly in several places that he regards this evolution as *a single process* from first to last. What does a single process mean but the dependence of changes upon anterior conditions, and what can the understanding of the process be but the understanding of the initial conditions?

The "Biology" is essentially a constructive undertaking, which is the same thing as a deductive process of reasoning. From certain factors in the primal cosmos, whenever we may fix the time, we have to deduce, or, which is the same thing, construct the cosmos as we now know it. Mr. Spencer's is not merely an inductive gathering up of all knowledge into one scientific proposition, but a deductive process from primordial principles. It is not sufficient, according to him, that we should know all that is, but that we should know it as what it must have been, and could not have been otherwise. Therefore the "Biology" comes to be a constructive process. We first see the construction of organic molecules out of inorganic, and then the building up of organic molecules into plants and animals represented as strict deductions from the properties of the original factors.

This is what Mr. Spencer says ("Psychology," p. 136):—

"Evolution being a *universal process*, one and continuous throughout all forms of existence, there can be no break, no change from one group of concrete phenomena to another without a bridge of intermediate phenomena." He then goes on to show how Geology is only a branch of a particular science which is in its totality Astronomy. Biology is only a specialised part of Geology, and Psychology is only a specialised part of Biology. "Theoretically all the concrete sciences are adjoining tracts of *one science*, which has for its object-matter the continuous transformation which the universe undergoes."

We therefore come to the conclusion that Mr. Spencer does undertake an explanation of the universe. He is not content, nor indeed is it sufficient merely to specify the general characteristics of cosmical history in all its branches. He rigidly lays down the necessity for the deductive process, and attempts the correlative constructive problem.

CHAPTER IV.

AN EXAMINATION OF THE "PRINCIPLES OF PSYCHOLOGY" WITH REGARD TO ITS POSITION IN THE SYSTEM FOR THE UNIFICATION OF KNOWLEDGE.

This chapter is undertaken for the purpose of ranging Psychology in its proper place in the deductive order of the sciences upon the scheme for the unification of knowledge propounded by Mr. Spencer. We wish to ascertain its place relatively to the other sciences in a properly ordered system of knowledge, and we also wish to ascertain in what respects it assists in the proper understanding of Mr. Spencer's system.

In this undertaking we do not propose to criticise the "Psychology" on its merits as an independent work, and we therefore pass over some of its most important features without note or comment. To do otherwies would be beside our purpose. Accordingly we omit many valuable and interesting inquiries, and confine ourselves strictly to the object we have in view.

In summarising the remarks that have occurred to us in our studies of the work, we find them to fall under three headings, and we divide our chapter accordingly. We shall first treat of a method for the unification of knowledge propounded in the body of the work, which is one altogether separate and different from the main and scientific unification upon the lines of which the great constructive portions of Mr. Spencer's works are carried out. Next, we shall consider the "Principles of Psychology" in regard to the constructive methods, to see how they fall in with the general plan. Thirdly, we shall consider how any of the difficulties we may have met in the course of our study are to be got over by means of the Double-Aspect Theory.

§ 1. *The Psychological Method for the Unification of Knowledge.*

(*a.*) *Study of Part VII. of the "Principles of Psychology."*

We shall first direct the attention of the student to Part VII. of the "Principles of Psychology," in which will be found the peculiar method for the unification of knowledge already referred to. It is entitled "General Analysis," and its object is defined to be "An Inquiry Concerning the Nature of Human Knowledge." We shall find it necessary to pursue a somewhat detailed inquiry, a procedure which, although more tedious to the general reader, is more satisfactory to the student and more just to the author than criticisms given in general terms. We find in § 385 (vol. ii. p. 307):—

"Knowledge implies something known and something which knows; whence it follows that a theory of knowledge is a theory of the relation between the two.* Observe how distinct are the three things.

"Here, on the one hand, is an aggregate of propositions respecting objects; and each group of these propositions, as, for instance, those constituting the science of Astronomy, we regard as expressing certain connections, which continue to hold whether we continue conscious or not. Here, on the other hand, is an aggregate of propositions concerning states of consciousness; and we regard these propositions as expressing certain connections which continue to hold irrespective of the continuance of any other connections. And now here are certain propositions which do not assert connections among Things, and which do not assert connections among Thoughts, but which assert connections between Things and Thoughts. Or, to speak strictly, though they tacitly assert certain connections among Things, and certain connections among Thoughts, which are indispensable elements of them, yet the connections with which they are immediately concerned are those between Things and Thoughts."

* Compare this with Mr. Spencer's definition of knowledge in "First Principles," § 42.

The rest of the section is taken up with a further explanation of the object sought for in a Theory of Knowledge. And this brings the author back to the main object of his Philosophy, and causes him to revert to the statement of that object made in the "First Principles."

This reference is made in § 386, and as we are now dealing with Mr. Spencer's main argument, and as careless or obscure references to long anterior passages of his work are likely to be misleading unless properly examined, it will be our duty to carefully study the connection between the train of thought therein set forth, and the final outcome in the chapters now before us. Thus at the outset we are obliged to make a long digression from our immediate study in order to estimate properly that original thought to which the new reasonings have to be joined. And first let us see if the representation now made of the argument set forth in the "First Principles" is correct.

The salient point of the reference is found to be (p. 310, line 16), "the complete unification of knowledge, in which Philosophy reaches its goal." This unification is declared to be found (line 15) in the complete establishment of the congruity of certain fundamental intuitions with all other dicta of consciousness. This process of proving or disproving the congruity is therefore seen to be (line 14) "the business of Philosophy," in the accomplishment of which is to be found the required unification of knowledge.

The following is a quotation of the passage in full, part of which we italicise :—

"§ 386. To do this will be to redeem the promise made by implication in 'First Principles,' when dealing with the 'Data of Philosophy.' It was there argued (§ 39) that 'developed intelligence is framed upon certain organised and consolidated conceptions of which it cannot divest itself; and which it can no more stir without using than the body can stir without help of its limbs. In what way, then, is it possible for intelligence, striving after Philosophy, to give any account of these conceptions, and to show either their validity or their invalidity? There is but one way. Those of them which are vital, or cannot be severed from the rest without mental dissolution, must be assumed as true provisionally. The fundamental intuitions that are essential to the process of thinking, must be temporarily accepted as unquestionable: leaving the assumption of their unquestionableness to be justified by the results. And it was further argued (§ 40) that setting out with these fundamental intuitions provisionally assumed to be true—that is, provisionally assumed to be congruous with all other dicta of consciousness—*the process of proving or disproving the congruity becomes the business of Philosophy;* and *the complete establishment of the congruity* becomes the same thing as *the complete unification of knowledge, in which Philosophy reaches its goal.*"

We find it, therefore, clearly stated, first, that the goal of Philosophy is the unification of knowledge; secondly, that this unification is accomplished when certain fundamental intuitions are found to be congruous with all the other dicta of consciousness; and, thirdly, that the proving or disproving this congruity is the business of Philosophy.

We will now refer back to the "Data of Philosophy" to see whether this is a correct representation of the passage. And we may as well say at once that we find there no such clear and concise statement, but a very long, diffuse, and indefinite discussion containing a variety of imperfectly conceived propositions.

Firstly, we think we come upon the primordial datum in § 41, which is thus presented to us:—*

"What is this datum, or rather what are these data, which Philosophy cannot do without? Clearly one primordial datum is involved in the foregoing statement. Already by implication we have assumed, and must for ever continue to assume, *that congruities and incongruities exist, and are cognisable by us.*"

The italicised proposition, therefore, is the first fundamental datum of philosophy, further explained towards the end of p. 141:—

"And here we get to the bottom of the matter. The permanence of a consciousness of likeness or difference, is our ultimate warrant for asserting the existence of likeness or difference; and, in fact, we mean by the existence of likeness or difference, nothing more than the permanent consciousness of it."

* First Principles, p. 140.

This, however, is not enough.

§ 42. "But Philosophy requires for its datum some substantive proposition. To recognise as unquestionable a certain fundamental *process* of thought, is not enough: we must recognise as unquestionable some fundamental *product* of thought, reached by this process. If Philosophy is completely-unified knowledge—if the unification of knowledge is to be effected only by showing that some ultimate proposition includes and consolidates all the results of experience; then, clearly, this ultimate proposition which has to be proved congruous with all others, must express a piece of knowledge, and not the validity of an act of knowing. Having assumed the trustworthiness of consciousness, we have also to assume as trustworthy some deliverance of consciousness.

"What must this be? Must it not be one affirming the widest and most profound distinction which things present? Must it not be a statement of congruities and incongruities more general than any other? An ultimate principle that is to unify all experience, must be co-extensive with all experience. . . . That which Philosophy takes as its datum, must be an assertion of some likeness and difference to which all other likenesses and differences are secondary. If knowledge is classifying, or grouping the like and separating the unlike; and if the unification of knowledge proceeds by arranging the smaller classes of like experiences within the larger, and these within the still larger; then, the proposition by which knowledge is unified, must be one specifying the antithesis between two ultimate classes of experiences, in which all others merge."

From this passage it would appear that the unification of knowledge, which is the goal of Philosophy, is to be reached by a different method altogether from those which we discussed in our former criticism. The theory of this latest method is: Since knowledge is classification, the more complete the classification the more completely unified is the knowledge, and the nearer we approach to a philosophy. When, therefore, we have all knowledge comprehended in two large classes, we can proceed no farther: knowledge is unified and Philosophy has reached its goal.

However, to proceed. We have to bear in mind that the "substantive proposition" which Philosophy requires for its datum has not been found in § 42. We pass on to § 43.

This section is a disquisition on the faint and vivid manifestations which compose knowledge, and which possess seven separate characters by which they are distinguished.

Section 44 groups these two classes of manifestations into *self* and *non-self*. The "vivid manifestations indissolubly bound together in relatively immense masses and having independent conditions of existence we call the *Non-ego*."

It must be borne in mind that we are now on the look-out for the "substantive proposition," the "ultimate proposition," proposed to be sought in § 42. Taking into consideration that this proposition is described as "one specifying the antithesis between two ultimate classes of experiences, in which all others merge," as "one affirming the widest and most profound distinction which things present," we are tempted to put down as the second datum this proposition, namely, that all knowledge —*i.e.*, Philosophy—is comprised in the proposition that "the widest and most profound distinction which things present is the distinction between the Ego and the Non-ego."

But there crops up here and there another datum, for which see § 44, p. 154.

"Or, rather, more truly, each order of manifestation carries with it the irresistible implication of some power that manifests itself . . . in the faint forms . . . and in the vivid forms."

Page 156.—"And so we are made vaguely conscious of an indefinitely-extended region of power or being, not merely separate from the current of faint manifestations constituting the *Ego*, but lying beyond the current of vivid manifestations constituting the immediately-present portion of the *Non-ego*."

These lead up to the datum or "postulate that the manifestations of the Unknowable" (*Power?*) "fall into the two separate aggregates constituting the world of consciousness and the world beyond consciousness."

This seems to be the fundamental proposition which has to be found congruous with every result of experience, direct and indirect, and which shall thereby become the unification of knowledge aimed at by Philosophy.

On p. 156 it is described as the "fundamental cognition."

"The establishment of this distinction precedes all reasoning; and while, running through our mental structure as it does, we are debarred from reasoning about it without taking for granted its existence; analysis, nevertheless, enables us to justify the assertion of its existence, by showing that it is also the outcome of a classification based on accumulated likenesses and accumulated differences. In other words—Reasoning, which is itself but a formation of cohesions among manifestations, here strengthens, by the cohesions it forms, the cohesions which it finds already existing."

In § 45 we seem to realise the substantive proposition proposed to be sought in § 42. "I have thus . . . indicated the essential nature and justification of that primordial proposition which Philosophy requires as a datum." This seems to refer to the previous passage at the end of § 44.

"And so we are made vaguely conscious of an indefinitely-extended region of power or being, not merely separate from the current of faint manifestations constituting the *Ego*, but lying beyond the current of vivid manifestations constituting the immediately-present portion of the *Non-ego.*"

The whole argument is summed up on the following page. We are never, however, given one fundamental proposition, but several; and their coherence, so as to form an unification of all knowledge, cannot, on the face of it, be recognised.

Page 157.—"In brief, our postulates are:—an Unknowable Power; the existence of knowable likenesses and differences among the manifestations of that Power; and a resulting segregation of the manifestations into those of subject and object."

What is segregation? It is a term derived from, and, properly speaking, exclusively applicable to, material bodies, and it refers to the process by which the like separates itself from the unlike, and each kind of substance under proper conditions, such as heat or liquidity, gathers itself together in separate places. We know of no possible method by which different kinds of manifestations of the Unknowable separate and gather themselves together, so as to form on the one hand faint manifestations which we call feelings, and on the other vivid manifestations which we call the world beyond consciousness. Who has perceived or will venture to describe the process? Can we, indeed, assert that we mean anything when we say that the faint manifestations of the Unknowable segregate and the vivid manifestations of the Unknowable segregate?

These, then, are the "organised and consolidated conceptions" referred to in the "Psychology," which have to be found congruous with all the other dicta of consciousness, and in which the unitative object of Philosophy is attained.

We have remarked throughout this chapter a great amount of vagueness, not merely of language, but also of thought. We seem to be carrying on two arguments, if not more, at the same time. We are apparently occupied mainly with an inquiry as to the data or groundwork of knowledge, the result of which inquiry is summed up on p. 157 as just quoted; and we are also on the outlook for the definite and substantive proposition proposed at the commencement of § 42 as requisite for the datum of Philosophy, and which the summary hardly supplies.

To revert now to the "Psychology," we find that the fundamental intuitions with which all other dicta of consciousness have to be found congruous, in order to accomplish a perfected philosophy and unification of knowledge, are these:—

1. The existence of an Unknowable Power.

2. The existence of knowable likenesses and differences among the manifestations of that Power.

3. A resulting segregation of the manifestations into those of subject and object.

The business of Philosophy, therefore, is the proving or disproving of the congruity between all other dicta of consciousness and these fundamental intuitions.

According to this statement, the proper course would be to ask three questions:—

Firstly, Are all the dicta of consciousness congruous with the belief in the existence of an Unknowable Power?

Secondly, Are they congruous with the consciousness of knowable likenesses and differences?

Thirdly, Are they congruous with the segregation into subject and object?

And if we give affirmative replies to all these questions, knowledge is unified and Philosophy attained.

At the same time, we fail to see that we are any wiser or better off for the fact. If this is the highest point to which Philosophy can attain, it seems to us a very vapid result. It gives us no insight into the relations of things; throws no light upon the sequences of the universe; affords no explanations; gives us no power over the course of events, because it gives us no knowledge of their relations; imparts no information as to our place in the historic cosmos, and is altogether a vain and empty conclusion.

In addition to this, it is to be observed that the unification thus effected does not conform to the requirements of the objects of Philosophy, as explained elsewhere in Mr. Spencer's works and quoted by us in the first chapter of this work. The object of Philosophy is to trace back the order of sequences of the Cosmos, so that given the relations of certain original factors in property and distribution, all the range of sequences can be understood as resultants therefrom.

To place the unification of knowledge in the finding of congruities between the multitudinous experiences of consciousness and those fundamental experiences out of which all consciousness has been evolved, is no more than finding congruities between a mass and the parts which make up that mass. In this respect, indeed, it might be said that if we find the present constitution of the cosmos and its past history congruous with some anterior simple state, although we do not understand the order of the sequences, then knowledge might be considered unified. But as a matter of fact, we do not find the requisite congruity between the known history of the cosmos and the supposed constitution of the primordial nebula, for the former includes subjective feelings which are not congruous with the contents of the latter.

But truly this is not Mr. Spencer's idea: his teaching seems to refer to the primordial experiences of individuals, or to individual conceptions of general primordial experiences of living creatures. Here again we would observe that the simple finding of congruities between the sum-total of experience and individual experience is nothing very important. What shall we say if this final result is no more than the bare statement that all experiences are manifestations of an Unknowable Power, which manifestations segregate into two orders, namely, the faint and the vivid?

(*b*.) *Digression.*

In our previously published criticism of Mr. Spencer we gave a different account of his unification of knowledge, gathered from his "Summary and Conclusion" in "First Principles." Let us now consider the teachings of the "Principles of Psychology" in regard to this question. We found that the unification of knowledge, which it was the object of Philosophy to accomplish, was the formulation of the whole series of changes passed through by every existence. Referring to "First Principles," we find—

Page 541.—"It was shown that a Philosophy stands self-convicted of inadequacy, if it does not formulate the whole series of changes passed through by every existence in its passage from the imperceptible to the perceptible, and again from the perceptible to the imperceptible. If it begins its explanations with existences that already have concrete forms, or leaves off while they still retain concrete forms; then, manifestly, they had preceding histories, or will have succeeding histories, or both, of which no account is given. And as such preceding or succeeding histories are subjects of possible knowledge, a Philosophy which says nothing about them, falls short of the required unification. Whence we saw it to follow that the formula sought, equally applicable to existences taken singly and in their totality, must be applicable to the whole history of each and to the whole history of all."

The succeeding paragraph (p. 542) refers to the Formula of Evolution, which is said to be the requisite formulation.

The question arises, which of Mr. Spencer's two methods is the one he really advocates, or, if he propounds both of them, are they identical? In the one case, Mr. Spencer states that

Philosophy accomplishes its object, namely, the unification of knowledge, by formulating some "ultimate proposition" which shall be found congruous with all other experience. Now a proposition is composed of three parts—a subject, a predicate, and a copula. The following sentence, which seems to be the summing up of the chapter on the "Data of Philosophy," to which we have been referred from the chapter of the "Psychology" now under consideration, is not a proposition at all:—

"In brief, our postulates are:—an Unknowable Power; the existence of knowable likenesses and differences among the manifestations of that Power; and a resulting segregation of the manifestations into those of subject and object."

Yet we can find no other proposition which is clearly stated as the one which is to unify all knowledge. The question then arises, have these postulates the effect intended? Assuming them to be correctly stated, do they unify knowledge? At first sight they seem to be comprehensive enough, but not to throw much light on the relation of sequence or process. They do not, for instance, explain the combination of oxygen and hydrogen into water, nor the varied states of ice, water, and steam. Again, they do not explain the nature of heredity. Nor do they throw much light on the sensitiveness of the eye to those undulations called light. Clearly the postulates do not explain the order of cosmical sequences.

Let us now consider the question as to the identity of the two methods of unification proposed by Mr. Spencer, viz.:—

"Evolution, is," &c.

"In brief, our postulates are," &c.

To us there do not appear to be any common elements of comparison. Let us, however, again refer to the "Summary and Conclusion," to enable us to determine what is the proposition which affords the desired unification of knowledge. The following is a short summary:—

Page 538.—A proposal to review the completed organisation of knowledge.

Page 539, 1st Par.—Philosophy is the unification of knowledge.

2nd Par.—The data with which Philosophy must set out, as already stated in detail.

3rd Par.—The primary truth. The Persistence of Force (*Query, is this the Philosophy required?*) includes the "Indestructibility of Matter" and the "Continuity of Motion."

Page 540.—Further corollaries.

§ 186. All these truths co-ordinated will form a philosophy. "That which alone can unify knowledge must be the law of co-operation of all the factors—a law expressing simultaneously the complex antecedents and the complex consequents which any phenomenon as a whole presents."

2nd Par.—The law sought must be the continuous redistribution of Matter and Motion . . . Hence we may be certain, *à priori*, that there must be a law of the concomitant redistribution of Matter and Motion, which holds of every change; and which, by thus unifying all changes, must be the basis of a Philosophy. (*Query, does this mean, must be the Philosophy required?*)

3rd Par.—Then comes the categorical statement of what is required of a Philosophy which affords our researches a standard of efficiency, and by which we find all Mr. Spencer's endeavours to fail.

Page 542, 1st Par.—The formula in view is the Formula of Evolution, but this is not the same kind of unification as that which was proposed to be effected in the formulation of a primary conception or fundamental proposition congruous with all other dicta of consciousness.

Page 543.—The Formula applied in detail.

Page 545.—Evolution one in principle and one in fact.

Page 547.—Still Philosophy is not complete as long as Evolution is only an induction. What is required is the statement of one fact or principle from which all the facts of Evolution and Dissolution can be deduced.

"Our next step, therefore, was to show why, Force being persistent, the transformation which Evolution shows us necessarily results."

We appear now to be coming in view of the grand ultimate formula or proposition which shall completely unify knowledge and constitute a Philosophy; for it turns out, after all, that the Formula of Evolution is not sufficient. The one comprehensive truth, therefore, would seem to be

"The Persistence of Force,"

which it is necessary to examine separately on its own merits as to meaning and efficacy, and which is so dealt with in our previous criticism.

Page 547 shows how the principle of the Persistence of Force involves as a consequence the instability of the homogeneous, and this being accomplished, everything else follows. The full consideration of this curious reasoning is given in our previously published criticism, and the weakness of it is manifest in the section now under consideration; for Mr. Spencer, we find, does not really treat of the homogeneous, but of a heterogeneous complex cosmos containing some "finite homogeneous aggregates" and "diverse forces," thus begging the question of the heterogeneity for which, according to the statement on p. 541, he had to account.

Page 549 ought to disclose the unificatory proposition of Philosophy; and it is stated that "each of these laws of the redistribution of Matter and Motion, was found to be a derivative law—a law deducible from the fundamental law. The Persistence of Force being granted, there follow as inevitable inferences, &c. . . . And thus discovering that the processes of change formulated under these titles are so many different aspects of one transformation, determined by an ultimate necessity, we arrive at a complete unification of them—a synthesis in which Evolution in general and in detail becomes known as an implication of the law that transcends proof. . . . Which further unification brings us to a conception of the entire plexus of changes presented by each concrete phenomenon, and by the aggregate of concrete phenomena, as *a manifestation of one fundamental fact*—a fact shown alike in the total change and in all the separate changes composing it,"—and thus answers to the requirements given on p. 541.

In § 191, p. 551, we come upon a rounding off of the argument by a reversion to the other statement of the method of a Philosophy, namely, by showing that the fundamental datum of consciousness is congruous with all other dicta of consciousness. We could not in its proper place find out with exactness what that datum was, but it is given here—"*The recognition of a persistent Force, ever changing its manifestations*," but unchanged in quantity throughout all past time and all future time, is that which we find *alone* makes possible each concrete interpretation, and at last unifies all concrete interpretations. . . . Our synthesis has proceeded by taking for granted at every step this ultimate truth; and the ultimate truth cannot, therefore, be regarded as in any sense an outcome of the synthesis."

We do not think that the original datum as thus expressed was given very clearly in the chapter on the "Data of Philosophy." If it was, then we find the proposition, "There is a Persistent Force or Power," alike the fundamental fact from which the Formula of Evolution is derived and the fundamental conception with which all other dicta of consciousness are congruous. This is, of course, Mr. Spencer's own statement. The difficulty we ourselves find is in understanding the meaning of the word Force, and then in deriving the corollaries. We have elsewhere stated that unless we can attach clear ideas to the terms Force, Matter, Motion, &c., none of the propositions in which they are used can be intelligible, and therefore such propositions are incapable of expressing an item of knowledge, a fact of cognition, a truth of Philosophy. They are out of court altogether, and Mr. Spencer himself states that they cannot be understood.

"There is a Persistent Force or Power ever changing its manifestations." The more we think over this proposition, the more incapable we find it of affording any satisfactory outcome. It is said to have corollaries, but we struggle about inside the hard bounds of our prison-house, and we cannot get out of it. Force shows no inclination to solidify into Matter or to manifest itself in Feeling, and we do not know that Motion even is a necessary mode of Force.

Section 192 is a general vindication of unity and a challenge.

"If it can be shown that the Persistence of Force is not a datum of consciousness; or if it can be shown that the several laws of Force above specified are not corollaries from it; or if it can be shown that, given these laws, the redistribution of Matter and Motion does not necessarily proceed as described; then, indeed, it will be shown that the theory of Evolution has not the high warrant here claimed for it. But nothing short of this can shake the general conclusions arrived at."

To this challenge we have previously replied by anticipation. We deny that the proposition predicating Persistence as an attribute of Force—Force itself being unknowable—has any corollaries, and we do not hold that the quantitative Persistence of Force is a datum of consciousness.

Section 193 is a re-statement of the unification effected throughout all knowledge by the theory of the Persistence of Force.

"Given the Persistence of Force, and given the various derivative laws of Force, and there has to be shown not only how the actual existences of the inorganic world necessarily exhibit the traits they do, but how there necessarily result the more numerous and involved traits exhibited by organic and super-organic existences—how an organism is evolved? what is the genesis of human intelligence? whence social progress arises?"

This places the unification of knowledge and the attainment of the goal of Philosophy on the basis of the definition on p. 541 rather than on the attainment of congruity of knowledge.

Section 194 is a repudiation of Materialism as ordinarily understood. With the statement and argument in this section we find we entirely agree. We believe there is as much mystery in the nature of the relations of Matter and Motion as there is in the nature of sentiency, in the relations of body with body, or in the relations of body with consciousness. Our contention is that in the face of so much mystery no unification of knowledge such as that described in § 193 and § 186 is possible, *i.e.*, an unification which shall show the necessary sequence of the traits of all existences, both inorganic, organic, and super-organic, from some primordial homogeneity. If we say there is the Persistence of Force, and then that there is Matter and Motion, logic stands impotently staring at propositions made up of symbols utterly incomprehensible, and cannot set to work till the ghosts depart and comprehensible realities only are left. Even supposing that we agree with Mr. Spencer that the controversy as between Spiritualism and Materialism is merely a war of words, still it does not follow that we can formulate all phenomena in terms of Matter, Motion, and Force. And if we do, then one of two things happens. Either, first, we attach no definite meaning to the words, and they are mere symbols without much content—the playthings of inquiring philosophers; or, secondly, we must insist that all the facts of the universe should be explained in terms of Matter, and Motion, and Force, according to the accepted meanings of these terms, and this is obviously a materialistic interpretation. In the former case explanation is clearly acknowledged to be impossible; in the latter it is insufficient.

Therefore we see no injustice in pressing upon Mr. Spencer, notwithstanding all his disclaimers, the charge of Materialism as ordinarily understood; and he can only escape it by having recourse to Mysticism—a confession of the inefficiency of any formula to explain all that he requires a Philosophy to explain, and a resort to a Power that cannot be understood.

It must be remembered that we entered upon this examination of the "Summary and Conclusion" in the "First Principles" for the purpose of ascertaining if the method of the unification of knowledge propounded in the "Psychology" was really identical with the method of unification propounded at p. 541 of the "First Principles." We found that an attempt was made to identify, or rather to comprehend, the two methods by inclusion in a larger proposition than either of them, viz., in the proposition that "There exists an Unknowable Power, ever changing its manifestations;" and our conclusion respecting that method of unifying knowledge was that it was ineffective, because it had no meaning and no corollaries. Indeed, one might just as well say that the alphabet is an unification of knowledge, since all knowledge is contained in its ever-varying changes and combinations. One would obtain just as much information out of the one proposition as out of the other. And as to Force—there is just as much efficiency in the magician's potent word "Abracadabra."

We therefore find that the only unification between the two methods for unifying knowledge is a mystical and incomprehensible one, and that if either of them is separately able to accomplish it, they must be considered separately. The one we fully considered in our former criticism, and found it utterly impotent. The other we think we have now also shown to be inefficient; but we must proceed further with our consideration of it in the part of the "Psychology" we have selected for our present study.

(*c.*) *Resumption of the Study of Part VII. of the "Psychology."*

It must be remembered that we proceeded with our examination of "Psychology," part vii., up to p. 310. To return to that page, we are reminded (line 18) that the organised conceptions forming the Data of Philosophy were only accepted provisionally; it is also explained that throughout the previous works composing the system of Synthetic Philosophy these organised conceptions have been assumed; and that all the detailed phenomena have been found to be congruous with such assumptions. We are then informed that "we are now called upon to reconsider these provisional assumptions . . . the question here to be met is, whether they admit of being unified * with the coherent body of conclusions to which acceptance of them has led us." . . . "In other words, we have to take up the vexed question of Subject and Object. The relation between these, as antithetically-opposed divisions of the entire assemblage of manifestations of the Unknowable, was our datum."

We would have the reader carefully consider what he is about here. A transformation of the argument seems to be going on, and it is necessary to be watchful. The transformation seems to be this:—

Our object, as stated in the first half of p. 310, is the "unification of knowledge." Having abandoned the unification of

* Query, does "unified" mean merely "shown to be non-contradictory," or does "unification" mean that they are both the necessary result of some common original activity?

knowledge as an unification of sequences by means of the Formula of Evolution, we seek it now in the establishment of congruities between organised primordial experiences and all the other dicta of consciousness. After a reference to the "Data of Philosophy," where these primordial assumptions are fully set out, Mr. Spencer states, in the second half of p. 310, that "Since then we have been occupied in carrying on the unification indicated, . . . we are now called upon to reconsider these provisional assumptions." "The process of unification . . . has brought us at length to these assumptions themselves; and the question here to be met is, whether they admit of being unified with the coherent body of conclusions to which acceptance of them has led us . . . it becomes needful to look closely at these postulates, and to test the arguments of those who deny their validity."

So far we understand our author. There were certain postulates assumed provisionally, and indeed necessarily, for they were such that the mind could not move without them any more than the body could move without the aid of its limbs; and we are now called upon to re-examine these postulates which were thus only assumed provisionally, our object being to test their validity. This is to be done by seeing if they are congruous with the coherent body of conclusions to which acceptance of them has led us.

Waiving the question as to the necessity and propriety of judging the validity of postulates by the congruity of their logical results with themselves, we take Mr. Spencer's statement as it stands. To do what he wishes evidently requires that the postulates to be thus tested should be carefully enumerated in definite language, and then, on the other hand, that the coherent body of conclusions by which they are to be tested should be summarised in some clear and formal statement. When that is done, we shall have to compare the two, and finding that the logical results of the postulates are congruous with them, we shall know that the postulates themselves are valid and trustworthy.

But if the reader expects this course to be pursued by Mr. Spencer, he will be disappointed. On p. 311 all the postulates are arbitrarily "unified" into one datum, and this is not the old favourite "Power or Force continually changing its manifestations," but it is the relation between subject and object as antithetically opposed divisions of the entire assemblage of manifestations of the Unknowable, which was our datum. The plural is changed into the singular; the whole is unified into one of its parts; and the congruity sought must be between this one datum and the coherent body of conclusions before referred to. In the next sentence, indeed, it seems to be inferred that all this coherent body of conclusions has been derived from this single datum, and not from all or any of the others we have had to consider; for Mr. Spencer says, "The fabric of conclusions built upon it must be unstable if this datum can be proved untrue or doubtful."

Now the consideration in question may be essential to Philosophy, but surely this is not the unification of Philosophy, nor is it the mode of unification of knowledge which Mr. Spencer has previously set out on page 310, and which we have just examined. While one side of the comparison is ignored altogether—*i.e.*, "the coherent body of conclusions," to which the acceptance of the primordial data led us—on the other side these primordial postulates or primary conceptions are all most unwarrantably and unjustifiably amalgamated into the narrow limits of a single datum, and the whole question is transformed into one respecting the validity of the distinction between Subject and Object, and the reality of the existence of these two.

If this were logical and allowable, it would follow that the accomplishment of this task would prove the congruity of all the primary assumptions or postulates with the coherent body of their logical results, and the accomplishment of this task we are to take for granted. It is one of Mr. Spencer's principal characteristics that he states very clearly what has to be done and then fails to do it. But what can we expect of any one who would grasp the universe in his arms perpetually? Sometimes the world of feeling eludes his hold; sometimes the physical universe still goes astray.

It is clear that our logical continuity has come to a stop. We abandon the comparison and verification we had intended, and which was to have been the final unification of knowledge, and now set out to follow Mr. Spencer in new and disconnected lines of thought.

(*d.*) *The Final Question.*

Collecting ourselves for a fresh start, we find the above heading to the chapter, and are refreshed. We have come across so many apparent finalities, and found they were not final, that we are glad to see it stated in a formal way that we have reached the final question at last. And we take it to be expressed in § 387, p. 311, viz., "The vexed question of Subject and Object." The question allowing of an affirmative or negative reply would seem to be this :—

"Are Subject and Object antithetically opposed divisions of the entire assemblage of manifestations of the Unknowable?"

Our first inquiry must be, Is this a fair statement of the "vexed question," or is it a statement which, by including too much, or tacitly asserting some theory, would not be accepted by all philosophers as a proper statement of the controverted point?

But Mr. Spencer asks us to be satisfied with this statement of the question, and to accept it as one which the idealist, the sceptic, the dualist, and the realist would all recognise.

If it is answered in the negative, Mr. Spencer states that, so far as he is concerned, "The fabric of conclusions built upon it must be unstable if this datum can be proved either untrue or doubtful."

The importance of this as a "final question" is not apparent, but we proceed with Mr. Spencer's course of thought. This leads us through Chapters II., III., and IV., which deal respectively with the assumptions, words, and reasonings of metaphysicians, who are here taken as Idealists. Chapters V., VI., VII., and VIII. are justifications of Realism; Chapters IX. to XIII. deal with the test of validity—all these chapters being necessary to the elucidation of the argument, and leading up to Chapter XIV., the Positive Justification of Realism, a short chapter, which is elaborated in Chapters XV., XVI., and XVII., which latter expounds "The Completed Differentiation of Subject and Object." We have not thought it necessary to enter upon a minute examination of these chapters, because we do not see much to disagree with, and because they do not seem to present salient points for criticism so far as regards our main object of examination, viz., the unification of knowledge to be attained by the recognition of the two classes of manifestations, or in any other way. The result of all these chapters appears to be summarised and expressed in the concluding paragraph of Chapter XVII., thus:—

"The general result is that the vivid aggregate, both as manifesting passive resistance and as manifesting active energy, inevitably comes to have associated with it in consciousness, the idea of power, separate from, but in some way akin to, the power which the faint aggregate perpetually evolves within itself."

This general result, then, is, after all, very ambiguous, and therefore not very efficient in the unification of knowledge, except upon the principle that the Knowable can only be properly understood by means of our ideas of the Unknowable. In order to understand the passage just quoted, we have to understand the power which the faint aggregate perpetually evolves within itself, and then we have to form some idea of "akinness," and attribute the same kind of power thus manifested to the vivid aggregate. The result of this attribution would be widely various, according to the different conceptions of the power which the faint aggregate perpetually evolves within itself.

But we now proceed to the study of Chapter XVIII., which seems to require a detailed examination. It is upon the "Developed Conception of Object."

It is here pointed out in §§ 347, 348, that the impression we call resistance "is the primordial, the universal, the ever-present constituent of consciousness." "It is primordial in the sense that it is an impression of which the lowest orders of creatures show themselves susceptible." . . . "It is universal, both as being cognisable by every creature possessing any sensitiveness, and usually as being cognisable by all parts of the body of each." . . . "It is ever present, inasmuch as every creature, or, at any rate, every terrestrial creature, is subject to it during the whole of its existence." And it was shown that this, consequently, "becomes the mother-tongue of thought, in which all the first cognitions are registered, and into which all symbols afterwards learned are interpretable."

This is evidently another first primordial datum, and is a very useful passage, because it gives us some clue by which to work out the use and value of the symbols which we have been constantly using in the course of our studies. It is a kind of key to the interpretation of the symbols Matter, Motion, Force, Evolution, Dissolution, Integration, &c. We find that they have all to be interpreted into "the impression we call resistance," and we find that all the "first cognitions," which we presume to be the fundamental data of philosophy, the primary assumptions, the original postulates,* are "registered" in this "impression of resistance." To this interpretation and registration we shall recur at a more convenient point. We must not allow too many digressions to mar the consecutiveness of our criticism. Mr. Spencer next says :—

"Hence along with the segregation of our states of consciousness into vivid and faint, the consciousness of something which resists comes to be the general symbol for that independent existence implied by the vivid aggregate."

Here we notice that "the consciousness of something which resists" comes to be "the general symbol" of external existence.

Again, "We have just seen that mutual exploration of our limbs, excited by ideas and emotions,† establishes an indissoluble cohesion in thought between *active energy as it wells up from the depths of our consciousness*, and the equivalent resistance opposed to it; as well as between this resistance opposed to it and an equivalent pressure in the part of the body which resists. Hence the root-conception of existence beyond consciousness, becomes that of resistance *plus* some force which the resistance measures."

* "In brief, our postulates are : An Unknowable Power ; the existence of knowable likenesses and differences among the manifestations of that Power ; and a resulting segregation of the manifestations into those of Subject and Object."—*First Principles*, p. 157.

† Elsewhere Mr. Spencer repudiates Feeling as a factor in Biology.

The statement seems to be this, we have the active conscious energy + the physical forces of the exploring limb = the resistance of the explored limb, *i.e.*, "a force which the resistance measures." This, firstly, implies a correlation of conscious force with physical forces—a theory not recognised by scientists. Secondly, it exhibits a confusion between the modes of the physical forces. Thirdly, it fails to show the correlation between the forces of mutual resistance of limbs and the impression of resistance. Fourthly, it fails to explain the differentiation of feelings in terms of the differentiations of resistances.

Mr. Spencer endeavours to reduce all knowledge to the relations of two factors, Object and Subject. Philosophy requires their unification as a corollary from one fundamental proposition. If this can be done, then the final proposition must be formed from the Persistence of Force, from which object and subject must as corollaries be derived. This Persistence of Force has many corollaries; but we submit that subject and object are not logically deducible from it.

Mr. Spencer proceeds to say—

"This essential element in our consciousness of the vivid aggregate, is also the essential element in our consciousness of each part distinguished as an individual object. The unknown correlative of the resistance opposed by it, ever nascent in thought under the form of muscular strain—the unknown correlative which we think of as defying our efforts to crush or rend the body, and therefore as that which holds the body together, is necessarily thought of as constituting body. On remembering, &c. . . . we shall see clearly that this unknown correlative of the vivid state we call pressure, symbolised in the known terms of our own efforts, constitutes what we call material substance."

This we can only interpret as meaning those mutual attractions according to known or ascertainable laws of chemical elements, causing combinations of such coherency that chemical elements otherwise combined, and forming an individual coherent body under the direction of the Will, are unable to dispart them. The nature of the coherency of the external body and of the body seeking to dispart it is the same, viz., chemical and cohesive forces of the elements which produce the formation of diversely coherent bodies; but the nature of the Will being unexplained does not imply an equivalence either of Will or Force, or anything else in the external existence. Nor does the aggregation of the elementary substances in any case imply consciousness.

Section 467 gives us a definition of Existence as the permanent in the midst of that which has no permanence. Not that the definition is very clear, nor that it is of any practical utility.

Section 468 requires careful study.

"On changing from passivity to activity—on evolving* the feeling which excites muscular motion, and using the limbs for mutual exploration, this partial differentiation is completed. For such exploration shows that muscular tension, resistance, and pressure, are correlatives and equivalents; that the vivid aggregate can initiate two out of these three correlatives—the pressure and the resistance; and that these imply a something equivalent to the third."

The reasoning is this:—Firstly, we have muscular tension, resistance, and pressure, as three correlatives. Secondly, of these the vivid aggregate (*i.e.*, external existence) can initiate (*i.e.*, render us conscious of) two, namely, pressure and resistance. Thirdly, these two correlatives imply a something equivalent to the third, namely, to the muscular tension.

We find a great difficulty in understanding this. Is muscular tension subjective or objective? Is it part of the vivid or the faint aggregate? The nearest approach we can make to a representation of the state of the case is that muscle being composed of nitrogen, &c., organised in a particular way, is caused by some incomprehensible power to press against some external object, or some other part of the body of which itself forms a part, and is then met by a resistance. Now these are external existences to each other. The active energy which evolved the feeling which caused the muscular tension is incomprehensible. But it is not said that this active energy, nor the evolved feeling, requires any correlative; but it is said that the muscular tension implies a something. It is indeed said that

* Used in the popular sense, and not as defined in "First Principles."

pressure and resistance imply a something equivalent to the third, *i.e.*, muscular tension, but it is difficult to see the necessity for such an implication. Perhaps it is thus : the muscular tension causes the pressure; this implies a something which causes the resistance. The argument takes it for granted that there must be an equivalence between the cause of the pressure and the cause of the resistance. If we take, firstly, the cause of the resistance, we should say that it was due to the mutual attractions of ultimate units constituted into separate and diversified bodies, according to shapes, sizes, modes, and rates of motion, which diversities are traceable to the original physical laws of attraction and repulsion of these ultimate units; and if we ask for the equivalent as the cause of the pressure, we should give the same reply. And this reply would be true, save and except the evolution of the feeling which caused the pressure—a plus is here revealed. But if, on the other hand, we demand an equivalent for the pressure and its cause, we have to say it is met with in resistance and its cause ; but for the cause of the resistance we need go no further back than the laws of attraction and resistance of ultimate units; and if equivalence is absolutely demanded, our only course is to limit the cause of the pressure to the cause of the resistance, or otherwise to expand the cause of the resistance to the cause of the pressure, namely, Will—a *plus* over and beyond merely physical explanations.

Mr. Spencer may suppose not only something equivalent in the external world to conscious force, but something analogous to it. This is a subject which is beyond the scope of our inquiry, for it is clear that if Feeling is not a factor in Biology, our studies are limited to the known relations of physical factors, and the unification of knowledge is to be confined to terms thereof. If consciousness and something analogous to it in the external world are necessary to that unification, it is obvious that we require to know more of this analogous force before we can unify our knowledge.

But to proceed with our examination. "Hence the vivid aggregate necessarily comes to be thought of as not simply independent of the faint, but as being, like it, a fountain of power. And this conception of it as a fountain of power, is made distinct by experiences of changes directly caused in us by it, like those directly caused in us by our own energies."

The principal thought to master here is "a fountain of power." This evidently means from the context "a cause of changes." The faint aggregate is a "fountain of power," *i.e.*, a cause of changes. The vivid aggregate is also a "fountain of power," *i.e.*, a cause of changes. An aggregate to be a cause of changes means that the items of the aggregate are so inter-related as not to be in a state of equilibrium or mutual adjustment, such as proximately exists in the case of the solar system, and so precludes change.* The supposition of a faint aggregate as a cause of change means nothing; taken in itself as apart from connection with the vivid aggregate, it is unknown; and in the latter connection it is a fountain of power—*i.e.*, an antecedent of changes in the vivid aggregate—only if it is independent and not merely a concomitant; and then, even if the laws of its action are understood, the manner of the connection is not understood, the "how" is mystery. If a man wills to pull down an opposing scale, he can only do so according to the relative weight of his body and the weight in the opposite scale. It is a matter settled for him by the laws of attraction of bodies; and whether he stands in the scale and throws the tension of his weight into the supporting chains, or hangs on to the beam with his hands, and experiences the muscular tension caused by the attraction of his body to the centre of the earth, the result is the same; his will, or his evolved feeling and his consciousness of muscular tension, weigh nothing; they find and imply no equivalent in the weight on the opposite scale.

Hence it follows that the fountain of power in the vivid aggregate and the fountain of power in the faint aggregate mean no more than this, that each exhibits changes and implies merely a cause or causes of changes, but towards an intelligible unification of these changes there is no approach.

* If it means anything more than this—if it is taken to mean that the items of the aggregate are caused, then it means that there is some other fountain of power which caused them, *i.e.*, laws of attraction and repulsion of ultimate units; or again, if we go further back still, we arrive at an ultimate fountain of power, or ultimate cause, and "fountain of power" means "ultimate cause."

If herein the argument is in favour of a duality of the causes of changes, it seems to be effective.

"The general conception thus formed of an independent source of activity beyond consciousness, develops into a more special conception when we examine the particular clusters of vivid states aroused in us. For we find that each cluster, distinguished by us as an object, is a separate seat of the power with which the objective world as a whole impresses us. We find that while it is this power which gives unity to the cluster, it is also this power which opposes our energies. And we also find that this power, holding together the elements of the cluster notwithstanding the endlessly-varied changes they undergo in consciousness, is therefore thought of by us as persisting, or continuing to exist, in the midst of all these manifestations which do not continue to exist."

Here we start with the idea of "an *independent source of activity* beyond consciousness." We not only recognise activities beyond consciousness, and independent of consciousness—*i.e.*, the changes of the external world—but we recognise an independent source of them. It does not seem to us that we do recognise a source of them. But it also "develops into a more special conception." Let us watch the development of a general conception into a more special conception. "We find that each cluster, distinguished by us as an object, is a *separate seat of the power* with which the objective world as a whole impresses us. We find that while it is *this power* which gives unity to the cluster, it is also *this power* which opposes our energies." If we start with the power which opposes our energies, we find it to be a specialised mode of the attraction of ultimate units. The temporary unity of any object is due to the accidents of the law of attraction and repulsion of ultimate units; and so long as no other body interferes with its stability, it is a separate seat of the same power—*i.e.*, the attraction of matter—and has special relations according to the shapes, sizes, modes, and rates of motion of the particles of which it consists, with other separate states of the same power, viz., the attractions and repulsions of ultimate units differently arranged and combined. The single power is thus seen to be the alternate law of the mutual attractions and repulsions of ultimate units. Any other "Power" we do not know in the external world; it is the only "independent source of activity" we can recognise "beyond consciousness."

"And we also find that *this power* holding together the elements of the cluster . . . is therefore thought of by us as persisting . . ."

To proceed with the next paragraph. "So that these several sets of experiences unite to form a conception of something beyond consciousness which is absolutely independent of consciousness; which possesses power, if not like that in consciousness yet equivalent to it; and which remains fixed in the midst of changing appearances. And this conception, uniting independence, permanence, and force, is the conception we have of Matter."

We have shown that the previous considerations unite to form a conception of something beyond and independent of consciousness, namely, Matter—that is to say, if we call the laws of attraction and repulsion of ultimate units Matter, or if we call ultimate units acting under laws of attraction and repulsion Matter, we have a conception at once of Matter and of that external world and power beyond consciousness. So far this is quite intelligible; whether we call the ultimate units units of matter or units of force or the chemical elements is quite immaterial; all we know of them is that they are separate units, and attract and repel each other, and nothing more. The forms in which we, then, know their combinations—as differentiated aggregates—are merely the result of those primal laws, and are the separate seats of the primal powers or forces called attraction and repulsion; and it is these which possess power "which remains fixed in the midst of changing appearances."

Mr. Spencer says that this power, if not like that in consciousness, is yet equivalent to it. Now, we do not see how any one can possibly understand this assertion. What is the power he refers to as in consciousness? The power that is in consciousness we take to be "our own energies," or "evolving the feeling which excites muscular motion." Mr. Spencer does not say that the "power" he speaks of in the external world and independent of consciousness is like it; but it is, nevertheless, *equivalent* to it. Equivalency is applied to numbers, spaces, values, matter in motion mechanically, sometimes figuratively to the meanings of words, &c. Power, as we have just ascertained it to mean, as an external fact means the mutual attraction and repulsion of ultimate units, atoms, molecules, and masses. Does Mr. Spencer mean that the power we are personally conscious of in the exercise of our own feelings and energies has a mechanical value, and that the sum-total of all conscious beings is equivalent to the sum-total of the power exhibited over the attractions and repulsions of the material world? Evidently there is no common measure by which to judge of their equivalence; and, again, before the existence of consciousness there was nothing for the material world to be equivalent with. The proposition that the external world possesses a power equivalent to that in consciousness is an impossible conception. It may be practically correct in the experience of the weight of a book in our hand, where there is an equivalence of exertion and weight, but it is only a temporary equivalence, for our hand tires, and the book falls to the ground. Or we put half a dozen upon our hands, and they obey the law of gravitation immediately, and fall to the ground. In this sense the power manifested in the external world is more than an equivalent for that in consciousness, and therefore is not equivalent.

It may be, however, that Mr. Spencer uses the term "equivalent" in a loose way for "analogous." There must be something in the resistance of inanimate matter analogous to what we feel in the resistance we make to pressure. But this involves an analysis of the "Ego." Is it more than the physical forces of the organised mechanism? If not, then the analogy between the forces of the Ego and the forces of the external inorganic world holds good. And if consciousness is merely a concomitant, the analogy is not interfered with, for it is not a force, but merely an unexplainable accompaniment. But if it is a force, then the analogy does not hold good; and if an analogy is necessary, then there is a something behind the external forces analogous to the conscious force of the organism. But what is the use of the supposition if all its manifestations of this force are known as manifested?

In § 469 Object is described as the "unknown permanent nexus which is never itself a phenomenon but is that which holds phenomena together."

Subject, in like manner, is the unknown permanent nexus, which is never itself a state of consciousness, but which holds states of consciousness together.

Now, when Object is spoken of as a permanent nexus, it means that the nexus of the properties of the chemical elements is permanent, or at the furthest that the properties of the ultimate units are permanent. Surely Mr. Spencer cannot mean that every individual aggregate has an individual nexus or bond constituting it an object, otherwise than as the result of the varied forces which produced the combination?

What is the meaning of the permanency of the Subject? Apparently the permanent nexus of the Subject comes to an end when the physical organisation with which it is connected comes to an end. We do not know that we can recognise anywhere "an unknown permanent nexus" which ever forms the Subject. In fact, Mr. Spencer says it is unknown, and if it is unknown, how can there be any meaning in our discourse of it?

What Mr. Spencer means, however, is seen in the next paragraph, and it only amounts to this, that as long as the organised body lasts the Subject is permanent, and the nexus of the Subject is permanent notwithstanding all the changeful consciousness of which it is the scene. But this is a different thing altogether from the permanence of the power, force, &c., of the independent, external, objective world, and is rather a consideration affecting the nature of that unity of conscious life which we call the Ego.

The further course of the argument shows the difference in the treatment of the permanency of the Subject nexus and the permanency of the Object nexus, for the discussion of the former naturally leads us to the discussion of the Ego in § 470.

At the conclusion of this section, which is the end of the chapter, there is a claim for "akin"-ship between the force manifested in the Ego and the force manifested in the Non-ego,* but it is badly and obscurely expressed, and does not make clear the question how far the persistence of force is affected by the variability of the quantity of conscious energy, nor how these two modes can be derived as corollaries from the Persistence of Force.

Here we refer to "Psychology," vol. i. p. 98, and find, with respect to the Subject:—

"Now, however, we turn to a totally distinct aspect of our subject. There lies before us a class of facts absolutely without any perceptible or conceivable community of nature with the facts that have occupied us. The truths here to be set down are truths of which the very elements are unknown to physical science. Objective observation and analysis fail us, and subjective observation and analysis must supplement them.

"In other words, we have to treat of nervous phenomena, as phenomena of consciousness. The changes which, regarded as modes of the *Non-ego*, have been expressed in terms of motion, have now, regarded as modes of the *Ego*, to be expressed in terms of feeling. Having contemplated these changes on their outsides, we have to contemplate them from their insides."

And again, "Psychology," vol. i. p. 140:—

"Under its subjective aspect, Psychology is a totally unique science, independent of, and antithetically opposed to, all other sciences whatever." . . . "Mind still continues to us a something without any kinship to other things; and from the science which discovers by introspection the laws of this something, there is no passage by transitional steps to the sciences which discover the laws of these other things."

What, then, are the results of our examination of this chapter? It is to be regarded in two aspects, according to the point of view from which it is criticised. If it is studied with a view

* In Chap. XIX., p. 494, we find a reference to a previous chapter in the 'Psychology," thus: "In the next chapter, on the 'Relativity of Relations between Feelings,' it was similarly shown that no relation in consciousness can 'resemble, or be in any way akin to, its source beyond consciousness.'" We do not know that this statement involves a contradiction, but it is rather puzzling.

to ascertain "how can there be found within consciousness this notion of an existence that is not within consciousness?" it may be regarded as a satisfactory and conclusive argument. But on the other hand, if it be studied with a view to unification of knowledge, an unification which shall enable us to understand the connection and relations of all sequences, or even only an unification which consists simply in the abolition of incongruities of knowledge, it does not seem to be of any value whatever, and it must be remembered that it was in pursuance of this latter object that we entered upon the present study.

In the following chapter on Transfigured Realism, in which, being the last of Part VII., one would naturally expect to find a connection of the results with the object of the inquiry, we find only a summary of the process of reasoning leading up to the conclusions of Realism, and without the requisite argumentative connection with p. 310.

The general summary is worth quoting on its own merits.

"The conclusion to which our General Analysis has brought us, is in perfect harmony with these conclusions, yielded by inductive inquiry at the outset. While *some* objective existence, manifested under *some* conditions, remains as the final necessity of thought, there does not remain the implication that this existence and these conditions are more to us than the unknown correlatives of our feelings and the relations among our feelings. The Realism we are committed to is one which simply asserts objective existence as separate from, and independent of subjective existence. But it affirms neither that any one mode of this objective existence is in reality that which it seems, nor that the connections among its modes are objectively what they seem. Thus it stands widely distinguished from Crude Realism, and to mark the distinction it may properly be called Transfigured Realism."

Mr. Spencer says in the last paragraph of Part VII. p. 502—

"Thus ends our examination of the Ultimate Question. We saw, when considering its nature, that Philosophy reaches its goal when it establishes universal congruity ("First Principles," Part II. Chap. I.) Before stirring a step towards this goal, however, Philosophy had to assume the validity of certain primary dicta of consciousness; since before there can be thought there must be some data of thought. A general survey brought us to the conclusion that the relation of Subject and Object was a dictum of consciousness which must be thus provisionally accepted. Accepting it, the process of establishing congruities was pursued, until at length it brought us round to the original dictum; and we had then to consider whether this could be absolutely justified. The foregoing chapters have led us not only to the result that it harmonises with all other dicta of consciousness, but also to the result that every adverse proposition is absolutely and in every way incongruous with them."

Here is to be noted some confusion of statements.

Philosophy had to assume certain *dicta.*

The relation of Subject and Object was *a dictum.*

Congruities were established with *the original dictum.*

The original dictum harmonises with *all other dicta* of consciousness, *i.e.*, both the other primary dicta and all the secondary consciousnesses.

Therefore the relation of Subject and Object, being found congruous with all other consciousnesses, primary and secondary, affords the unification of knowledge, which is the goal of Philosophy.

It is to be presumed that any other of the primary dicta of consciousness—for there appear to be others treated in the same way—would also afford the unification of knowledge, which is the goal of Philosophy. Philosophy is rich in methods, all equally useless for any object of enlarging our definite and useful knowledge, and all equally inefficient in informing us of our place in the cosmical history.

After having thus settled "The Ultimate Question" we come to "The Final Question."

"Finally, then, we resume this originally-provisional assumption but now verified truth. Once more we are brought round to the conclusion repeatedly reached by other routes, that behind all manifestations, inner and outer, there is a Power manifested. Here, as before, it has become clear that while the nature of this Power cannot be known . . . we learn that the one thing permanent is the Unknowable Reality hidden under all these changing shapes."

We confess we do not see anything in this leading to the unification of knowledge according to any of the various modes proposed by Mr. Spencer. Neither the finality of the relation of Subject and Object, nor the finality of an Unknowable Power, are of any use to organise knowledge, and give it that structural unity which is the characteristic of completed science, and for which we look in a science of the sciences.

(*e.*) *Summary of this Section.*

The general consideration involved in this section is, whether the problem of the unification of knowledge is rightly propounded by Mr. Spencer in the passage so often referred to by us, in which it is placed in the explanation of all things and events as resultants of original factors, requiring of us a system of historical reconstruction, or whether it is to be rightly sought in the correlation of the objective and the subjective, or by some of the other methods of the class advanced in this section? It is true it might be held that they are all identical, but certainly Mr. Spencer has not undertaken to explain that they are so. Failing this unification, one class must be held to exclude the other, and the student is in doubt which to pursue. But of the two classes, the one we have just been considering does not possess the greater value. The deductive or historical problem is the one of all-absorbing interest to humanity.

With respect to the treatment of the subject by Mr. Spencer, we have shown, we think, that he has not treated it with clearness and logical continuity. The argument passes through many phases, and is characterised by changefulness and uncertainty of thought and language. In its final result, as an explanation of the relations of Realism and Phenomenalism, we think it exceedingly valuable, and if our object were other than the examination of Mr. Spencer's system of the unification of knowledge, we should have more to say than this mere acknowledgment of the substantial merits of his teachings on this subject.

We cannot help thinking that Mr. Spencer, in Part VII. of the Psychology, confounds *a theory of knowledge* with *a theory of the unification of knowledge.* What he there advances is the former, not the latter, although it professes to be the latter. Yet his own criterion of the unification of knowledge is placed not in forming a theory of knowledge, but in forming a cosmical reconstruction. We therefore consider that all the claims made in this part for effecting the unification of knowledge are wrongly made, and rightfully appertain to a theory of knowledge, placing them therefore as only subordinate considerations in the more general inquiry.

§ 2. *The Problem of the "Psychology," being a Consideration of the Science of Psychology with Regard to its Place in Mr. Spencer's Constructive Scheme.*

The problem sought to be elaborated in the "Principles of Psychology" may be gathered from Part I., Chapter VI., "Æstho-Physiology;" Chapter VII., "The Scope of Psychology;" Part III., Chapters I. and XI., "Life and Mind as Correspondence;" Part V., Chapters VI. to X., "The Relation of Psychical Laws to the Physical Synthesis."

The problem to be solved from our point of view is the affiliation of the Evolution of Pyschology upon Evolution in general. Thereupon arises the question, What is Psychology? and what is meant by Evolution?

(*a.*) *What is Psychology?*

We will first consider what Psychology is not. In the first place, it is not Biology. The whole process of biological evolution is a purely physical process, wrought out by the action of environment upon organic masses, and, down to the very minutest detail of the arrangements of the completed organism, the result of physical and chemical relationships under the guiding law of that physical law of equilibration by which a moving equilibrium adjusts its forces to counterbalance external forces threatening its destruction.

When we come to study the "Biology," we shall find that Feeling is carefully excluded as a factor, as indeed not being one of the circle of energies it is bound to be—for it is incapable of doing work by changing into other forms of energy. We must therefore understand that the action of the organism throughout, including every nervous current and every cerebral change, is part of an unbroken physical sequence. With these sequences, therefore, Psychology has nothing to do as a factor, that is to say, as an active agency being the cause of change.

These actions of the organism, however, are accompanied in great measure by subjective feelings. These feelings vary qualitatively and quantitatively. They are found to be specially localised, and to vary in intensity with physiological conditions. The study of these localisations and variations with physical conditions is not, however, the science of Psychology, but is called "Æstho-Physiology."

"Æstho-physiology has a position that is entirely unique. It belongs neither to the objective world nor to the subjective world; but taking a term from each, occupies itself with the correlation of the two." *

Mr. Spencer here very happily states the case, but he does not tell us which are the two specific terms, nor does he attempt to express the nature of their correlation. All that he has done in the preceding chapter has had reference to the localisation and the dependence of the variations of feelings. The generalisation is not attempted which would express the general relation of subject and object.

We rather think Mr. Spencer considers such a generalisation impossible, for at the commencement of the chapter he says—

"Now, however, we turn to a totally-distinct aspect of our subject. There lies before us a class of facts absolutely without any perceptible or conceivable community of nature with the facts that have occupied us. The truths here to be set down are truths of which the very elements are unknown to physical science. Objective observation and analysis fail us; and subjective observation and analysis must supplement them. In other words, we have to treat of nervous phenomena as phenomena of consciousness. The changes which, regarded as modes

* Psychology, vol. i. p. 130.

of the *Non Ego*, have been expressed in terms of motion, have now, regarded as modes of the *Ego*, to be expressed in terms of feeling." *

Are we, then, to consider that the science of Psychology relates to the subjective only, that is to say, to the distinguishment, connections, order, and general relations of feelings, ideas, emotions, &c.? Is it merely the subjective mode of speaking of the nervous and cerebral changes—changes which we have already seen are wholly biological, and determined by the physical interaction of the organism with its environment? If so, it is but a subjective aspect of physical processes which somehow have that aspect, and since the determining causes are wholly physical, are more properly to be regarded as coming within the science of Biology. To treat them separately would in this case be merely a matter of convenience; for although the real agencies are actions of the brain and nervous systems, they are beyond the reach of our observation, and are only known to us subjectively.

However, this does not accord with Mr. Spencer's definition of Psychology, and we now approach the inquiry as to what is meant by the term. For this purpose we study the chapter on "The Scope of Psychology." It commences by a negation of Biology and Æstho-Physiology as included in the study. Biology is regarded as a purely physical study; "the direct meanings of all the propositions set down have nowhere implied consciousness or feeling; and, ignoring consciousness or feeling, they have left out that which is tacitly or avowedly contained in every proposition of Psychology." † This is a first approach to a recognition of the contents of that science. Nevertheless, it is distinct from Æstho-Physiology, because the latter is confined to propositions expressive of relations of phenomena occurring wholly within the organism.

Mr. Spencer proceeds to say that this is the case with regard to Biology also. He endeavours to make out that the science of Biology is a science complete within the limits of the organism. He has to admit that "distinct or tacit reference has, indeed, been made to some external force. . . . But such

* Psychology, vol. i. p. 98. † Ibid., p. 130.

references, vague or distinct, have been made merely because it was needful to suppose something by which an organic change was set up; not because this something had to be included in the proposition set down, which in every case formulated an internal relation only." *

"Now so long as we state facts of which all the terms lie within the organism, our facts are morphological or physiological, and in no degree psychological. Even though the relation with which we are dealing is that between a nervous change and a feeling, it is still not a psychological relation so long as the feeling is regarded merely as connected with the nervous change, and not as connected with some existence lying outside the organism."

Mr. Spencer here seems to speak of Morphology and Physiology as if they could be sciences in themselves without reference to the environment, and as if they could now be studied in that old-fashioned isolated way; whereas the great object of his work on Biology is to show that all the facts of that science have been produced by the action of the environment on certain peculiarly constituted masses of matter, from which also the subjective presumably results. Therefore we do not understand the distinction which he proceeds to make.

"For that which distinguishes Psychology from the sciences on which it rests, is, that each of its propositions takes account both of the connected internal phenomena" (*query, objective or subjective?*) "and of the connected external phenomena to which they refer. In a physiological proposition an inner relation is the essential subject of thought; but in a psychological proposition an outer relation is joined with it as a co-essential subject of thought. A relation in the environment rises into co-ordinate importance with a relation in the organism. The thing contemplated is now a totally different thing. It is not the connection between the internal phenomena" (*query, objective or subjective?*), "nor is it the connection between the external phenomena; but it is *the connection between these two connections*. A psychological proposition is necessarily compounded of two propositions; of which one

* Psychology, vol. i. p. 113.

concerns the subject and the other concerns the object; and cannot be expressed without the four terms which these two propositions imply. The distinction may be best explained by symbols. Suppose that A and B are two related manifestations in the environment—say the colour and taste of a fruit; then so long as we contemplate their relation by itself, or as associated with other external phenomena, we are occupied with a portion of physical science. Now suppose that *a* and *b* are the *sensations* produced in the organism by this peculiar light which the fruit reflects, and by the chemical action of its juice on the palate; then, so long as we study the action of the light on the retina and optic centres, and consider how the juice sets up in other centres a nervous change known as sweetness, we are occupied with facts belonging to the sciences of Physiology and Æstho-Physiology. But we pass into the domain of Psychology the moment we inquire *how there comes to exist* within the organism a relation between *a* and *b* that in some way or other corresponds to the relation between A and B. Psychology is exclusively concerned with this connection between (A B) and (*a b*)—has to investigate its nature, its origin, its meaning, &c." *

Mr. Spencer then proceeds to combat the opinion that Psychology is part of Biology, on the ground that all biological structures and functions are produced by the intimate actions of the environment upon organic masses and organisms. "The life of every organism is a continuous adaptation of its inner actions to outer actions; and a complete interpretation of the inner actions involves recognition of the outer actions." † But Mr. Spencer thinks that "throughout Biology proper, the environment and its correlated phenomena are either but tacitly recognised, or, if overtly and definitely recognised, are so but occasionally; while the organism and its correlated phenomena" (*query, subjective?*) "practically monopolise the attention. But in Psychology, the correlated phenomena of the environment are at every step avowedly and distinctly recognised; and are as essential to every psychological idea as are the correlated phenomena of the organism." ‡

* Psychology, vol. i. p. 134. † Ibid., p. 132. ‡ Ibid., p. 134.

This reply is based upon the statical aspect of Biology, whereas by no one more than by Mr. Spencer has Biology been taught as a continuous process. And it is surprising to find him say—

"In brief, then, the propositions of Biology, when they imply the environment at all, imply almost exclusively its few general and constant phenomena, which, because of their generality and constancy, *may be left out of consideration;* whereas the propositions of Psychology refer to its multitudinous, special, and ever-varying phenomena, which, because of their speciality and changeability, cannot be left out of consideration." *

Now, any one who will refer to the "Biology," and study the detailed instances by which it is made clear that the whole of the morphological and physiological history of every animal and plant, down to the minutest detail, is the result of the action of the environment upon the organism, and who is able to master the general principle of biological equilibration as propounded by Mr. Spencer, through which all this comes about, will be astonished at such a passage as the foregoing from the pen of the self-same writer.

However, this matter does not affect our present criticism. Here our point of interest lies in studying the problem of "*the connection between these two connections.*" On the one side we have the objective connection (A B), and on the other side we have the clearly subjective connection (*a b*).

The problem of Psychology is to ascertain how there comes to exist within the organism the subjective connection (*a b*). We note in the first place that it is a historical problem, "how it comes to exist," and in this view of it we consider the true and only manner in which it is to be regarded is with the object of assigning its place with regard to evolution in general. Our studies, as Mr. Spencer indicates, should be directed to an inquiry as to "its nature, its origin, its meaning," &c. To this we will recur, but in the meantime would point out that the subjective connection (*a b*) only exists as the subjective aspect of some physical arrangement of the cerebrum or nervous system; and if this cerebrum or nervous system, being part of

* Psychology, vol. i. p. 135.

the physical organism, has been produced by ordinary biological evolution, its subjective aspect can only come within the purview of the science of "Æstho-Physiology," and therefore the origin of the connection (*a b*) is to be accounted for on its objective side as the particular nervous arrangement (symbolised by A B) produced by the object (A B), and the only remaining question appertaining to the inquiry is as to the nature, origin, and meaning of the subjective aspect of (A B) which is symbolised by (*a b*). This mode of stating the inquiry implies three sets of connections instead of two. The cause (A B), the effect (A B), and the concomitant (*a b*). And it results in the statement that every representation of the subjective in italics is but the unaccountable concomitant of all arrangements of the small capitals representing the result of their interaction with the environment, symbolised by large capitals, or of their own interaction.

Mr. Spencer next proceeds to dispute the demarcation of Psychology from Biology by a sharp line. Evolution is one and continuous. This is shown by a study of the relative connections of the different sciences.

"Theoretically, all the concrete sciences are adjoining tracts of one science, which has for its subject-matter the continuous transformation which the Universe undergoes. Practically, however, they are distinguishable as successively more specialised parts of the total science." *

"And Psychology is a specialised part of Biology, limited in its application to the higher division of these peculiar aggregates, and occupying itself exclusively with those special actions and reactions which they display, from instant to instant, in their converse with the special objects, animate and inanimate, amid which they move."

We must say this is not very clear. As long as the actions and reactions are the interrelations of the physical environment with the physical organism, they come within the scope of Biology, and the whole thing is complete in itself without Psychology at all, as witness the work on Biology and the exclusion of Feeling as a factor in these interrelations. Mr.

* Psychology, vol. i. p. 137.

Spencer enters upon an argument in which he calls some of the complex results of simple factors "additional factors," adding to the results of the previous complexity. By this means he makes a broad distinction between Molecular Physics and Chemistry, and by analogy implies a similar connection yet difference between Biology and Psychology.

"In this way it is, then, that the conspicuous presence of additional factors differentiates Psychology from Biology proper; although in Biology proper these factors make an occasional appearance." *

There is evidently some confusion of statement in Mr. Spencer's works as to what Psychology really is. Obviously it is a branch of knowledge. Is it a knowledge of subjective impressions, feelings, memories, &c., as a body of knowledge complete in itself, and further added to by a knowledge of the physical conditions under which they occur and with which they are universally associated, and of which they are thereby one aspect, although they have no place as factors in the interrelation or changes of these physical concomitants? If so, then clearly, in the absence of the knowledge by which, in pursuance of these physical interrelations, the subjective arose, and in the absence of any influence of the subjective upon the physical organism, Psychology is a separate science, cut off from the hierarchy of the sciences by a sharp line.

Is it, on the other hand, but a study of the higher complexities and organisation of the physically-constituted nervous system by which the various incident motions are traced to their effects upon multitudinous centres of nerve force and to the regulative action of these centres, resulting eventually in efferent currents of reaction upon the external world? If so, then it is merely a higher branch of Biology.

Is it, again, a study of the connection between these two sets of connections? Then, as pointed out before, all we can do at the present time is to note the relation of definite feelings with special parts of the organism and of concomitant variations. Until the general relation of feeling and physical change is formulated, this knowledge is merely a body of unorganised

* Psychology, vol. i. p. 140.

facts not yet arrived at the dignity of a science. This would be the science of Æstho-Physiology.

If to this has to be added a knowledge of the relation of bodies external to the organism, this knowledge is of two kinds, one in regard to the physical relationships, and again in regard to the manner in which external objects affect the subjective percipient. But the former seems clearly a branch of physical science, and the latter to be only capable of study intermediately through Biology and Æstho-Physiology—unless, indeed, it is a branch of that unknown science, not yet formulated, which will deal with the historic relationship of the objective and the subjective. From all which we judge that Psychology cannot yet be ranked in the deductive sequence of the sciences, and that the unification of knowledge is not complete.

The fundamental problem is considered by Mr. Spencer, when, in the chapter "On the Substance of Mind," he treats of units of consciousness as in some way analogous to nervous shocks (though more simple than them), and suggests a theory of the differences of the sense-impressions as due to differences in these nervous shocks. This is a reasonable and suggestive hypothesis, but one which, until it is worked out in the formulation of relations, ought not to be made too much of; and failing that formulation, still leaves the history of the organism completely within the range of physical science, the subjective being something merely added to and incident upon the operation of the physical factors.

(*b.*) *What is Evolution?*

Having now considered what is meant by "Psychology," we must next inquire what is meant by Evolution.

If by Evolution is meant a gradual growth from a state of "indefinite, incoherent homogeneity to a definite coherent heterogeneity," then undoubtedly there may be proved to have taken place such a development of correspondences, symbolised by small capitals and by italics, as to attain a result more and more representative of the ever-growing complexities of the realities symbolised by the large capitals. The acceptance of this truth involves, indeed, only the purely descriptive portion of the Formula of Evolution, but then the part of it which does imply some connection of sequences is only applied by Mr. Spencer in simple physical evolutions, and is practically of little account.

Except in the definition of Evolution given in "First Principles," Mr. Spencer seldom uses the word in the sense there defined as the concentration of matter and the concomitant dissipation of motion, but he universally employs it (like everybody else) as meaning the advance from a state of homogeneity, indefiniteness, and simplicity, to a state of definite, coherent complexity.

The history of Mind accords with this idea. The question is, does this similarity of modes of development constitute an unification of knowledge? Mr. Spencer seems to think it does, for in his "General Synthesis" he considers it sufficient to show this gradual growth of mind in the manner specified.

Perhaps this is hardly correct. Considering mind as part of Biology, he shows not an independent but a dependent and concomitant development of mind *pari passu* with the evolution of physical organisms, and then says, see how mental evolution conforms to general evolution! We submit that this conformity of characteristics of development, however significant it may be, does not bring Psychology within the deductive process from original factors which the unification of knowledge requires. It is something, however, if the Evolution of Psychology by natural growth is recognised. It is something more if this development is found coincident with another order of development. But still, the mere establishment of the fact of Psychological Evolution is not an *explanation* of it, and until it finds its place amongst the deductions from the properties of original agencies, it cannot be held to rank in a system of unified knowledge.

(*c.*) *Digression on Verbal Modes of Identifying Processes.*

Before proceeding with an investigation of the second or true mode of presentment of Evolution, let us consider the manner in which the development of Psychology is identified verbally with the processes of Biology, and thus the semblance of an identity of sequence wrought out. This is effected by the employment of the same set of terms in the description of both processes. It is for us to inquire if the likeness of process giving warrant for the common methods of description is one of similarity of process only, or one of identity of sequence.

For the study of this question we take Part III. of the "Principles of Psychology," entitled "General Synthesis," commencing with the idea of "Life and Mind as Correspondence," and followed by chapters showing the development of this correspondence from the direct and homogeneous, through various accretions of heterogeneity of space, time, speciality, generality, and complexity, eventuating in their co-ordination and integration.

The primary relations between an organic mass and its environment are direct—that is to say, are merely chemical and physical; but when this mass has become a "moving equilibrium," these direct equilibrations are overborne by the power which the mass now possesses of adapting or rearranging its structure or motions, so as to resist the disintegrative effect of the direct equilibrations, and thus counterbalance force by force. This is the special characteristic of all biological change, and the ruling cause of all biological development. Therefore, whenever an adaptation, rearrangement, or adjustment of an organism to its environment is spoken of, it is this kind of change which is referred to, the terms just mentioned being merely used for variety of expression, but are really representative of the same thought.

The term "correspondence," which is the one made use of so largely in the "General Synthesis" to cover the development of Mind on the same method as the development of Life, is but another term having the same reference. Vital changes, instead of being spoken of as biological equilibrations, are spoken of as "correspondences." Thus, speaking of the locomotion of organisms, Mr. Spencer says—

"Thus then, the addition of mechanical changes to the changes displayed by motionless organisms, is the addition of new internal relations in correspondence with new external relations." *

* Psychology, vol. i. p. 298.

Of course a correspondence is displayed, but the effect of regarding the development in this indefinite manner is to throw into obscurity the assigned cause of the change in the special law of biological equilibration, and to bring forward a general indefinite notion of correspondence which shall afterwards cover psychological as well as physiological developments.

We could review each chapter, pointing out how this fundamental fault of the argument vitiates its teachings; but to do so would produce too great a bulk of criticism, and after all that has already been done, the student will be able to take up these points for himself. We might instance passages on pages 301, 304, 305, 319, 330, &c.

There is a most singular passage on page 331 :—

" Out of the primordial irritability which (excluding the indeterminate types that underlie both divisions of the organic world) " (*query, how then can it be primordial?*) " characterises animal organisms in general, are gradually evolved those *various kinds of irritability* which answer to the *various attributes of matter*." (*What then are the various attributes of matter?*) " The fundamental attribute of matter is resistance. The fundamental sense is a faculty of responding to resistance." (*Query, what does "responding" mean? What is sense, and how does it originate, and in what does it inhere?*) " And while in the environment, associated with this attribute of resistance, are other attributes " (*note that these attributes are of a different kind, and not composed of the fundamental attribute*) " severally distinctive of certain classes of bodies " (*what they are we shall see just now*); " in the organism there arise " (*by Mr. Spencer's law of biological equilibration?*) " faculties of responding to these other attributes—faculties which enable the organism to adjust its internal relations to a greater variety of external relations; faculties, therefore, which increase the speciality of the correspondence. We see this not only in the rise of the senses that are affected by the sapid, odorous, visible, and sound-producing properties of things," &c.

We find, therefore, that Mr. Spencer considers bodies to have the attributes or properties of producing odour, visibility, and sound, which properties are associated with, but are not composed of, the fundamental attribute, resistance. We understood that the latest teachings of science are to the effect that sound, visibility, colour, &c., are merely the names of subjective sensations, the result of vibrations aërial and ethereal. Surely Mr. Spencer does not mean to say that they are attributes of matter, but only the relations of the series (*a b*), &c., to the series (A B), &c., which, again, are related to the series (A B), &c.

If the fundamental sense is the response to fundamental resistance, then the solution of the whole question is to be found in some theory of the nature of the response. But to say that the senses are an increase of the degree of subjective correspondence (or response) is to throw no light upon the explanation of the correspondence or the necessity for it, and, as we have before said, the introduction of this term only tends to confuse the consideration of the argument. Correspondence, adaptation, and adjustment should all be abolished in favour of the real ruling principle of biological equilibration as taught by Mr. Spencer.

Eventually we come upon the term "integration," and would ask what this means in relation to biological equilibration. Is it one of its results? We could easily frame a theory of it in relation to ordinary mechanical equilibration. But in Chapter X. we have an account of the integration of correspondences. Does this mean an integration of the series (A B), &c., or of the series (*a b*), &c. The use of the word "integration" is no doubt meant by Mr. Spencer to carry the mind back upon the Formula of Evolution. But we must remember that the integration taught there was the integration of matter, and we must also remember that the essence of the formula was the concomitance of the dissipation of something, viz., Motion. Now in this case, if we have the series (*a b*), &c., in view, we have not only no integration of Matter, but also no concomitant dissipation of anything. Therefore if the present use of the word is intended to convey the idea that we are here effecting the unification of knowledge, it is merely one of the simulations of unification treated of in Chapter I. § 13. It is still more difficult to say how psychological integration is related to Mr. Spencer's law of biological equilibration; and when we come to consider the integration of psychological correspondences as part of that process, we believe that we have arrived at a problem of which we can form no conception, and which it is impossible to solve.

Under cover of the term "correspondence," Mr. Spencer elaborates his argument in a series of chapters, through which the greater part of its course is carried on by means of physical development, until in the end he is able to say :—

"Thus then we find illustrated in all ways the truth enunciated at the outset, that the connexions among vital actions directly or indirectly correspond with the connexions among actions in the environment. That method by which we sought out the fundamental fact on which to base a Synthetic Psychology, is justified by its results. On comparing the phenomena of mental life with the most nearly allied phenomena—those of bodily life—and inquiring what is common to both groups, a generalisation was disclosed which proves on examination to express the essential character of all mental actions. Regarded under every variety of aspect, intelligence is found to consist in the establishment of correspondences between relations in the organism and relations in the environment, and the entire development of intelligence may be formulated as the progress of such correspondences in Space, in Time, in Speciality, in Generality, in Complexity." *

No doubt Psychology has made the development described, no doubt Biology, including Morphology and Physiology, has made the development described, but while for the latter there is a hypothetical explanation in the special law of biological equilibration, there is none whatever for the former, and it is this which is looked for in a scheme of unified knowledge. To call the psychological developments by a term which may be applied as descriptive of the biological series, but which does not disclose the law of their connection with the preceding and continuous evolution, is not to find a place for Psychology in Evolution in general.

* Psychology, vol. i. p. 385.

Nevertheless, Mr. Spencer considers this has been accomplished, and says—

"The presentation of Intelligence as an adjustment of inner to outer relations . . . . leaves us with a conception which obviously requires further development. The various degrees and modes of Intelligence known as Instinct, Memory, Reason, Emotion, Will, and the rest, must be translated in terms of this conception. If, as above alleged, the several grades of Mind and its component faculties are phases of the correspondence and factors in the correspondence, they can be interpreted as such, and to complete the argument it is needful that they should be so interpreted." *

To this task Mr. Spencer forthwith proceeds in Part IV. It is sufficient, however, for our purpose if we confine our considerations to the essential preliminaries of such an explanation.

We do not quite understand Mr. Spencer's position when he says that the psychological relations take part in the determining of events "as factors in the correspondence." Probably he does not wish to convey this meaning, as he has elsewhere excluded all modes of feeling from the factors of Biology, and he nowhere teaches that a Psychic Force finds its place in the circle of the physical energies by which the work of the organism is carried on, and we know already that no such mode is included in Balfour Stewart's list of energies.

The whole onus of the affiliation of Psychology upon Evolution in general is thrown upon the term "correspondence," and upon the translation of all biological developments into the same terms. It is evident, however, that this is a verbal and not a logical connection. To make it a logical connection it would be necessary to show that all correspondences were identical in their law of origin, and since all biological correspondences are occasioned from the law by which moving equilibria generate arrangements for counterbalancing destructive forces, it would have to be shown that not only the relations (A B) were thus generated, but that the relations (*a b*) also were thus originated, and that they reacted as counterbalancing forces like the arrangement (A B).

* Psychology, vol. i. p. 392.

In the first place, amongst the constituents of the organism we cannot recognise anything which could be transformed into the relation (*a b*), and in the second, since it is out of the list of Physical Energies, we do not see that it could react against its external originator.

Mr. Spencer says :—

"These two progressions are in truth parts of the same progression. Without dwelling upon the fact that the primordial tissue displays the several forms of irritability in which the senses originate, and that the organs of sense, like all other organs, arise by differentiations of this primordial tissue—without dwelling on the fact that the impressions received by these senses form the raw materials of intelligence, which arises by combination of them and must therefore conform to their law of development—without dwelling on the fact that intelligence advances *pari passu* with the advance of the nervous system, and has the same law of development as the other systems—without dwelling on these facts, it is sufficiently manifest that as the progress of organisation and the progress of correspondence between the organism and its environment are but different aspects of the evolution of Life in general, they cannot fail to harmonise. In this organisation of experiences which constitutes evolving Intelligence, there must be that same continuity, that same sub-division of function, that same mutual dependence, and that same ever-advancing *consensus*, which characterise the physical organisation." *

If the argument commenced with the properties of primordial tissue, and this tissue were known to have the two sets of properties of balancing itself physically with the environment according to Mr. Spencer's law of moving equilibria, and of organising itself *pari passu* in a subjective manner, then the whole of Mr. Spencer's argument would hold good. But since he has set himself the task of explaining the order of the cosmos from a simple state of unorganised matter consisting of the chemical elements, we never get as far as the primordial tissue or its irritability, while the law of biological equilibration—a purely physical one—is also never established.

* Psychology, vol. i. p. 388.

Many other objections could be raised, but contenting ourselves for the present with showing the merely verbal nature of the unification developed in Part III., we proceed to a consideration of the affiliation of Psychology upon that view of the unification of knowledge which presents it to us as the reconstruction of the cosmos from original factors, or what is the same thing, deducing it in a series of corollaries from primordial truths.

(*d.*) *Psychology Considered as a Direct Deduction from the Persistence of Force.*

Are we to deduce Psychology from the doctrine of the Persistence of Force? Manifestly, if Force is unknowable the logical process is an impossibility. Are we, again, to deduce it from Professor Balfour Stuart's list of Forces and Energies? It will become merely a physical problem shortly to be considered.

It is a curious question, and one deserving of consideration, whether the Subjective is a mode of Force. In the face of Mr. Spencer's disavowal of Feeling as a factor in Biology, it is, in regard to Mr. Spencer's Philosophy, a superfluous question; for in that Philosophy the whole series of changes are within the constant quantity of the Forces and Energies of Nature, not as the Unknowable, but as actually manifested in knowable modes of Force quantitatively persistent and equal.

For those, however, who think that passion, emotion, will, &c., are not mere concomitances of molecular changes within the physical organism, it is an interesting, curious, and difficult question about the action of these subjective feelings, considered as beyond the absolute quantity of Force, and yet regarded as having power with which to act upon the energies of the physical organism. Whence and how do they derive this power, and how come they to be specifically differentiated as tending to act thus and thus?

Is it possible, again, to suppose that the physical energies are capable of transformation into subjective forces? Is Energy capable of becoming under certain circumstances self-conscious?

Is there an element of Consciousness, or unorganised Feeling, in all operations of Force or Energy?

We shall see in the next sub-section that Mr. Spencer considers that mind cannot be explained by a series of deductions from the Persistence of Force.

(*e.*) *Psychology Considered as an Indirect Deduction through Physical Histories.*

Let us now consider the problem of Psychology as associated with a physical synthesis.

The first part of the "Psychology" is devoted to an account of the nervous system and its functions. Chapters I. and II. lead up to Chapter III. where these functions are more explicitly generalised. The functions of the nervous system are—(1.) the reception of motion, (2.) the liberation of locked-up motion, (3.) the direction of motion. The *reception of motion* is the reception of motion from the external world by molar contact, undulatory action, chemical action; in fact, of heat or light, the mechanical action of other bodies, &c., the disturbances set up by which motions run along certain definite lines of nerves according to circumstances. The *liberation of motion* is founded upon the conception—not properly explained anywhere by Mr. Spencer—of "locked-up motion," but which we can indefinitely picture to ourselves as "energy" capable, under given circumstances, of effecting motion. The *direction of motion* is not to be confounded with the directive power of any subjective will or personality. The direction referred to is only an engineering arrangement by which, under given circumstances, certain small stores of energy are given off along specific channels. Treating nerve actions on their physiological side we have to ignore the subjective side, and in doing this we have no option but to formulate them in terms of motion.* Hence the first five chapters of the "Psychology" consist of "propositions which are exclusively morphological and physiological. In them the structure of the nervous system, its functions, the conditions to its action, &c., have been dealt with purely as physical phenomena—phenomena as purely physical as the absorption of the

* Psychology, §§ 18 and 24.

nutriment or the circulation of the blood. Whatever implications may have arisen from the use of words that carry with them indirect meanings, the direct meanings of all the propositions set down have nowhere implied consciousness or feeling; and, ignoring consciousness or feeling, they have left out that which is tacitly or avowedly contained in every proposition of Psychology." *

We have already sufficiently considered the parts treating of Psychology proper, and proceed to Part V., which deals with the Physical Synthesis. The problem here is, "How is mental evolution to be affiliated on Evolution at large, regarded as a process of physical transformation?" It is not enough that the general syntheses of psychical life have been traced up along with the phenomena of physical life, and have been observed to progress in integration, in heterogeneity, and in definiteness, while from first to last intelligence has found its growth due to the repetition of experiences, the effects of which are accumulated, organised, and inherited. "It may yet be asked—By what process is the organisation of experiences achieved? Granting that a survey of the facts proves it to take place; still, no answers are given to the questions—Why does it take place? And how does the transformation which brings it about come within the formula of Evolution in general?" †

To effect this affiliation it is necessary to bring Psychology within the terms of the Formula of Evolution, which terms are Matter and Motion and their interrelations; and although the Persistence of Force finds no place in the formula, yet as it is the main idea of the work, Psychology must also be affiliated upon that truth. However, we are saved this trouble, for Mr. Spencer says:—

"Though the development of Mind itself cannot be explained by a series of deductions from the Persistence of Force, yet it remains possible that its obverse, the development of physical changes in a physical organ, may be so explained; and until it is so explained, the conception of mental evolution as a part of Evolution in general, remains incomplete."

"Specifically stated, the problem is to interpret mental

* Psychology, vol. i. p. 129. † Ibid., p. 507.

evolution in terms of the redistribution of Matter and Motion. Though under its subjective aspect, Mind is known only as an aggregate of states of consciousness, which cannot be conceived as forms of Matter and Motion, and do not therefore necessarily conform to the same laws of redistribution; yet under its objective aspect, Mind is known as an aggregate of activities manifested by an organism—is the correlative, therefore, of certain material transformations, which must come within the general process of material evolution, if that process is truly universal."

We are at a loss to foresee how Mr. Spencer will regard our criticism. For the sake of properly apprehending the problem, we refer to his Appendix to "First Principles" for information as to the import of the terms Matter and Motion. Evidently we have to interpret mental evolution in terms of the redistribution of Matter and Motion. The development of Mind cannot be explained by a series of deductions from the Persistence of Force, but only mediately by means of the Formula of Evolution. But if we go further, and ask what Mr. Spencer means by Matter and Motion—what conceptions we should have of them when we wish to understand the development of mind by means of their interrelations, he replies:—

"Though I have repeatedly made it clear that our ideas of Matter, Motion, and Force are but the x, y, and z with which we work our equations, and formulate the various relations among phenomena in such a way as to express their order in terms of x, y, and z—though I have shown that the realities for which x, y, and z stand cannot be conceived by us as actually existing thus and thus without committing ourselves to alternative absurdities; yet," &c.*

In spite of this, we are asked to interpret physical evolution, and mental development as involved therein, in terms of realities which cannot be conceived by us as actually existing thus or thus without committing ourselves to alternative absurdities. We naturally ask what is the good of an explanation at all under these conditions, and how is it possible to interpret the order of nature by such instruments of thought.

* First Principles, p. 580.

However, we take up the thread of our inquiry where we left it, and we find that we are led to an investigation of the genesis of nerves proposed as a physical problem. "If from a corollary to the Persistence of Force, we can legitimately draw the conclusion that, under certain conditions, lines of nervous communication will arise, and having arisen, will become lines of more and more easy communication, in proportion to the numbers and strengths of the discharges propagated through them; we shall have found a physical interpretation which completes the doctrine of psychical evolution, as set forth in the last two parts. It will be made manifest how the experience of an external relation produces a corresponding internal relation—how, as experiences of the external relation become more numerous, the internal relation becomes more coherent—how perpetual repetitions of the one cause indissolubleness of the other—how outer persistences that are almost or quite absolute, establish, in the course of generations, inner cohesions that are automatic or organic; and thus the interpretation of instincts and forms of thought will be assimilated to that of the ordinary phenomena of association." *

It is always well to consider whether the mode of stating a problem is satisfactory or not, before considering the proposed solution. We are not by any means certain that the finding of sundry physical processes to be corollaries of the Persistence of Force (considered as a symbol of the Unknowable) is the same thing as the proposal to interpret mental evolution in terms of the redistribution of Matter and Motion (taken as sums total of the chemical elements and physical energies) so as to bring our reasonings within the scope of the Formula of Evolution.

In furtherance of the inquiry, the problem next proceeded with is the Genesis of Nerves. This is an inquiry as to the origin of the Biological connections (A B), &c., represented by the small capitals as correspondences to the external relations (A B), &c., and not as to the origin of the Psychological relations (*a b*), &c. As such, it is an inquiry which we reserve for criticism in our next chapter. But it is obvious that the

* Psychology, vol. i. p. 509.

mere ascertainment of concomitance of development between *some* of the connections (A B), &c., and the connections (a b), &c., is not an explanation of the origin of (a b), &c., in the same manner as the origin of (A B), &c., is supposed to be accounted for as logically deducible from the interrelations with (A B), &c.

Nor is the logical difficulty avoided by merging the question into one of Function studied in Part V. Chapter VI. In the preceding chapters the origin and development of nervous structure have been studied. The function of this structure is evidently the reception of motion, the storage of energy, the liberation of motion, altogether forming a highly complex mechanism, with a vast number of little engines and channels for the reception, redirection, and expenditure of energy. Notwithstanding its wonderful complexity and delicacy of construction, it is a purely physical arrangement, and its actions are altogether physical. To characterise its natural actions by the term Function is correct enough so long as this term carries with it a biological meaning only. But if it is used as a cover for "nascent" intelligence, we have to protest against the slipping in of the subjective. We are engaged upon a truly deductive study, and not upon an inductive one. So again the study of "reflex action" and "the gradually increasing excitement of the new motor apparatus" is followed by the statement—

"Thus, then, results what we call *perception;* for we have here a cluster of real feelings caused by the presented object, joined with a cluster of ideal feelings, representing certain other real feelings which the object has before produced and can again produce."*

"Between a perception physiologically considered and a perception psychologically considered, the relation now becomes manifest," &c.†

A physiological perception is, for instance, the action of the rays of reflected light coming from a body and falling upon the eye, which motions are continued into the cerebrum and thereafter redistributed. In this application of the term "perception" we do not think Mr. Spencer is justified. "Percep-

* Psychology, vol. i. p. 561. † Ibid., p. 562.

tion" we hold to be a purely subjective term. We can understand the action (A B) as the result of the connection (A B), but although experientially we know of the concomitant (*a b*), we cannot discern it as a deduction from the relations of (A B) and (A B).

By the same method of identifying the physical and the subjective concomitants in the terms of biological function, Mr. Spencer affords supposed explanations of ideas and afterwards of emotions. Since we know as a matter of fact that the intimate concomitance he describes does exist, and judge that the antecedent concomitant history he refers to did take place, it seems ungracious to argue against him; but as a matter of logic, in the deductive study he proposes the subjective connections (*a b*), &c., are not explainable as to origin, history, meaning, &c., by any of the methods he attempts.

(*f.*) *General Considerations with Regard to the Unification of Knowledge.*

To all such criticisms Mr. Spencer undertakes a reply in Chapter X. The general result of criticism, as Mr. Spencer truly anticipates, is a charge of "Materialism." But in his reply to this charge Mr. Spencer singularly misses the point of the criticism so far as it is of value from a logical point of view, and it is with this aspect only that Mr. Spencer and his scientific critics are concerned. He considers "Materialism" a term of opprobrium, and by the mouths of two Materialists makes reply. The first vindicates the delicacy and sensitiveness of the mechanical motion of some material bodies, and then proceeds to impress upon us the wonderful complexity of the constitution of inorganic bodies. The second identifies Mind with Motion—that is to say, the connection (*a b*) with the action of the connections (A B), or with the delicacy and vivacity of ethereal motions. Both of these vindications are in the sermonising strain, and deal with the charge of Materialism as a term of opprobrium. In the oratorical reply, the coolness and accuracy of pure logic are lost sight of. However, Mr. Spencer remarks that neither of these are true replies to the criticism advanced, and he proceeds to meet it in his own way.

The criticism, as we take it, is to the effect that from the given factors of premises, oxygen, nitrogen, carbon, hydrogen, &c., and a various environment of solids, liquids, and gases, together with the action of light, heat, electricity, &c., we are not able to deduce—

Firstly, Biological histories. But if biological histories are capable of being so deduced, then it forms a purely materialistic history, using materialistic as a term expressive of the sum-total of the above factors and as excluding all other agencies.

Secondly, Psychological histories. For even supposing biological histories are deducible as just specified, which is a logically possible problem, still the psychological histories present results which are not logically deducible from our conceptions of the given factors.

In this view, the charge of Materialism simply means that the explanations given of biological histories being merely materialistic explanations, they do not account for the subjective accompaniment, and most decidedly shut it out from taking any part in the processes of the sequences. For whatever the consciousness of conflict, or doubt, or choice, or determination, they are merely the concomitants of physical processes in the brain, and this consciousness is not a factor influencing the result.

We have nothing to do in our present study with any ethical or sentimental estimation of this mode of representing human action. We have merely to view it in its logical aspect, and the logical view of it is that the subjective result is not contained in the given premises which are termed materialistic, but that nevertheless if subjective sequences are wholly determined by these materialistic factors (the subjective being merely concomitant), then most certainly the explanations are materialistic, however much Matter may be advanced in our estimation by oratorical efforts.

What is Mr. Spencer's reply? He speaks about the unknowability of the ultimate nature of Mind, and the unknowability of the ultimate nature of Matter and of Motion. But it is at once seen that our premises have nothing to do with "ultimate natures." The reasonings in the "Biology" all proceed from the known properties of the elementary substances named and the laws of the physical environment. To place the question upon more remote antecedents is to alter the problem completely, and to make it not only impossible but altogether inconceivable. If, again, the non-knowability of the ultimate nature of mind is an obstacle in our way, then truly we must be forced to admit failure in the unification of knowledge.

Confessedly we end in a predicament, but a predicament is not the unification of knowledge.

"See our predicament. We can think of Matter" (*oxygen, &c.*) "only in terms of Mind" (*consciousness*). "We can think of Mind only in terms of Matter" (*i.e., as the concomitant of some physiological actions*). "When we have pushed our explorations of the first to the uttermost limit, we are referred to the first for a final answer; and when we have got the final answer of the second, we are referred back to the first for an interpretation of it. We find the value of x in terms of y; then we find the value of y in terms of x; and so on we may continue for ever without coming nearer to a solution. The antithesis of subject and object, never to be transcended while consciousness lasts, renders impossible all knowledge of that Ultimate Reality in which subject and object are united."

What are we to understand by this? The first impression is that Mr. Spencer has adopted Talleyrand's use of language. But what are we to understand by it? Does it mean that the two volumes on the evolution of Biology are adhered to or abandoned? Does it mean that the factors upon which that great deduction proceeded are inconceivable, and the whole of our reasonings upon them worthless? Or, again, does it mean that not knowing the ultimate nature of Mind, our reasoning powers are unreliable? We can imagine no other practical application of the above passage; and if so, what becomes of the unification of knowledge? We would contrast it with Mr. Spencer's criterion of the unification of knowledge quoted by us at the outset of our task,* and ask the student to consider whether this is a satisfactory outcome of the enterprise we have undertaken. For our part, we think a more damnatory condemnation than the above passage could not have been written

* Supra, p. 4.

by any opponent of Mr. Spencer. Yet he has written it in regard to his own undertaking.

Nevertheless, this predicament is said to bring us to the true conclusion, "that it is one and the same Ultimate Reality which is manifested to us subjectively and objectively. For while the nature of that which is manifested under either form proves to be inscrutable, the order of its manifestations throughout all mental phenomena proves to be the same as the order of its manifestations throughout all material phenomena."

This may be so; but if we can form no conception of this Ultimate Reality so as to be able to deduce the histories of the cosmos from it, knowledge is not unified. We observe the universality of its manner of operation, but we do not discern the secret of the sequences, or rather, we discern it partly, and would extend our scientific knowledge to the whole. The deficiency of our knowledge is not made up by recognising the universality of modes with its implication of community of origin.

It would be well, however, to give a separate consideration to the suggestion made in this reply as to the Ultimate Reality manifesting itself by a "double aspect."

§ 3. *The Double-Aspect Theory.*

As we have somewhat anticipated the subject of this section in Chapter III. by showing the futility of the Double-Aspect Theory in any attempt to find an explanation of the historical series of events culminating in the subjective aspect itself, as deductions from primordial factors, there is not much left to say. It would be as well, however, to give a little more attention to Mr. Spencer's treatment of the subject, and to the language employed in the statement of his views.

We first direct attention to § 194, being the closing section of "First Principles," of which the following is a summary:—

The deepest truths we can reach are the widest uniformities in our experiences of Matter, Motion, and Force.

These are but symbols of the Unknown Reality.

An Unknowable Power works in us certain effects.

These effects we class together under the names Matter, Motion, and Force.

Between these effects there are likenesses of connection.

Analysis reduces these effects to one kind of effect.

Analysis reduces the kinds of uniformity to one kind of uniformity.

"And the highest achievement of Science is the interpretation of all orders of phenomena, as differently conditioned manifestations of this one kind of effect, under differently conditioned modes of this one kind of uniformity."

Science, therefore, merely systematises our experience.

We do not know that these uniformities are absolutely necessary—only that in our thoughts they are necessary.

We cannot conceive how the one is related to the other. The connection between the phenomenal order and the ontological order is for ever inscrutable.

(We remark here that the classification and systematisation of our experiences is not the same kind of unification of knowledge as that by which all sequences are to be deduced as corollaries from one ultimate truth or from primordial factors.)

The connection between the conditioned forms of being and the unconditioned form of being (*query—is there any?*) is also inscrutable.

The interpretation (*query—what does interpretation mean?*) of all phenomena in terms of Matter, Motion, and Force is nothing more than the reduction of our complex symbols of thought to the simplest symbols.

"Hence the reasonings contained in the foregoing pages afford no support to either of the antagonistic hypotheses respecting the ultimate nature of things. Their implications are no more materialistic than they are spiritualistic; and no more spiritualistic than they are materialistic."

This all depends upon the meaning given to the terms. The discussion after all does not relate to ultimate natures. Ultimate natures, being absolutely unknowable and inconceivable, do not enter into the discussion at all. But taking the materials and facts of chemistry and the laws of physics as imagined in a nebula, can we from these primordial factors deduce the solar system, and the forms of life with which we are acquainted on the earth at the present time? This is what would generally be called a materialistic explanation, and that it appears to us Mr. Spencer attempts. To discuss the ultimate nature of these bases of knowledge is going beyond science. Either their ultimate natures are all conditioned as we know them, and hence the deduction is possible; or they are not all conditioned and known, which makes (as is the case) the deduction impossible, and causes knowledge to remain ununified.

However, Mr. Spencer says—

"The Materialist, seeing it to be a necessary deduction from the law of correlation, that what exists in consciousness under the form of feeling, is transformable into an equivalent of mechanical motion, and by consequence into equivalents of all the other forces which matter exhibits; may consider it therefore demonstrated that the phenomena of consciousness are material phenomena." And the Spiritualist may argue the converse.

"Manifestly, the establishment of correlation and equivalence between the forces of the inner and the outer worlds, may be used to assimilate either to the other; according as we set out with one or other term. But he who rightly interprets the doctrine contained in this work, will see that neither of these terms can be taken as ultimate. He will see that though the relation of subject and object renders necessary to us these antithetical conceptions of Spirit and Matter, the one is no less than the other to be regarded as but a sign of the unknown reality which underlies both."

We submit that the correlation and equivalence between the inner forces and the outer, between the subjective and the objective, has not been made out except in regard to the dependence of the former upon the latter. Mr. Spencer repudiates Feeling as a factor in Biology, and makes all his interpretations as resultants of certain elementary substances and certain physical conditions. And we have before shown, Chapter I. p. 43, that subjective consciousness is excluded from the list of energies which are acknowledged by scientific men as correlated. So that Mr. Spencer's explanation of the order of sequences is couched in materialistic terms, and to say that the unknowability of ultimate natures invalidates the explanation is to say that Mr. Spencer's explanation fails, and to undo all the work that he claims to have performed.

Can Mr. Spencer complete his work, on the double-aspect theory, by making a complementary explanation in subjective or spiritualistic terms and processes? Can he explain chemistry and physics and the growth of organic molecules and organisms in terms of the subjective, and derive all as deductions from certain spiritualistic factors? When this is done we may acknowledge that the series of events is a process one and continuous, having a double aspect, and capable of being deductively demonstrated and explained in two sets of terms, materialistic and spiritualistic. At present it seems to us we can only explain the course of cosmical events in materialistic language down to a certain point at which the materialistic language fails us, and then the spiritualistic or subjective comes in as necessary for other explanations, though still dependent upon the materialistic. We find that we have to begin our explanations with one aspect, and end them with two. How came the second to be evolved?

If materialistic explanations now take the language of dynamics rather than of geometry, they are still materialistic in the sense of not being subjective. If we use the terms affinity, attraction, repulsion, polarity, equilibration, &c., they are all objective terms. So also are segregation, integration, dissipation, rhythm, &c. These are the terms of Mr. Spencer's explanations. Can we graft upon them other meanings, so as to render them capable of expressing the order of sequences in a subjective cosmical explanation?

Is it to be done by means of the term Force, which may be considered common to both aspects? Our studies all point in that direction; but it is at present no more than a suggestion, for even with his powerful and acute mind Mr. Spencer cannot work it out into a logical, coherent, and systematic deductive system.

Mr. Spencer refuses to allow Matter and Motion to bear definite meanings. He maintains that Matter, Motion, and

Force are *merely* symbols; not symbols standing for something known, but indefinite symbols, standing for something not known or only partly known. We are allowed to use them in physical studies of their combinations and aggregations. We are allowed to use generalisations about matter in the explanation of objective processes, but when we come to processes in which occur phenomena not so explainable, we are asked to give Matter another aspect. Now it is evident that up to a certain point the view of Matter which takes it in its known conditions as chemical elements is able to furnish explanations. Why then should we be called upon to view it up to this point in some other aspect? Because we have to argue backwards, and infer that since Matter becomes self-conscious, there must have been something in the original factors which was capable of becoming organised into consciousness. Admitting this to be the case, it would appear that the ultimate units of Matter were units of attraction and resistance, and something more; or else Matter was not units of attraction and resistance, nor yet a conscious subjectivity, but something between the two; not either of them, but a something of which neither subjectivity nor objectivity could be predicated—something of which neither attraction nor resistance could be predicated, nor yet consciousness. Thus we are lost in the Unknowable Force; we are thrust beyond the limits of Philosophy; we are in the presence of an Unknowable Power. As long as we contemplate it, Philosophy has nothing to do but to sit waiting patiently till it manifests itself in some definite form. If it does so manifest itself, and eventually resolves itself into a quantitative Attraction and Repulsion, then Philosophy seizes upon it as her raw material, and builds up systems of worlds until she comes to Consciousness. Then she says, "Surely I have got more in my hands than I thought; there is something that feels." This does not alter the definite knowledge of the interrelations of Attraction and Repulsion, nor the conceptions of them. It does not alter the aspect of looking at them, nor change their value, operation, or quantity in the least degree. If it is said that they have a subjective aspect also, it is saying something that cannot be understood, and which

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those who hold that view must explain. Let the subjective aspect of units of Attraction and Resistance be described. Let the subjective aspect of the formation of the sixty or seventy so-called elements be described also. What is the subjective aspect, for instance, of the union of oxygen and hydrogen into the compound called water?

The dilemma at which we arrive in the course of evolution is this: By a formula of Attraction and Repulsion we may be able to generalise all physical processes, and explain the existence and history of every aggregate, but by and by we reach events which the physical formula will not explain, namely, subjective phenomena. The difficulty is to account for and explain these in a general formula. We find the old one will not do. What must be done? Will it do to say that Matter and Motion, Attraction and Resistance, are not really objective—they have another aspect also? If so, we thereby destroy the definite meaning of our formula, as already so much insisted upon.

If every event has a double aspect, and to treat of the history of events under one aspect is insufficient, we must amend our formula, so that by exhibiting the double aspect we shall be able thereby to deduce the double-aspected evolution. The formula to account for a double-aspected evolution must itself be double-aspected.

Thus we should have to say—

$$\begin{array}{r}\text{Evolution is}\\ \text{and a concomitant}\end{array}\left\{\begin{array}{l}\text{integration ? of feeling and}\underline{\hspace{6em}}\\ \text{integration of matter and dissipation of}\end{array}\right.$$

$$\underline{\hspace{10em}}$$
$$\text{motion, wherein, \&c.,}$$

filling in all the blanks in terms of the other aspect.

It is asserted, however, that the process of evolution is not two concomitant evolutions, but one evolution. Notwithstanding Mr. Spencer's exclusion in the "Biology" of Feeling as a factor, yet in the passage quoted above he says—"The Materialist, seeing it to be a necessary deduction from the law of correlation, that what exists in consciousness under the form of feeling is transformable into an equivalent of mechanical motion, and by consequence into equivalents of all the other forces which matter exhibits." We, however, noted at the time that Professor Stewart did not include Feeling in his list of energies which were mutually equivalent or transformable. Mr. Spencer has in various places maintained that in conscious beings the subjective never interferes in any physical action. It is said to be inconceivable that any muscular reaction from an external stimulant has been at all interfered with or influenced by any subjective feeling. There is a course of molecular motion along a nerve, there is some change caused thereby in the substance of the nerve or brain, and there is a molecular reaction due to the previous action; but to suppose that this reaction is at all influenced by feeling is out of the question; we are merely conscious of it. All molecular movements in an organism are not two events, but only one. A muscular motion may be described mechanically or subjectively, but it is one and the same event. The amount of energy has not been augmented nor diminished by the action of any feeling, nor could feeling augment or diminish it without being itself a mode of motion, which it is not. It is inconceivable that feeling should have a mechanical function. Muscular and all other actions of an organism are all chains of mechanical action uninterfered with by feeling. Yet they are one and the same; the subjective and the objective within the organism are one and the same thing viewed differently. The question arises, are all external changes to be regarded in the same way as objective and subjective at the same time?

As a proposition limited to the actions and consciousnesses of organisms, the "double-aspect" theory is one which is capable of being understood, if not accepted; but as a general truth applicable to the historic explanation of the inorganic universe, we cannot understand it. And if, impelled by a desire to so represent it, we endeavour to frame a formula explanatory of the universe in this double-aspected way, as attempted above, we find it is impossible to formulate any proposition of an intelligible character.

The double-aspect theory may serve a very useful purpose after the stage of biological evolution has been attained, as affording diversified modes of description of the complex occurrences affecting organisms, in which one or other set of terms may be used, according as the incidents of a series of events may have their chief import objectively or subjectively; but as a key to the order of events, and as a means of cosmical explanation, it is useless.

It is worthy of remark that the "double aspect" is not claimed for all the operations of the physical organism. There are some changes which have the double aspect and some which have it not. What are called the organs of sense have the concomitance of subjective feeling; so have muscular motions and other events of the organism; but the processes of accretion and secretion have not this accompaniment. We must certainly consider this a shortcoming in the Double-Aspect Theory.

Again, the "double aspect" is confined within the limits of organisms. When we speak of the double aspect, it is the double aspect of changes of a conscious organism. Therefore if knowledge is some arrangement or state of the molecules and fibres of the brain and nervous system, then all knowledge has a double aspect, of which the physical arrangement is one side, and the concomitant subjective is the other. This is indeed a method of representing the theory of the Relativity of Knowledge, since all knowledge is subjective, and the subjective is but the consciousness of certain physical organisations, which organisation is produced by physical interrelations. But when certain portions of this physical arrangement (with which goes the subjective) have effected that mechanical arrangement, with which is concomitant the consciousness of there having been an antecedent condition of the cosmos in which there was no consciousness, no subjective aspect, then the physical arrangement of the brain which is the objective process of reasoning is unable to bring about that other physical state of the brain which is the physical state of an explanation of the origination of the subjective concomitant; and also that general arrangement of the molecules and fibres of the cerebrum and cerebellum which would produce the consciousness of the unification of knowledge has not been effected. We assert, in short, that the physical arrangement of the brain which is equivalent to the argument of the Double-Aspect Theory does not produce the cerebral organisation which is the analogue of the unification of knowledge. It is true we are unable to examine the physical changes in a direct manner, for they are beyond our reach. We can only judge by our consciousness of them.

The real solution of the difficulty would have to be placed in the statement of an ultimate truth or factor, from the double nature of which as a series of corollaries the conscious double aspect of organised living beings could be deduced. This problem is attacked by Professor Clifford with his usual intrepidity of thought in the bold hypothesis of "Mind-Stuff." He says,* "The reality external to our minds which is represented in our minds as matter, is in itself mind-stuff." "The universe consists entirely of mind-stuff. Some of this is woven into the complex form of human minds, containing imperfect representations of the mind-stuff outside them, and of themselves also, as a mirror reflects its own image in another mirror *ad infinitum.* Such an imperfect representation is called a material universe. It is a picture in a *man's* mind of the real universe of mind-stuff." "Matter is a mental picture in which mind-stuff is the thing represented." "Reason, intelligence, and volition are properties of a complex, which is made up of elements themselves not rational, not intelligent, not conscious."

Thus it will be seen that the term "mind-stuff" is equivalent to "mind-matter," a double-aspect word supposed to be representative of the factor of the universe. This theory is examined by us very fully in the Appendix to our former work. We only note here the kind of factor which the Double-Aspect Theory forces us to look for, the impossibility of forming any conception of it, and finally, the impossibility of deducing the sequences and evolution of the cosmos from it by way of corollaries.

In the first section of this chapter we referred to Mr. Spencer's account of the faint and vivid manifestations which presumably forms another account of the Double-Aspect

* *Mind*, No. ix. p. 66.

Theory. But we do not see that it assists us at all in escaping from our difficulties. There are two different orders of manifestations of Force. They segregate, and apparently segregate in parallel groupings, the one corresponding to the other, but whence the parallelism and correspondence does not appear. Again, we found that all knowledge would have to be expressed in terms of the impression we call Resistance, implying both the impression and the mutual action of pressing and resisting bodies; again implying the double aspect. But then, as a matter of fact, when events have to be considered as corollaries, or such of them as can be so considered, the terms used are all of the objective or physical side, and valid explanations can be given on this aspect only.

Mr. Spencer's term "Force" itself appears to be a "double aspect" term in that it manifests itself objectively as opposed to our consciousness and subjectively in our consciousness. But Mr. Spencer himself acknowledges that we can form no conception of it, although he apparently proposes to get corollaries from it—only that his corollaries are from, not the factor itself, but only its adjective of "Persistence." Here, again, we only obtain any meaning when we consider the objective aspect in the scientific doctrine of the "Conservation of Energy," and that of a definite and limited character.

If the evolution of the subjective is to be unified with evolution in general, as part of one universal process on the ground of the conformity of its modes with the modes of the general evolution of Force; if because its characteristics are such that they can be deemed corollaries from the theory of the Persistence of Force in the same way in which the evolution of physical bodies can be deemed deductions from that theory, then subjectivity must itself be a mode of Force, and take its place in the circle of the interchanges of correlative forces, and is not a mere aspect of modes of physical forces. It must be one of them. Otherwise it is a merely dependent something unrelated as a corollary with any general primordial factor.

For the further study of the theory in its practical application we append an examination of Clifford's "Seeing and Thinking," and of Dr. Bain's "Mind and Body."

APPENDIX TO THIS SECTION.

(*a.*) *Professor Clifford on the Double-Aspect Theory.*

In the third chapter of "Seeing and Thinking," the late Professor Clifford makes an ingenious attempt to represent the double-aspect theory. The first object is to show how all external events come upon the human organism as motions, and as such are transmitted to ganglions and other still larger nervous centres, where other groups of motions are set up which either immediately or after an interval react upon the environment in certain definite manners. This is, in fact, a chain of physical events, and the supposition is that man and all his actions can be so represented, and would have come into being and worked as a thoroughly complete and perfect machine, even had there been no feeling or consciousness at all; that this latter has been no factor in his evolution, but that his existence and all his doings are incidents in the chain of physical development—the mechanical explanation being complete in itself.

What is required, therefore, is a full and complete representation of human actions in physical terms. Now, since it is ascertained that all the facts of sensation and action are connected with the nervous system, the problem resolves itself into a description of the nervous system as a complicated mechanical arrangement, and of all events as a series of motions of this mechanism.

The first stages of this description are comparatively simple and easy, and tend to bear out the theory. The further stages are more and more surmise, and rely for acceptance on presumed analogies, and on the probable continuance of processes, rendered more plausible by the consideration of the structure of the brain; while the final stages slip out of the reckoning altogether, even surmise finding no vague mode of expression in the language of physics. Here Professor Clifford is forced into the exclusive use of subjective terms, seeing his facts utterly escape a physical representation.

Let the reader carefully examine this chapter, with the steady resolve to keep to language of physics, and see how he fails. He will find, in the first place, a very liberal use of the terms "message" and "messages." All of these he will cross out, substituting in the margin the term "motions." He will see that motions of the nerves are the result of incident motions of light, heat, contact, &c., of the environment; and will remember that the function of the nerves was heretofore stated to be the transmission of these motions. Therefore he will at once discard the other more indefinite term "message" and keep rigidly to the term "motion." The substitution of terms is just as illegitimate in philosophical studies as is the substitution of chemical substances by chemists in their experiments.

This substitution will have to be made eleven times up to page 77, where the problem is re-stated :—

"How out of that simple process we can build up that exceedingly complicated thing which we call human life."

So that in a microscopical examination of the brain of a living man, if it were possible—

"You would see nothing more than the merely mechanical actions that we have described hitherto."

How then does Professor Clifford describe the interrelation of mind and brain, and formulate mental processes in terms of mechanical actions? He simply states the co-existence of the sensation of sight with certain motions of a special part of the nervous system, and speaks of the sensation as being "in the mind." And from this point he begins to confuse his subject. He does not keep to his stated problem, how out of simply mechanical processes to build up human life. Instead of this, he introduces sensation as a factor in the chain of events; not merely as an accompaniment, but as a link in the course of the motions, which by the supposition is excluded, and by some is said to be inconceivable; for it would be equivalent to saying that that which is not Energy (which is quantitatively invariable) affects Motion, and would thus vary the quantity of Energy. If he does not indeed do this directly, he does so by implication; as thus (p. 81)—

A *sensation* comes into the eye or the ear.

A *disturbance, i.e.*, a set of motions, comes into the eye or the ear.

A *sensation* comes into the mind.

It gives rise to a *train of thought.*

It goes on to manifest itself in an action ; as thus—

It causes a feeling of wanting to do something.

It causes exertion to satisfy that feeling.

From this point the sequence proceeds objectively, the immediately following description being given in physical language, p. 82 (bottom) to p. 85. In reading these pages the terms "messages" and "disturbances" must be translated into the mechanical term "motions."

"A motion is produced in the eye."

"A motion is produced in the optic nerve."

"A set of motions is produced in the mechanical arrangement called the brain."

"The brain was in a state of complicated motions."

"The new motion alters the motions of the mechanism of the brain."

The motion is rearranged "according to the ordinary laws of action in the brain," *i.e.*, mechanical—these laws being explained as "dependent upon the shape of it, upon the way in which these white threads in the interior are arranged, that connect the different parts together," making the procedure "an orderly sequence of purely material events in the brain."

This is followed (p. 85) by a message, *i.e.*, a motion, going out from the brain to the muscles. "Here we have some disturbance" (*i.e., motion*) "which has come into the brain" (*i.e., a mechanism*) "from without, and which has re-arranged itself" (*i.e., produced certain mechanical effects upon the mechanism according to the laws of motion*) "in the brain" (*mechanism*), "going out again along certain muscles" (*or connections of other parts of the mechanism*), "and passing away from the brain" (*a particular part of a larger mechanism*) "altogether. It" (*the motion*) "goes to those muscles" (*mechanism*) "and moves them, and that is all the brain" (*part of the mechanism*) "has had to do with it."

How do we stand now? We have examined the subjective chain of events, and have seen its dependence upon the physical chain, and its apparent interference with the subsequent chain of physical events. We have also traced the mechanical sequences of an incoming motion till we have lost them in the complicated motions of the mechanism of the brain, and we have failed to discern how the motions constituting, say, the perception of a purse on the ground, can mechanically explain the sequence of picking it up. We trace motions from the eye to the brain; we discern consequent motions in the brain. But we cannot see the mechanical connection necessitating those further motions of the mechanism which, issuing to the muscles, result in picking up the purse.

If we ask what was the cause of the "picking up," are we to be told that it is a purely mechanical action, the beginning of which we can explain in detail, and the latter part of which we can explain mechanically in an intelligible manner, but the middle part of which we are, as yet, from want of sufficient knowledge of the mechanism of the brain, unable to set out in detail, though we judge from the first part and from the latter part of the explanation that it must be of the same nature—*i.e.*, mechanical? Then the fact of the "picking up" as a sequence from the perception is a purely mechanical event from first to last, and would have happened quite independently of any sensation, feeling of want, or feeling of exertion.

If we say, however, that this sensation, feeling of want, and feeling of exertion were factors in the series of sequences without which the "picking up" would not have taken place, then we manifest the insufficiency of the mechanical explanation, and also affirm the existence of a force or power which is capable of interference in a mechanical manner so as to the direct the motions of material particles, which, indeed, is no less a miracle than the removal of a mountain by word of mouth, and a plain contradiction of the constant quantity of Energy or of Motion, or of that more abstract proposition, the Persistence of Force.

How is this difficulty to be got over? Professor Clifford says by the theory of parallelism or of a double aspect to the phenomena. This parallelism is well described on p. 85:—"A sensation apparently comes into my mind from without; it is turned over in my mind; conclusions are drawn from it, and an action follows. A disturbance comes into my brain from without, a purely mechanical disturbance; it is turned over and reverberated in my brain, and then it is sent out from my brain again to a muscle to move it."

Let us carefully examine this theory of "parallelism" and the "double aspect," to see that it does not confuse our scientific intentions. The object of Science is to understand the sequences of the cosmos—the object of Philosophy is to express in one formula the whole series of sequences. What we wish to know is whether the whole series here illustrated is a series of mechanical sequences derivable from the actions of light and colour upon the eye, the optic nerve, and the mechanical construction of the brain, and ultimately from the laws of the interrelation of aggregates of the chemical elements; or whether, on the other hand, no such result would have taken place if it had not been for certain subjective facts which affected the mechanical motions of the brain. In the latter case, a mechanical explanation is evidently insufficient. Yet, if we say that we are only speaking of the same event, and use different language merely to denote the aspect from which we view it, we do not escape from the responsibilities of a mechanical explanation—we are not speaking of a subjective event which has a mechanical side, but of a mechanical event which has a subjective side. The whole weight of the explanation rests with the mechanical theory, unless we are prepared to grant subjectivity as a separate factor interfering with the mechanical. We are obliged to say, then, that when we speak of a mental event as having a double-aspect, we mean a physical event with a subjective aspect. We must also say that there are, correctly speaking, no mental events nor mental sequences, but only mechanical events and mechanical sequences, which have also a subjective aspect. The real factors are the chemical elements, or aggregates of attractions and resistances; but certain combinations and interrelations of them (why is admittedly a mystery) are accompanied by subjectivity, which subjectivity does not in the least interfere with the course of the mechanical sequences. If this is so, then it must be admitted that mental science exists merely by courtesy or by way of convenience, and that every fact, event, law, and correspondence finds an independent representation and explanation objectively in the structure and actions of the brain and nervous system regarded as mechanisms—these mechanisms not being in the least dependent upon the sensations, the feelings, or the exertions of the subjective in their construction or actions.

We do not think there is any reason here for charging us with a misunderstanding of the double-aspect theory. It may be urged that we do not look at the matter exactly as our teachers would have us look at it. They will say, "You keep the aspects too much separated; you *will* divide them when you ought to unify them." We reply that when we look at the action of a man, as it were, "statically," we can, we think, place ourselves fully at the point of view of those who hold the double-aspect theory; and even when we take a man as he is constructed, and view him under the influence of some external motions, as before described, we are almost able to regard the series of events as equally subjective and mechanical, though at the same time we fail to see how the external incident motion, either directly or indirectly, through the consequent motion of the nerve substance, can originate or influence or change the subjective. But when we come to study the structure and actions of man as part of the history of the cosmos—when we have, that is to say, to study the subject historically, tracing all existences and actions as consequents of previous existences and actions; when we come to a time when those chemical aggregations with which the subjective is indissolubly connected did not exist, we find ourselves quite unable to account for the origination of the double aspect of certain existences and events. The origin, structure, and functions of these aggregates hypothetically rely upon that mechanical explanation which seems to be sufficient for the explanation of all preceding events and existences. Certain compounds in certain aggregations, however, seem to possess the property of a double aspect, and it is not correct, considering their physical origin, to say of them that they are the same series of events having two aspects, one subjective and the other objective, but that they are a special and limited class of objective events occurring in due order of physical sequences, which have, we know not why, a subjective aspect.

The word "parallelism" almost confutes the theory of the "double aspect." It would partly imply that a double yet independent series of events went on at the same time. It is, indeed, a figure of speech, and is therefore a very unsafe term to use. Parallel lines run on for ever, and never affect each other, and never meet. They are separately independent, and are only in relation in our minds; and if we regard them as the motions of bodies, still they do not affect each other; one does not diverge because the other does, for that would be a dependence or sequence to the action of the other; one does not move faster or slower in accordance with the movement of the other, for that, again, would mean dependence. Parallelism may, it is true, mean that the initiative is taken by one line and is followed by the other; and this, indeed, would seem to be the meaning intended when people speak of the parallelism of the mental with the physical operations of the brain and nervous system; but then the onus of all the explanations rests with the mechanical processes to which the mental run parallel. But if, on the other hand, it is held that the mechanical runs parallel with the subjective, then the difficulty of the explanation of the dependence of the physical upon the mental process seems insuperable. If, again, we adopt a mixed explanation, then sometimes the mechanical will run parallel with the mental, and sometimes the mental will run parallel with the mechanical; and we have a contradiction of parallelism altogether. We have then to resort to the supposition of two perfectly independent courses running parallel without any intermediate line of connection, the course of each independent movement being explainable in itself and on its own grounds, though each has a uniform correspondence with the other, the cause of this correspondence being explainable otherwise than as one of mutual interaction. The theory of parallelism is explained from pages 85 to 89. Parallelism is, indeed, a weaker mode of representing the theory than that of the double aspect. The latter, indeed, is one that could be adopted if the mechanical explanation were shown to be capable of accounting fully for all the facts of the origin and evolution of life, and if the relation of the subjective to the objective in the original simple factors could be formulated.

This brings us back to Professor Clifford, who now proceeds to some such explanation. He first takes the case of hunger and feeding (p. 90).

"Let us first take a very simple connection between sensation and action—that is to say, suppose that at a time when we are hungry a piece of food is put into our mouth, and we instinctively begin to go through the very complicated motion of chewing and swallowing it. This involves, in the first place, a previous state of the brain implied in saying that we are hungry." We stop the quotation here in order to ask what is the *state of the brain* viewed as a mechanism? There is not the slightest attempt to describe this state mechanically, nor even a hint at the kind of mechanical condition of the brain that would be produced by hunger. Professor Clifford continues:—"And it then involves a very complicated and combined message" (*i.e., motions*) "to be sent up from the tongue and from the muscles of the mouth, and then an exceedingly complicated message" (*i.e., motions*) "comes back to direct the motion of the tongue and the teeth in chewing and swallowing the food."

"Here the important things to notice are two: first of all, what are the messages which go in? and secondly, what are the messages which go out? . . . That instinctive movement of the mouth does not follow in cases where we have already had enough to eat. It is necessary that there should be beforehand that *state of the mind*, and that *concomitant state of the brain* which we express by saying that we are hungry.

"What is the meaning of that? It means that we get messages" (*motions*) "to our brain, not only from those organs which we call the five senses, . . . but that we also get messages" (*motions*) "from the inside of our bodies. The sensation" (*subjective*) "of hunger is a message" (*i.e., motion*), "which is sent to me from my stomach and from the rest of my body, to say" (*this does not seem to be either a mechanical or a subjective term, but a figure of speech*) "that there is a want of nutriment. But this sensation" (*subjective*) "of hunger differs from the other sensations in this. It suggests" (*a mental, i.e., a subjective term*) "that I" (*subjective*) "should get" (*subjective, endeavour to get*) "something to eat." Here, then, we see that the mechanical explanation attempted as being a process complete in itself utterly fails in an instance which Professor Clifford has selected as a simple illustration. We do not say that such a mechanical explanation may not some day be possible. We do not say that it is, in fact, not a purely mechanical process, part of a larger course of mechanical causation, of which the subjective aspect is merely one side; but we do mean to say that a mechanical explanation is not now possible, and therefore no one has any right to claim it; and we do mean to say that as long as those who desire to explain the process drag in subjective terms, so long are we obliged to infer that subjective feelings are factors in the result, however impossible it may be for us to conceive of that which is not Energy affecting a series of mechanical processes.

Professor Clifford, then, in a very careless manner, by way of "&c., &c.," refers to "stomachic sensations," and "appetites" and their "promptings," as if to imply that the illustration selected having been so plainly rendered, all these other things "go without saying."

The outgoing nerves move the muscles or pinch the blood-vessels. The blood-vessels feed and reconstitute the wasted parts, more particularly the nerves which have become worn out, &c. All this is saying nothing. We require the mechanical nature and connection of the whole process explained.

We do not know that it is worth while to take up the explanation as resumed on p. 95, and examine it in detail. If Professor Clifford wishes merely to show the concomitance of feeling with mechanical changes of the organism, he succeeds. If he means to prove that all the actions of organisms are parts of a course of mechanical sequence in which the formation of the organism is itself an incident, and in which feeling has no part and is no factor, he does not succeed, because his explanations are full of subjective terms.

It is tedious to writer and reader, and, moreover, expensive to have printed in a book these long-detailed examinations of verbal intricacies; and yet we consider it important both that writers should be required to be precise, and that readers should be taught to be critical, so as not to be misled by the reputation of the author. Therefore, let us resume our study.

"Now, let us go back to the case where the stomach has sent up a message" (*motion*) "saying" (*figure of speech*) "that it wants" (*doubtful meaning*) "food" (*also ambiguous*). "This message" (*motion*) "has produced" (*mechanical change*) "the sensation" (*subjective*) "of hunger, and the incoming message" (*motion*) "would naturally have to go out again" (*why?*) "and move something or other. But if you have no food at the time it is unable to go out and move your muscles, so as to make you eat food, which is the natural" (*ambiguous term*) "thing for it to do; it must, therefore, do something, and what it does is to direct" (*ambiguous*) "your attention" (*again ambiguous*) "to the fact that you are hungry" (*ambiguous*). "That is what we call having an appetite, that is to say, the concomitant states of the mind and body in which we are more particularly ready to reply to certain suggestions from without. These are really states which again are produced in these grey centres, the centres of grey matter which connect together the sensations" (*motions*) "which are to come in, and the motions which are to follow, so that, in fact, the state of having an appetite means the state of being attentive to those connections whereby, when a piece of food is put into your mouth, you will naturally proceed to masticate and to swallow it."

Here again it seems to us that there is a want of logical coherence. Suppose we say that the use of the word "hungry" is to denote a mechanical state and a subjective state, and that these states are always concomitant. It is admitted that this state is produced, and it is admitted that certain actions result from this state. We will ask, firstly, what produces the state. The physical state is produced by the giving off of Matter and Motion from the body, so that there is a lack of material in the mechanical organism to continue its action. This implies a certain physical or mechanical change in the organism. Since this results in hunger and thirst, the acting cause of the mechanical state of hunger and thirst is a mechanical one, and the sensations of hunger and thirst are merely concomitants. This mechanical state of hunger and thirst produces actions. It is argued that the lack of incident forces on the coats of the stomach or elsewhere, or perhaps a change or falling off in the motions from the stomach or elsewhere, produces a change in the actions of some of the mechanically constituted molecules and structural arrangements of the mechanism called the brain, and results in the process of going to the cupboard to get a cake and some wine. The question is, has the *feeling* of hunger and thirst anything to do with this result? or would it have taken place had there been no such feeling? We understand it to be argued that the *feeling* is not a factor in the series of events, but is only a concomitant. The whole explanation is supposed to rest with the mechanical process. It is right that we should clearly understand the position, but it is right also that we should ask for the whole series of changes to be given to us in mechanical terms; and when physiological science is sufficiently advanced, we shall even demand that the series of changes shall be represented by means of diagrams and models.

Next Professor Clifford deals with the emotional state, and shows the transformation of sensation into action, which we take to be the transformation of the subjective into the objective. (See pages 97 and 98 down to the second sentence of the second paragraph.)

Resuming at p. 102, we come upon the question of propositions and their physical counterparts. What is the mechanical nature of a proposition? Is it a molecule of the brain, or two molecules connected together? or is it a motion of two molecules, or what is it? and how are two propositions compared by means of a mechanical process? Are some sets of molecules brought from different parts of the brain to a common centre, to be there adjusted in relation to each other? Professor Clifford thinks there is every reason to suppose that propositions are packed somewhere in the cerebral hemispheres. He thinks that the formation of a proposition is effected by a physical connection between different parts of the sheet of grey matter which lies just inside the skull.

In this theory we have a duplex difficulty—a difficulty which presents itself both from the subjective side and from the mechanical side. We ask how propositions are packed away? How a memory of any fact is mechanically effected? What is the mechanical description of a logical process of classification, of generalisation, of deduction?

And again, on the other side, what is the nature of the brain of the infant with its mass of grey matter, and its emptiness of propositions? Are the molecules of the brain like empty boxes ready to be filled, and what is the nature of the mechanical change as the propositions are formed and as they become more general? Professor Clifford calls it packing, and packing, and still closer packing, a term we very well understand in its usual sense, but of which we do not see the application in the present instance. We pack a number of simple propositions into general ones, and we pack general propositions into words, and so on. Does Professor Clifford mean that molecules of grey matter are packed into bundles, or that pairs of them get so packed, and are then compressed into a smaller size like trusses of hay under a hydraulic press, or what does he mean?

Evidently Professor Clifford thinks he has succeeded. He says—

"We have so far then successfully built up out of one elementary process" (*we suppose this means the concomitancy of a nerve motion with a nerve shock or unit of feeling*) "the correspondence of action to sensation; we have got as far as what takes place in the mind" (*subjective*) "of the thinker who combines together" (*subjective*) "our old signs" (*ambiguous*) "or rearranges them and produces new ones out of them. We first of all combined" (*subjective or mechanical?*) "a number of very simple messages" (*motions*) "coming along" (*mechanical*) "the nerves" (*mechanical*) "by means of a lump of grey matter" (*mechanical*), "we then combined a number of outgoing messages by means of another lump of grey matter, and produced a complicated action" (*mechanical*), "then we combined these together by means of propositions" (*subjective*), "so that any number of complicated sensations" (*motions? subjective?*) "coming in" (*mechanical*) "could find" (*intelligently?*) "their appropriate" (*ambiguous*) "propositions" (*subjective*), "and by being coupled with them" (*mechanical*) "could bring about the appropriate" (*ambiguous*) "action" (*mechanical*); "and lastly, we have combined together a great number of propositions" (*subjective*) "into a general conception" (*subjective*) "which is expressed in language" (*mechanical and physical*), "and which requires language" (*physical*) "in order to express" (*physical*) "it, and that is what makes for us a picture" (*a very curious term, evidently highly figurative*) "of the universe, which is the one" (*i.e., the picture!*) "we have in our minds" (*subjective*) "from day to day" (*i.e., continuously—query, fixed or changeable?*) "although it is not the one" (*i.e., the picture*) "which we immediately see" (*i.e., in our minds*) "when we get particular perceptions" (*subjective or motions?*)

There is one last achievement of the mechanical explanation, viz., choice.

Read the paragraph beginning "But there is one class," &c., and pass on to the next.

"Now let us see what it is that determines the strength of them. When a sensation" (*motion and subjective*) "comes in" (*i.e., to the brain and the mind*), "and there is time to deliberate" (*ambiguous*) "about it, and to act voluntarily" (*ambiguous*), "messages" (*motions*) "go out" (*mechanical*) "from that part" (*physical*) "of the brain" (*mechanical*) "which receives these messages" (*motions*), "and go out to all parts of the cerebral hemisphere" (*a mechanical arrangement*), "and there they are compared together." (*How are motions compared together? We never heard of a machine comparing the motions that arise in it from the introduction of different substances or from applied forces.*) "So, then, if two sensations" (*motions or subjective?*) "come in" (*to the brain*) "together, these messages" (*motions*) "will go out from each of them" (*mechanical*) "to all parts of the cerebral hemisphere, and they will also be compared together." (*Here we have "compared" again.*) "But that one" (*i.e., that motion or subjective sensation*) "which has the strongest connection" (*mechanically read, this must mean either the greatest harmony of motion, or the toughest or thickest thread or fibre connecting molecules or aggregates of molecules*) "with the memories" (*evidently we were wrong when we took the mechanical interpretation, unless we can render memories into mechanical terms*) "of past sensations" (*here evidently the physical result of some motions*) "leading to a certain action" (*mechanically*) "if that is all that takes place, if only the cerebral hemispheres themselves are consulted" (*a strange new term, partaking of intelligence*) "will have the strongest effect" (*notice—not in directing, but miscellaneously*) "upon the muscles, because it will excite the greatest number" (*why the greatest number?*) "of outgoing messages" (*motions, but whence the connection of the choice thus mechanically explained in the cerebral hemispheres, and the direction of the muscular motions?*)

There is an undoubted and intimate connection between cerebral action and mental action, and the above explanations of the order of sequences is so intermixed by the indiscriminate use of objective and subjective terms that we may feel ourselves forced to adopt a theory of concomitance or double aspect; but as a branch of the study of the unification of knowledge, where each fact and event is viewed as the result of a previous set of circumstances, forming altogether one dependent chain of sequences, it is necessary to know whether the facts and events of Biology, including mental action, are continuous with that chain of physical sequences which lead us up to its threshold:—whether organic processes, although accompanied by subjectivity, are themselves capable of mechanical explanation from first to last, the subjective being merely their obverse aspect, and never interfering from beginning to end in the chain of biological events. We need to know, supposing this important aspect of things be left out of the reckoning altogether, if the course of the history of a physical organism or of a species would have been just the same without it as it actually has been with it. If so, we shall be satisfied that we understand the proposed unification, although we shall find in the next chapter that even this is ineffective within its own limitations. But when, in addition, we take into account the historical fact of the appearance of the subjective amongst the results of this physical process, we feel that the limitations of our factors are transcended. We are obliged to recognise amongst our preceding factors more than we supposed, or else to recognise an interfering cause. But if the burthen of explanation is thrown upon the physical factors only, then the double-aspect theory is seen to be really beside the question; it does not fall within the scope of our deductive interpretation at all. We trace the sequence of events, and if they are all capable of mechanical explanation, it is not to the point that a certain range of the events under our consideration has another aspect. The interdependence and continuity of our chain of sequence is wholly complete and independent of this concomitant, and perfect without it. The subjective aspect comes in, we know not how, we know not why, at a certain stage, and at a certain stage it disappears; but whatever the intensity of the experienced pleasure and pain, whatever the desires, the sorrows, the joys included in the immense varieties of the subjective aspect, they do not interfere with the exact mechanical course of the machines we call animals and plants.

(*b.*) *Dr. Bain on the Double-Aspect Theory.**

Dr. Bain's book may be read as a work complete in itself, or in connection with some theory of the cosmos. Naturally we read it in connection with Spencer's theory of the unification of knowledge. It is valuable to us in relation to our present study of the double-aspect theory, which is the one held by Dr. Bain. Mind, according to him, forms the subjective aspect of certain physical phenomena; the history of mind details the subjective aspect of a certain series of physical events. Apparently these physical events are part of the cosmical series, which, at a certain stage, assume a subjective aspect, a fact which does not in the least interfere with the onward course of the physical events. The whole series of sequences might, through the

* "Mind and Body. The Theories of their Relation." By Alexander Bain, LL.D. London: C. Kegan Paul & Co. 1878.

period of double-aspectedness, remain purely physical, and be all quite explicable simply as physical processes.

It is a satisfaction to meet with a theory so plainly stated. Dr. Bain does not say that these physical processes are due to the laws of Matter and Motion, or ultimately of Force, and then turn round and say that these are unknowable factors, yet the explanation nevertheless stands good. He maintains the physical explanation in a plain, straightforward way, and we are able to deal intelligibly with it. Dr. Bain does not connect the study with any cosmical scheme; nor does he even connect it with any theory of heredity and propagation. He does not advance any hypothesis of Biology. We infer that he approves some doctrine of development, although we nowhere detect that he adopts Mr. Spencer's System of Evolution.

We cannot but believe that he establishes the concomitance of nervous change and mental change. We also recognise the fact that the actual study of this concomitance is, from the nature of the case, very difficult and obscure, more particularly as a study of individual events; for the brain cannot be observed in action, and he who observes the subjective cannot at the same time observe the concomitant physical changes.

Yet there are individual facts and large general observations which go to establish the theory of the concomitance of brain and nerve action with mental events. But as to the question whether the ruling cause of the double-aspected change be altogether physical, or whether (although in the present state of our knowledge it is certainly inconceivable) feeling enters as an interfering factor, observation does not show any result, consciousness does not reveal any sign; it merely gives a *prima facie* probability, and reasoning does not altogether make the matter clear.

The two principal chapters claiming our study are Chapters V. and VI. The former contains an account of the physical organism and its changes, the subjective aspect of which is Mind; and the latter contains an account of the double-aspect theory in general.

Apparently Dr. Bain presents more modest claims for the present age than does Mr. Spencer. He confines himself within the limits of actual knowledge. He looks forward hopefully to the extension of knowledge and of consequent light in the future without aiming at the universalistic. The explanations he recognises are those which are justified by actual experience (pp. 127–129). It is good that we can reduce the elements of experience in a last result, if not to one, at least to *two.* These two are the mental series and the physical series, and "it remains to consider the expression most suited to this union of the two distinct and mutually irresolvable natures."

Dr. Bain says that the old theory of the independence of the mind, as taught by Aristotle and Aquinas, is now out of date, and that the modified opinion of modern times can no longer be held. "It is now often said that *the mind and body act upon each other;* that neither is allowed, so to speak, to pursue its course alone; there is a constant interference, a mutual influence, between the two."

Dr. Bain thinks "we have every reason for believing that there is, in company with all our mental processes, *an unbroken material succession*" (i.e., *uninfluenced by any mental aspect or feeling*). "From the ingress of a sensation" (*query, impact*) "to the outgoing responses in action, the mental succession is not for an instant dissevered from a physical succession" (*which it does not influence*). "While we go the round of the mental circle of sensation, emotion, and thought, there is an unbroken circle of thought, there is an unbroken physical circle of effects" (i.e., *part of the general physical sequences of the cosmos*). "It would be incompatible with everything we know of the cerebral action to suppose that the physical chain ends abruptly in a physical void, occupied by an immaterial substance, which immaterial substance, after entering alone, imparts its results to the other edge of the physical break, and determines the active response—two shores of the material with an intervening ocean of the immaterial. There is, in fact, no rupture of nervous continuity. The only tenable supposition is that mental and physical proceed together, as undivided twins." (*Here we have an ambiguity; it is better to say that the chain of events is physical, having a subjective aspect.*) "When, therefore, we speak of a mental cause, a mental agency, we have always a *two-sided* *cause;* the effect produced is not the effect of mind alone, but of mind in company with body."

Here we find that Dr. Bain endeavours to unify an already accepted ultimate duality by means of word-compounds. After insisting upon the unbroken chain of physical sequences, from incident forces upon an organism to the outgoing actions, he speaks of mental causes and mental agencies as a *two-sided cause.* Now a cause, we take it, is that which produces change. A mental cause, if there is such a thing, is that which produces change or effect, according to its properties under given conditions, for we are only able to understand and speak of causes and effects according as we understand these properties and conditions. Therefore, when we speak of a mental cause producing effects, we must ask what are its properties? The properties are evidently not those of mind alone, but of mind in company with body. Are we also to suppose that the effect produced is not of body alone, but of mind in company with it? If so, the purely physical theory is abandoned. Or are we to suppose that what Dr. Bain means is that a certain physical state has a mental aspect, and this physical state is the cause of other physical states which also have their mental aspects? The produced mental aspect is not the effect of the precedent mental aspect, but is the mental aspect produced by a physical change consequent upon a precedent physical condition. The expression a "*two-sided cause*" is one of those figures of speech which are the crutches of metaphysics, and enable halting theories to make progress. We find the same difficulty in realising in our mind the conception of a "*two-sided cause*" as we have in realising a blue sound or a three-sided motion. The term "cause" is a mode of naming a particular set of known agencies, which, acting together with another set of known agencies, produces certain changes. The study of them gives us knowledge of their uniform relations. Thus the term cause is a general term or term of totality, connoting such sets of circumstances. That which acts is nothing without that which is acted upon, and *vice versa.* There is no singular "cause;" there are, in fact, no plural "causes," except as indicating the interactions just referred to. There is of course no abstract "cause," and no objectivised abstraction which is to be recognised under that name. A "two-sided cause," taken figuratively, can only mean that of certain sets of active properties producing effects, some of the active properties are capable of separate classification, but they are co-operative in producing the result. Therefore we take it that when we speak of a mental cause or mental agency, we speak of a set of active properties which may partly be classified as mental and partly as physical. In what respect the former differ from the latter we do not know, nor whether they are subjective, but Dr. Bain says that the effect produced is not the sole product of either class, but the result is the effect of their co-operative action. This is something more than the double aspect of a physical chain of events, and is not in harmony with the preceding passage maintaining the unbroken chain of physical sequence. But Dr. Bain does say that mind is a cause; the effect produced is not "the effect of mind alone, but of mind in company with body." Now the effect produced is a physical change, *i.e.*, a change in the brain substance, nerves, muscles, &c., of the organism. Dr. Bain says that this is partly produced by the mind and partly produced by the physical cause. But he cannot mean that, for he holds that the physical series of events has been unbroken and uninfluenced. Does he, then, mean that the changed mental aspect has been produced by the incident mental aspect? But this cannot be true, because the changed mental aspect is the mental aspect of a physical change, which change has been produced by a precedent physical state; therefore this state is the cause of the changed mental state. Accordingly Dr. Bain cannot be right in speaking of a mental state as a cause of an effect. The cause of any change in the brain and nervous system is a preceding physical state, and the mental change is the accompaniment or subjective aspect of that physical change—a change with which it has had nothing to do. And, indeed, Dr. Bain immediately reverts to his position: "It is, after all, body acting upon body." But even after that statement he considers that "mind-body giving birth to mind-body" is "a much more intelligible position." We think the only intelligible position is not contained in any compound word which resolves all mysteries by means of a hyphen, but in a proposition which discloses the sequences of events with single intelligible words for its terms. It would appear as if philosophers were incapable of stating their doctrines without resorting alternately to figures of speech, untranslatable abstractions, capital letters, and hyphens. The difficulty arises in the historical fact of the precedence in order of development of the physical, unless, indeed, the subjective be reckoned amongst the initial causes, and is admitted as a factor.

Returning to Dr. Bain's exposition, is it not sufficient to end here, at this assertion of the continuity and independence of physical changes, and of mind as the subjective aspect of the changes in a physical organism? Apparently not, for Dr. Bain proceeds to discuss their relation. But in the succeeding portion of the chapter it seems to us that Dr. Bain is fighting with extinct Satans; he is attempting to deal with difficulties that do not arise after we have rendered all mental changes into a subjective aspect of certain independent physical changes. He says a mental fact is the subjective aspect of those classes of physical facts which have a subjective aspect (p. 133). Then he goes on to speak of the *union* of mind and matter, which can mean nothing else than the question why certain classes of physical changes should have a subjective aspect conjoined with them; yet he speaks of the mind as if it were something, and says, p. 136—

"This, then, it appears to me, is the only real difficulty of the physical and mental relationship. There is an *alliance with matter*, with the object, or extended world; but the thing allied, *the mind proper*, has itself no extension, and cannot be joined in local union."

Here Dr. Bain speaks of "the mind" when there is no existence which can be called mind, except the subjective aspect of the changes of the brain and organism. He speaks of "the mind proper." He speaks of it as a thing or entity, and of its being allied to matter, just like any ordinary thinker. Indeed, most philosophic works exhibit such instances of what Mr. Darwin calls "survivals." Dr. Bain concludes that "the only adequate expression is a CHANGE OF

STATE: a change from the state of the extended cognition to a state of unextended cognition." What is the meaning of an extended cognition? Perhaps Dr. Bain means a change from the cognition of the extended to a cognition of the unextended. But the question arises, what is a cognition? and what is the meaning of a cognition changing its state? Does a cognition remain the same cognition when a cognition of the subjective aspect as of the objective aspect of any fact? The word "unextended" is a negative word; it has no positive meaning, and declares that a certain substantive or noun is not amicable with a certain other word, "extended," as thus "unextended cognition;" that is to say, the word "extended" is not applicable to the word "cognition." Again, if we are to speak of "the unextended," we have an objectivised abstraction apparently referring to some entity which has no existence. Dr. Bain seems to have adopted this method of expressing himself, not from pursuing the paths of science, but from sitting at the feet of theologians:—

"By various theologians heaven has been spoken of as not a place, but a *state;* and this is the only phrase that I can find suitable to describe the vast, though familiar and easy, transition from the material or extended to the immaterial or unextended side of our being."

We desire to know what it is which undergoes transition, and what is meant by the process called transition. If we are speaking of the brain and nervous system, it changes its state constantly, but only to other states of the brain and nervous system. It never changes its state by becoming immaterial and unextended. There is never any transition from the one condition to the other. The only transition is that relating to the double-aspect theory, where the passage is from one point of view to another, from one kind of language to another, from a set of objective terms to a set of subjective terms or *vice versa.* There is certainly no change of state implying the transition of the material and extended into the immaterial and unextended, or *vice versa.*

The question is certainly interesting: How came the material and extended under certain laws of its own to have a subjective aspect? This is a natural question to ask, but it meets with no elucidation from Dr. Bain's treatment of the subject. He may not indeed admit that the material was prior to the subjective, or he may not consider that the problem is a historical one at all.

The last paragraph of this chapter is also mystical :—

"The only mode of union" (i.e., *of Mind and Matter*) "is the union of close succession" (*is close succession union?*) "in time." (*Time is not anything but succession, yet it is often thus used, as if it were an entity containing other entities.*)

Or again—

"The only mode of union that is not contradictory is the union of . . . position in a continued thread of conscious life."

That is to say, the only mode of union between Mind and Matter is not one that we can explain, but one of which we are merely conscious. So that if this paragraph was really intended to convey any definite explanation, it has failed.

"We are entitled to say that the same being is, by alternate fits, object and subject, under extended and unextended circumstances."

This, again, is not explaining a mode of union nor a change of state; it is merely stating an inexplicable mystery.

"And that, without the extended consciousness, the unextended would not arise."

We know nothing of "extended" or "unextended" consciousness. We have a consciousness of our limbs and body, and we may say that we have so many cubic feet of consciousness as we may each individually displace in a vessel of water; but we do not see that this method of measuring consciousness throws any light upon the nature of the union between the physical body so measured (which would measure just the same if the body remained in it, and no consciousness was left) and the consciousness which formed the subjective side of it. Nor do we see how the unextended consciousness can "arise" out of the extended consciousness.

Let us next examine Chapter V. Our object will be to see whether the operations of the intellect can be explained by changes in the brain and nervous system. The operations of the intellect are composed of three powers or three facts (p. 83): "(1.) *Discrimination*, the sense, feeling, or consciousness of difference; (2.) *Similarity*, the sense, feeling, or consciousness of agreement; and (3.) *Retentiveness*, or the power of memory or acquisition. These three functions, however much they are mingled, and inseparably mingled, in our mental operations, are yet totally distinct properties, and each the groundwork of a different superstructure. As an ultimate analysis of the mental powers, their number cannot be increased nor diminished: fewer would not explain the facts, more are unnecessary. They are the intellect, the whole intellect, and nothing but the intellect."

Dr. Bain next goes on to show how Discrimination is the foundation of all knowledge, and then considers the physical embodiment of that fact. This is found to consist, firstly, in the particular organ and nerves employed, and secondly in the degree of energy of the motion. So far, all that Dr. Bain establishes is the concomitance of consciousness with nervous structure and nervous change, and we await the further development of our study. He says, "These two circumstances—namely, the separate consciousness of separate nerves and the changing intensity of the currents—we may regard as the primitive mode of diversifying the consciousness; but it is in the countless combinations of these simple elements that we are to seek for the physical concomitants of our ever-varying consciousness. The union of different stimulations in different fibres and in different degrees would unavoidably give birth to a complex and modified consciousness."

The second power is that of Recognition, the sense of similarity or agreement, and implies "a great power of reproducing our past experience and acquisitions, an extension of the resources of memory." We first remark that this sense of similarity must be dependent upon memory. Dr. Bain has been arguing upon the principle, "No change, no cognition; no sense of difference, no knowledge." He has been considering the changes of nervous structure, and the changes of intensities of motions therein, as causing or being changes of consciousness. Now he is apparently arguing that continuity of state or similarity of the continuing current is also a knowledge; which statement is not consistent with the first. But we find that this sense of identity or agreement really means the identity or similarity of a motion in a nervous structure with an antecedent motion. It is an identification with a remembered one, and in this respect the background of memory is common both to the sense of Discrimination and the sense of Agreement. What is the nature of the process of the obliteration of impressions? How is it possible to forget? Indeed, it is as important a problem to solve how is forgetting possible as to solve how is memory possible.

The next remark we have to make is to the effect that, whereas Dr. Bain endeavours to assign a physical basis for the sense of Discrimination, he omits altogether any attempt at assigning a physical basis for the sense of Agreement. However, it appears that he omits this designedly, finding, in fact, that his study forces him to rest his ultimate explanation on that of the "remaining intellectual function, Retentiveness, or memory. This explanation would make all the rest easy enough."

The exposition of Memory is commenced on p. 89, and we find a difficulty at the outset in the statement that Retention is the power of continuing in the *mind* impressions, &c., and of recalling them at after-times by *purely mental forces.* However, we pass this difficulty by to get at the physical explanation, and we find that the renewed feeling occupies the very same parts as the original feeling and in the same manner, not any other parts, nor in any other manner that can be conceived.

Dr. Bain illustrates this, not by any memory of figures or abstract laws, but by recollections of sound, sight, taste, &c. He supposes the case of a clapper striking a bell and producing certain vibrations of the air, which impinge upon the ear, and are transmitted by means of motions of the nerve substance to some nervous centre in the structure of the brain. The motion in this particular system of nerves with the connected brain centre as well as its intensity has, of course, a mental counterpart in our consciousness. The first question is, what becomes of the motion? The sound of a bell when struck gradually dies away till it ceases altogether. Dr. Bain seems to argue that the motion does not so die away, but goes on for ever in the mechanism of the brain and nervous system, and this constitutes memory :—

"If we suppose the sound of a bell striking the ear and then ceasing, there is a certain continuing impression of a feebler kind, the idea or memory of the note of the bell, it would take some very good reason to deter us from the obvious inference that the continuing impression is the *persisting* (although reduced) *nerve currents aroused by the original shock.*" And again, "If that be so with ideas, with ideas surviving their originals, the same is likely to be the case with ideas resuscitated from the past—the remembrance of a former sound of the bell." The case so far stands thus :—The sound of a bell has caused a persistent motion of, say, a small fibre between two cells of the grey matter of the brain, which either goes on for ever or comes wholly to a state of rest. If it comes wholly to a state of rest, the memory of that sound perishes; but putting aside the difficulty of imagining a perpetual continuance of this motion, we will suppose it persistent, constituting a standing memory; then we have to suppose the recurrence of a similar sound. What is the physical explanation of the identification of the present sound with the past one? Of course, the nervous and cerebral changes are identical, and so are the physical changes of the bell itself; the whole process is identical from first to last, yet the bell has no memory or sense of agreement or difference, while the conscious organism has. Even if the bell were conscious, it would have no memory. Consciousness would come and go in accordance with the incidence and intensity of shocks, but there would be no memory of them. Wherein lies thec ause of the retention of the motion by some particular nervous matter, or wherein lies the physical explanation of a resuscitation of memories?

Dr. Bain also introduces the doctrine that the consciousness produced by intense motions, *i.e.*, energetic motions of a nervous system, may be reproduced in a reduced form, or represented by feebler motions in some nervous connections in the brain. We should like to know what warrant he has for this doctrine from the physical sciences.

But again, Dr. Bain speaks of memory as "revived currents of the brain," as if the sound of the bell had produced, not a continuing movement, but a change of structure capable of reproducing the memory when put in motion again. But whether this structure is capable of destruction or reconstruction by some other incident force or not, Dr. Bain does not say.

This, however, seems to be all preliminary.

"And now, as to the mechanism of Retention.

"For every act of memory, every exercise of bodily aptitude, every habit, recollection, train of ideas, there is a specific grouping or co-ordination of sensations and movements, by virtue of specific growths in the cell functions."

The proof of this proposition seems to be its general probability :—

First, From the fact of the connection between the brain and nervous system, on the one hand, and memory, bodily aptitude, &c., on the other, as well as the concomitant complication of the two.

Second, From the fact of reflex action in simple cases, implying reflex action of a complicated nature in more complicated cases.

Third, From the known effects of diseased brain or nerve upon the memory.

Fourth, From the limit of acquisition corresponding to the limit of brain and nerve substance.

It is not quite certain whether pages 94 and 95 are additional reasons, or come under the fourth heading. A great deal of the matter contained in them seems to refer to subjective experiences, which do not imply any physical counterpart. What, for instance, is the physical counterpart of the suffix "ness," by which thirteen hundred adjectives are connected with abstract nouns? Again, how is the "great principle of the will" represented mechanically, and shown to be by its nature self-correcting?

However, so far we have made no progress beyond the fact of the intimate correlation of the mind with nervous and cerebral structure and change. What we want to ascertain is the actual mechanical process.

Dr. Bain next proceeds to a comparison of the number of mental acquisitions with the number of nervous elements in the brain. This is interesting and curious, but it does not touch the main question. It is all very well for Dr. Bain to say that "every special acquirement is the re-compounding of the elementary groupings above sketched. A science, for example, such as arithmetic, is a vast aggregate of new, sensible groupings; the elements being our conceptions of number gained from numbered things, the ten ciphers, and their union in the decimal system," &c. If he could describe to us the specific changes in the brain produced by learning the multiplication table, this little bit of solid information would be far more useful than so much conjecture. Moreover, like most philosophers who deal with the subject, he fails in consistency of language. Is the science of arithmetic, for instance, made up of "notions of number"? or is it made up of motions of nerves and cell junctions? and how do these new growths or structural changes and increments rule all the processes treated of in continuance by Dr. Bain?

After this comparison between the number of acquisitions and the number of nervous elements in the brain Dr. Bain proceeds to the study of structure; and this portion is evidently of higher importance than the other. The essence of Dr. Bain's theory is connection and modes of connection. The molecules of grey matter and the ganglions and nerve junctions are after all only centres of force, varying according to size and state of exhaustion. They are merely centres of energy, furnaces and boilers, springs, galvanic batteries, or what not; and the actions to which they give rise are due simply to the channels by which incident motions enter, and the channels by which liberated motions pass out.

The explanation of the system of nervous connection is given on pages 110 to 116, after which Dr. Bain says—

"Having thus considered how to provide for every new mental connection demanded for our progressive acquirements a special nervous track for that connection, the remaining point is to consider by what means the connections are permanently fixed in the several tracks. That is, to assign the physical bond underlying memory, recollection, or the retentive power of the mind."

Dr. Bain's explanation so far amounts to this: he accepts the fact of a child being born, without inquiry as to the causes of its production and constitution. Nevertheless, he seems in some places to refer to the question as to the origin of nerves and the causes of a nervous system, and as to the development of the nervous and cerebral mechanism simply as a mechanism, and not only to give an explanation of it as it is, but also to show why it must have been so. However, he does not state what he aims at distinctly, and we are left in a state of doubt. The general impression he produces is that he is explaining not merely an actual existence, but also the origin of that existence (*i.e.*, the brain and nervous system); but since he does not treat this question thoroughly, he does not do it well. Moreover, seeing this is really necessary for the explanation of the organism as it is, he only presents us with a crude, a very crude mass of general considerations, lacking scientific order and precision.

In the main, Dr. Bain represents the nervous system as a system of wires for the conveyance of motion to centres of energy, and the giving off of motions from these centres of energy to other wires. And since all incoming motions, or some of them, set up new connections or new wires, which grow into every wire they cross, thus forming new cell junctions, and since also each new wire produced by incoming motions is perhaps duplicated by an outgoing one, there arises at last a very complicated system, which is continually receiving motion from the external world, and imparting motion in return to the external world. In accordance with the nature of the incident energies will be their far-ramifying mechanical results in the system of connections and forces; and as the centres of energy may be fully charged or otherwise, so will be the effect along the outgoing wires, and the result in muscular action.

It is all a matter of nerve currents and their connections, together with any extra impetus arising from the storage of energy in any of the nerve centres. There is no difference in structure of the nervous substance for different feelings or different ideas; it is merely a matter of how the centres branch off in different directions.

There is just sufficient show of warrant in the facts to lend some plausibility to this explanation, and Dr. Bain himself merely advances the view as "hypothetical;" but how far off from a real explanation is it after all! So far as we recognise it to be true, it only accounts for the simpler reflex actions; all beyond is surmise, and the hypothesis, while wholly failing to account for feeling and consciousness, does little to explain human action, and falls short of a physical explanation of memory, of reasoning, of the prudent regulation of action.

Dr. Bain has been at some trouble to explain memory as an alteration of the structure and redirection of the nervous currents in the brain. This is connected with habit and explains motive. It also explains perhaps the slow process of learning a language. But how does he explain rapid and enormous memory of incident, such as will enable a man in coming home from a theatrical performance to give an account to a friend of all the incidents of a party going to the play—how they dined, what they ate and drank, what they talked about, what they did, how they got ready, the occurrences during the drive and on the arrival at the theatre, the auditorium, the people, the overture, and then the wonderful combinations and successions of sights, sounds, language, expressions, costumes, gesture, music, and the varied incidents that crowd up the next two or three hours? Yet a person with a good memory can give a wonderfully long and correct account of such an evening.

We cannot but remark that Dr. Bain's argument winds up very imperfectly, for though he begins by saying that the physical explanation of the processes of Discrimination and Identification depends, after all, upon the physical explanation of memory, still, when that explanation has (in a manner) been made, he does not return to the processes of Discrimination and Identification to show how comparisons of present and past motions or growths of nerves and brain are physically effected. Indeed the word "Discrimination" appears to belong to the subjective class, and the problem is to give it a physical analogue. Any way, there is a want of completeness in the argument owing to this omission.

Given the proposition that the facts of Biology are all explicable as interrelations of aggregates of the chemical elements with environment, and given the proposition that Feeling and Consciousness are but the subjective aspect of the physical processes of Biology, without in any way entering into or expressing these processes, which are entirely independent of subjectivity, and constitute in themselves an unbroken chain of physical causation, then two questions arise, or rather two lines of investigation present themselves to the student:—

The first refers to the concomitance of subjective mentality with physical development, and gives rise to such questions as the following:—

What is the weight and structure of an infant's brain, and what mentality is represented by it?

What structural or physical change is effected in the infant's brain in learning to talk, and in learning the properties of the objects in its environment?

What structural or physical change is effected in the brain in learning the alphabet and spelling, and in learning the multiplication table? There are sixty-six propositions in the latter; what sixty-six structural changes are effected in the brain in connection with the oral and visual teaching of these propositions?

Again, How can we explain the physical analogue of the feeling of sympathy?

What is the physical explanation of Imagination? of Motive? of Temptation? of Indecision? of Remorse? of Self-control, Prudence, Reflection, Determination, Benevolence, or Introspection?

Or again:—What is the cause and what is the result of the lengthening of a nerve? of the thickening of a nerve? of two nerves which cross each other uniting together?

What is the cause and effect of a growth *in* or *of* the cell-junction?

Or, taking a different view of the subject—

What is the physical description of that state of the nerves which gives the sense of pain or of pleasure?

What is the difference, described physically, between the state of the nerves which give the sense of sight, the sense of smell, and the sense of taste? Mere locality is not a sufficient explanation; it is not that we are conscious of a sensation in a particular place; there must be some differentiation either in the molecular construction of various sense organs or in the motions taking place in them. The recipient structure must be suitable for the incident energy.

We have already noted that Dr. Bain treats his subject in a very imperfect manner, in that he deals with it too much by itself, instead of treating it as part of a general science of Biology. In his hands it is an isolated study. But it is evident that the greater rules the less. He cannot treat of cerebral structure and changes as complete in themselves. If he has to consider nervous or cerebral change in connection with memory, if he has to speak of growths in the cell-junctions or ganglions of nerves, he has to consider the origin, causes, and history of nerves and their changes in general. He has to adopt a theory of Biology. Indeed, he may have to go further, and find a theory of the cosmos before he is able to give an explanation of even one of its details. And in this respect, again, Dr. Bain's argument is deficient.

The second great consideration which presents itself to our minds in relation to the theory under consideration refers to Subjectivity as a cause of action. This the theory precludes. It is held impossible to conceive of Feeling acting upon matter and causing the motion of matter. We know that the action of matter in motion upon other matter causes motion. Physical science teaches us in the domain of Dynamics, Physics, Chemistry, and the like, how aggregates of matter and motion affect each other; and the highest sciences teach us the conservation of energy and the indestructibility of matter, and tell us that no energy comes into existence to effect a change but has had an anterior physical existence. Science teaches, in fact, the unvarying totality of the quantity of energy or motion, and the unvarying totality of the quantity of matter. Hence motion is caused only by some mode of energy, but since Feeling is not a mode of energy, it cannot be a cause of muscular motion.

But is this so? It seems to contradict our experience. We are apt to think that we select our viands from anticipation of pleasure, and reject those which are offensive to our feelings. Perhaps this is not a matter of feeling, but of motion and structure of nervous system; but still it seems to us that it is the pleasure or the feeling of disgust which rules our action. It would seem also that all our voluntary actions are thus caused by the desire to secure feelings of pleasure and to avoid painful ones. We are apt indeed to claim for Feeling a monopoly of rule as regards our voluntary acts. We take all precautions to avoid pain; and as we act ourselves so we act upon others. In our relations with them, we deal with them in respect of anticipated pleasures, or the prospect of avoiding discomfort or pain. In all descriptions of occurrences it is seldom that we give a mere narration of events, but either in speech or in emotional expression there is a large admixture of the varying feelings of pleasure or pain.

Indeed, the principle "The greatest happiness for the greatest number" is a subjective rule. Happiness is the end and aim of all philosophies and most religions, thus recognising a subjective motive as the main spring of human actions.

The question thereupon arises, is there any mechanical, *i.e.*, physical means of recognising feeling? It is impossible to conceive of it. Nor can we build up a physical system, a structure of nerves and brain, which, as mere recipients of motion, collectors and reservoirs of motion or force, shall explain to us the methods of memory, the process of comparison, emotional changes, or the influence of rules of conduct, as purely mechanical independently of the feelings; and yet we cannot conceive of feelings influencing action. Still we cannot but recognise that the desire for present, and still more extraordinary, the anticipation of future pleasures, and the avoidance of present and future pain, are the ruling causes of the whole of our voluntary actions—the principal part of our life. And although Dr. Bain's proposal is to show the operation of a "two-sided cause," *i.e.*, of subjective and physical as co-equal factors, still we find that he is obliged to make all his explanations in terms of physical arrangements and sequences, the subjective being merely the concomitant of the physical, and in no way entering into the processes as an agency having a determining effect.

CHAPTER V.

AN EXAMINATION OF THE "PRINCIPLES OF BIOLOGY" WITH REGARD TO ITS PLACE IN MR. SPENCER'S SYSTEM.

§ 1. *General Considerations.*

To study a work individually, and to study it as part of a larger scheme, obviously require different methods of treatment, which may end in very different estimates of its real value. The present examination is undertaken not with the view of estimating it on its own merits, but with the object of ascertaining the place of the "Biology" in Mr. Spencer's great scheme of philosophy. If, as we suppose, the main idea of this scheme is the unification of knowledge, then the natural question to ask is this—How does the "Biology" fall in with the system proposed for that object? If Mr. Spencer had propounded one distinct and intelligible method, our inquiry would have been of a very simple character; but, as the reader has already seen in Chapter I., the methods proposed or suggested by Mr. Spencer in the course of his works are numerous and confusing, if not indeed mutually destructive. To which of them then are we to look for the affiliation of the "Biology"? Probably to several. Let us therefore first distinguish between those which are likely to aid us in our endeavour, and those which are wholly inadmissible.

(*a.*) *The Mystical Method Excluded.*

In the first place, we may exclude all those methods which are of a mystical character. If any terms are used the import of which is not precise and definite, it is evident that any xplanations in which they occur are vitiated at their source.

It is impossible to explain the known by the unknown. If in the explanations of Biology the factors, or relatively general and simple antecedents, of all biological change are known, then explanations founded upon them are valid; but if they are not wholly and completely known, but are in some respects unknown, then these explanations cannot but fail. How much more so if the original factors are represented in our minds by symbols standing for unknowables of which we are unable to form any mental representation, while the very attempt to do so only lands us in ultimate contradictions of thought.

(*b.*) *The Metaphysical Method Excluded.*

We are also justified in excluding from our consideration all methods of a metaphysical character. We have seen in § 6 of Chapter I. that these delusive methods are worked out by means of ideal entities—entities invented by the mind itself, but having nothing to correspond with them in the actual universe. For the most part they are objectivised abstractions. These non-entities have taken too large a part in the history of human thought; but any one who would clearly study the science of Biology must steadfastly repudiate the use of terms, or all those senses of the terms he is obliged to employ, which connote any such ideal factors.

(*c.*) *The Psychological Method Excluded.*

We have already pointed out that Mr. Spencer's psychological methods do not harmonise with his main idea of unifying knowledge by means of explanations of the sequences of the cosmos. They form a class of methods altogether apart from the main course of his constructive system.

In the first place, the methods expounded in Part VII. of the "Psychology" are theories rather of knowledge than of the unification of knowledge, and do not relate to the explanation of historical sequences at all. In the second place, the Double-Aspect theory also has been shown to be a theory of knowledge rather than a theory of the unification of knowledge. The explanations of the order of sequences are all on the physical side—feeling and consciousness being merely concomitants, whose presence is altogether unexplained. These do nothing—they perform no part—they are not even directly related. As far as any share in the unification of knowledge is concerned they may be thrown out of consideration altogether, for the knowledge we wish to unify is but the subjective aspect of certain physical arrangements of the brain, and its unification, therefore, is but the subjective aspect of a complicated and co-ordinated cerebral arrangement.

(d.) *Feeling and Consciousness Excluded.*

Feeling and Consciousness are so universally associated with living things, that it seems strange to have to commence our study of biological changes and developments by a strict dissociation of all Feeling and Consciousness from every part of our inquiry. We have first of all, in what laborious and patient manner we may, to unlearn our supposed knowledge of the influence exerted by Feeling upon muscular motions, and to believe that these are only accompaniments and not causes of biological change. We have to learn that all that takes place in the human frame and in all other animal and vegetable organisms is the operation of bodies under mechanical and chemical laws, and that feeling and consciousness have no place whatever in the process.

That this view is held by Mr. Spencer is clear from his combating the theory of Feeling as a factor in the structure of organisms, as taught by Dr. Darwin and Lamarck. The passage to which we refer occurs in §§ 145–147 of the "Biology," vol. i. At p. 404 Mr. Spencer quotes Dr. Darwin thus :—"From their first rudiment or primordium, to the termination of their lives, all animals undergo perpetual transformations; which are in part produced by their own exertions, in consequence of their desires and aversions, of their pleasures and their pains, or of irritations, or of associations; and many of these acquired forms or properties are transmitted to their posterity." Mr. Spencer hereupon remarks: "True though it is, as Dr. Darwin and Lamarck contend, that desires, by leading to increased actions of motor organs, may induce further developments of such organs; and true as it probably is, that the modifications hence arising, are transmissible to offspring; yet there remains the unanswered question, 'Whence do these desires originate?' The transference of the exciting power from the exterior to the interior, as described by Lamarck, begs the question. How comes there a wish to perform an action not before performed? . . . To assume that in the course of evolution there from time to time arose new kinds of actions dictated by new desires, is simply to remove the difficulty a step back."

We have here to remark that although the general tenor of Mr. Spencer's criticism is in full accordance with his own philosophy, yet he seems to us to be inconsistent with it when he admits in the beginning the truth of the fact that "desires" lead to increased action of the motor organs, and thereby to increase of structure. Is not this an admission of the factor of Feeling into the evolution of structure at some stage, and does it not involve the admission that Feeling has in more and more obscure forms had an influence on the actions of organic matter from the very first?

By this admission, and the concomitant repudiation of Feeling as a factor at the beginning, Mr. Spencer lands himself in the conclusion that Feeling is developed in some way from the mechanical arrangements of Matter and Motion in those complex organisations of colloids which we find in plants and animals, and thereafter it becomes a factor in the further development of those structures. If so, this is a department of Evolution that Mr. Spencer has altogether overlooked, and it would thereby indicate the insufficiency of the formulas and explanations which he gives us—an insufficiency which we already feel, and which, in his admissions of the unknowableness of the principal terms of those formulas and explanations, he seems himself to acknowledge, notwithstanding the precise and all-inclusive claims he sometimes makes for his explanations.

However, we have to take Mr. Spencer's words as we find them, and since he deliberately controverts the position of Lamarck and Darwin as to the influence of Feeling and Consciousness on biological development and the differentiation of species, we must hold that our inquiry is purely one of physical science, free from any such influences. For in any case he implies the origin of Feeling from the original relations of an aggregate of chemical molecules with its environment. And as a matter of fact we find Mr. Spencer's "Biology" is an attempt to describe the genesis, structure, and functions of all organisms, both as individuals and as races, in the terms of Mechanics. Witness his declaration ("Biology," vol. i. p. 444), where he says :—

"This survival of the fittest, which I have here sought to express in mechanical terms, is that which Mr. Darwin has called 'natural selection, or the preservation of favoured races in the struggle for life.'"

And in the same manner, in his account of morphological and physiological development in Vol. II., Mr. Spencer endeavours to give a mechanical interpretation to all the occurrences in animal and vegetable life.

It is worthy of notice that in Mr. Spencer's actual dealing with the origin and development of the changes included in biological science, he treats them not as subjects beyond our understanding, but as events occurring in the mutual relations of the chemical elements as we know them under the influence of physical environments and the conditions of heat and cold, gravitation and light, and their recurrences. He explains all biological development in the physical language of molar and molecular motion, segregation, differentiations by incident forces, equilibrations, and the like. Feeling and Consciousness do not enter as factors into the process at all. Biologic changes are treated of as events in a physical history, and the theory is that all plants and all animals are merely organised aggregates produced in the chain of physical events, and modified, propagated, or destroyed according to the exigencies of physical conjunctures. It is held that Feeling and Consciousness have not been factors in any structural organisation or development of function, have not been the causes of any action, nor of any motion—have not, in fact, had the least influence upon any fact in biological history. The whole series of events from the beginning to the end of a life-history is a series of physical sequences, and the whole history of a race is but the aggregate of a large number of these individual series of physical events.

This view of the case is justified by some writers on the ground of the Continuity of Motion, and it is in complete accordance with "First Principles." "Can we suppose the motions coming upon the body and received by the sensory organs, and transmitted by them to the brain, to go off there," it is asked, "into vacuity—whatever you may call this vacuity, whether Will, Consciousness, or Soul—and to be thence transformed into return motions, which shall act upon the outer world?" Upon the theory of the Conservation of Energy we can suppose no such thing. If we believe in this doctrine, the motions carried by the nerves to the ganglions or to the brain must produce a physical result, which physical result must be either change of structure in the nervous mechanism or a discharge of the motion in a return action through established channels of nervous energy. We can neither conceive of the physical motion of the nerves ending in nothing nor of the origination of motion in motor nerves out of nothing. Such motion can only arise from an antecedent physical motion. If there is any ending of motion without the production of other motion, or if there is any commencement of motion without its being produced by antecedent physical motion, there is an end to the theory of the Conservation of Energy, or at any rate of the Continuity of Motion. Therefore, since we cannot conceive of Feeling or Consciousness as Motion, neither Feeling nor Consciousness can be factors in any chain of biological action. They cannot be comprised in the circle of changes of motion. They are not even part of the endless band included in the Conservation of Energy, whose members are mutually convertible, viz., heat, molar motion, electricity, magnetism, gravitation, &c. Therefore they have to be left out of account in considering the history of the origin and development of plants and animals.

It may be asked what Mr. Spencer has to say about Feeling and Consciousness as factors in biological development. The reply is not easily found. Some passages of his works would seem to imply that he regards them as mysteries, their place in Biology as unknowable, and their influence as incapable of appraisement. In other places they are assigned a place as factors (see "Psychology," Part II., chap. ix.) At other times they are treated as merely accompaniments of changes of physical states (see "Psychology," Part I., chap. vi.) In the first case, Philosophy must be incomplete and incapable of completion. The second case will be reserved for separate study. The third case is the one actually countenanced by Mr. Spencer in his "Principles of Biology," and as it throws the burthen of explanation upon the interrelations of physical factors, it is reserved for examination in the succeeding sections of this chapter. In this view, Feeling and Consciousness are regarded merely as the subjective aspects of physical events.

In the "Psychology," when Mr. Spencer treats of the Substance of Mind, he assigns something like a very simple form of nervous shock as the ultimate unit of consciousness from the integration of which in successively higher degrees of complexity all the feelings, &c., arise and are accounted for. But upon what does this integration and growing complexity and differentiation depend?

"If each wave of molecular motion brought by a nerve-fibre to a nerve-centre, has for its correlative a shock or pulse of feeling, then we can comprehend how distinguishable differences of feeling may arise from differences in the rates of recurrence of the waves, and we can frame a general idea of the way in which, by the arrival through other fibres, of waves recurring at other rates, compound waves of molecular motion may be formed, and give rise to units of compound feelings: which process of compounding of waves and *production* of correspondingly-compounded feelings, we may imagine to be carried on without limit, and to *produce any amount of heterogeneity* of feelings." *

According to this reading, the burthen of explanation rests with Physics. Upon this supposition, all biological changes have to be explained in a physical manner, and if this can be done, it is of no consequence to the unification of knowledge that Consciousness somehow arose and became the accom-

* Psychology, p. 154.

paniment or additional aspect of changes upon which it had no influence whatever as a factor. For if it can indeed be shown that without it organisms originated, continued, underwent modification, propagated, separated into races, all as incidents in an unbroken chain of physical sequences, the whole thing is complete, and it is but idle to inquire the place of the subjective aspect, and to ask why certain of these motions are accompanied by pleasures or by pains.

So we must clearly understand in the biological inquiry into which we are about to enter, that Feeling and Consciousness find no place, and as a matter of fact in Mr. Spencer's study of the subject no place is assigned to them. We shall see that the factors of Biology are certain of the so-called elements and certain external physical conditions. The language used is that of Physics—namely, matter, motion, incident forces, aggregation, equilibration, polarity, and so on. Our explanations of motives, emotions, hunger, passion, memory, &c., will all have to be effected by means of physical structure and function. One instance of the nature of this mode of treatment we have already had when considering Dr. Bain's explanation of memory in the preceding chapter. We shall find that we have not only to consider the inquiry as relating to one long continuous individual, but to generation, reproduction, and the continuance of species and races of individuals. We shall have boldly to grasp the whole problem of Biology, including all the races of plants and animals, and expound it as a physical history.

According to this explanation, a man does not eat because he is hungry, nor drink because he is thirsty. He does not marry and surround himself with a household for his pleasure and comfort, for this would be introducing subjective causes for physical events, which cannot be conceived, and contradicts the theory of the Conservation of Energy. He does all these things because of certain interrelations of the physical states and structures of his nervous mechanism. The fear of pain, the hope of pleasure *as such*, are excluded from the causes of human actions. The subjective has no place in the chain of cosmical events.

We wish to impress this upon the reader before entering upon the explanations of Biology. It may be regarded as an incomplete or unfair statement of Mr. Spencer's views. But Mr. Spencer's works contain many inconsistent theories. All the critic can do is to consider each one of them in its turn, bring it out into clear statement, and taking it as the real opinion for the time being, subject it to a rigorous examination. We have therefore to ask the student to free his mind from all associations of Feeling or Consciousness in connection with animals and plants, and to set out in his constructive task with the materials provided for him in Chapters I. and II. of Mr. Spencer's "Principles of Biology."

(*e.*) *Simulations of Unification.*

Before entering upon our studies of Mr. Spencer's actual explanations, it would be well to call the reader's attention to the various "Simulations of Unification" in order to free the scientific inquiry into the sequences of Biology from all misleading influences.

It will be remembered that Mr. Spencer's leading idea is the deduction of all sequences as corollaries from some primordial truth or truths. These primordial truths are variously given as the Persistence of Force, or as the laws of the relations of Matter and Motion; or else are vaguely referred to as "Evolution in general." Now, with regard to these it may be said, that none of the so-called corollaries are drawn out in proper logical form, and that none of them can be put into the shape of syllogisms at all. And Mr. Spencer's presentment of concrete developments in their relation to these so-called primordial truths is not always an implication of such logical connection. Very frequently he uses the phrase "will be found in harmony with;" but to find a certain process "in harmony with," or, what is much the same thing, "non-contradictory of," a given principle, is not identical with the logical process of deducing a corollary from some antecedent truth. The latter is a true explanation, a deductive warrant, and the mind is fully satisfied by it. But to find that one truth is in harmony with another simply means that they are not mutually destructive. Thus a house is built in harmony with the laws of gravitation, but that fact does not explain the building of the house. So a plant or an animal develops in harmony with a great number of physical laws, but until we know the particular relations of the physical factors which have caused the origination of that plant or animal, we have not found an explanation of its existence. Accordingly when in the course of our studies we find that certain developments, certain processes, certain facts are said to be "in harmony with" primordial truths, we shall understand that the required explanations have not been effected by this simple statement—it is a mere simulation of unification.

We would further call attention to the misleading use of the term Evolution, and to the very partial use of that Formula of Evolution which was promulgated in the "First Principles" as the means of unification of all processes. Mr. Spencer appears at different times to mean many different things by the term Evolution. In the preceding section we have taken his meaning to be a deduction from the relations of certain given original factors. But in the "First Principles" it is defined for us as meaning merely the concentration of Matter (whatever that may be) accompanied by the transference of Motion. On page 133 of the "Biology," vol. i., we are told that it may mean growth or increase of bulk, and development or increase of structure, and that it is reserved for occasions when both are implied. Mr. Spencer very often employs it in its ordinary reference to recognisable development by the operation of natural laws, as opposed to special creation. In this respect further light is thrown upon Mr. Spencer's real opinion about Evolution by some of the chapters in Part III. of the "Biology." In Chapter I. it is expressly declared that the truths of Biology are in harmony with "those primordial truths set forth in 'First Principles.'" We are then told, "What interpretation we put on the facts of structure and function in each living body, depends entirely upon our conception of the mode in which living bodies in general have originated." "We have to choose between two hypotheses—the hypothesis of Special Creation and the hypothesis of Evolution. Either the multitudinous kinds of organisms that now exist, and the still more multitudinous kinds that have existed during past geologic eras, have been from time to time separately made; or they have arisen by insensible steps, through actions such as we see habitually going on." * Here arises the point of our criticism. Mr. Spencer takes it for granted that the definition of Evolution ought to be "an accumulation of insensible differentiations," whereas his own well-known definition runs, "Evolution is an integration of matter and a concomitant dissipation of motion," &c.† Now if Mr. Spencer is able to establish the theory that an insensible increment of differentiations accounts for the different species of living organisms, and if he calls this theory by the name of Evolution, it is clear that he establishes a verbal connection between the "Biology" and the "First Principles" which may well pass in an immense work like this for a logical connection; but when we notice the different meaning attached in the two places to the word Evolution, we perceive that it is a verbal connection only, and that there is a grand severance in thought between the formula going forth in all-conquering might to enclose and reign over all knowledge, and the sham king which here usurps the rule in its stead. The authority of the nominal sovereign is never once appealed to throughout the work, but in its room we find a principle which is clothed in its raiment, and which is called by its name, though when its mantle is cast aside it is discovered to be only a counterfeit. This is largely exemplified in Chapter III., "General Aspects of the Evolution Hypothesis."

Throughout this chapter, Evolution is taken to mean differentiation by means of natural laws,—insensible differentiation, gradually accumulating and resulting in wide divergences; and this meaning of the term Evolution is amplified till it not only is held to include organic development, but the whole operations of the cosmos. "The interpretation of phenomena as resulting from Evolution, has been independently showing itself in various fields of inquiry, quite remote from one another. The supposition that the Solar System has been *gradually*

* Biology, vol. i. p. 331.
† See also First Principles, § 97.

evolved out of diffused matter, is a supposition wholly astronomical in its origin and application. Geologists, without being led thereto by astronomical considerations, have been step by step advancing towards the conviction, that the Earth has reached its present varied structure through a *process of evolution.* The inquiries of biologists have proved the falsity of the once general belief, that the germ of each organism is a minute repetition of the mature organism, differing from it only in bulk; and they have shown, contrariwise, that every organism, arising out of apparently-uniform matter, *advances* to its ultimate multiformity *through insensible changes.* Among philosophical politicians, there has been spreading the perception that the *progress* of society *is an evolution:* the truth that 'constitutions are not made but *grow,*' is a part of the more general truth that societies are not made but *grow.* It is now universally admitted by philologists, that languages, instead of being artificially or supernaturally formed, have been *developed.* And the histories of religion, of philosophy, of science, of the fine arts, and of the industrial arts, show that these *have passed through stages* as unobtrusive as those through which the mind of a child passes on its way to maturity. If, then, the recognition of Evolution" (*i.e.*, gradual differentiation, according to a natural law, the working of which is not given, and which cannot be the Formula of Evolution), "as the law of many diverse orders of phenomena, has been spreading; may we not say that there thence arises the probability that Evolution will presently be recognised as the law of the phenomena we are considering?" *

Mr. Spencer then proceeds to vindicate organic evolution. He says, in § 118, that although the hypotheses of special creation and of Evolution are both symbolic conceptions, yet "the one belongs to that order of symbolic conceptions which are proved to be illusive by the impossibility of realising them in thought; the other is one of those symbolic conceptions which are more or less completely realisable in thought." † Here we are glad to notice that the hypothesis of Evolution is one that

* Biology, vol. i. p. 347. † Ibid., p. 348.

can be grasped. That is satisfactory. So much indeed would seem to be necessary for a hypothesis which is to unify knowledge. Yet, to say the truth, we were doubtful of it in considering the Formula of Evolution, which contained two terms, viz., Matter and Motion, which we were told could not be grasped and were not realisable in thought. However, we find that this is not the evolution now referred to, but that the symbolic conception which is more or less completely realisable in thought is a much simpler principle:—"The production of all organic forms by *the slow accumulation of modifications upon modifications*, and by the slow divergences resulting from *the continual addition of differences to differences*, is mentally representable in outline, if not in detail." The words we have italicised form the *working* definition of Evolution as acted upon by Mr. Spencer throughout his works. The original formula of Evolution is abandoned. The new use of the term is a sufficient covering for all phenomena, although it does not disclose its *rationale*, or mode of universal applicability, nor afford corollaries which coincide with the actual order of sequences. In the separate departments of Physics and Biology it may give us independent descriptive propositions, and it thereby affords us a single descriptive proposition applicable to both, but it is not of that explanatory character which would enable us to deduce all developments as corollaries from one ultimate proposition. How completely Mr. Spencer has identified the idea of *graduality* with the essence and scope of Evolution is singularly evident in his illustration, p. 348:—

"There is no apparent similarity between a straight line and a circle. The one is a curve; the other is defined as without curvature. The one encloses a space; the other will not enclose a space though produced for ever. The one is finite; the other may be infinite. Yet, opposite as the two are in all their properties, they may be connected together by a series of lines no one of which differs from the adjacent ones in an appreciable degree. Thus, if a cone be cut by a plane at right angles to its axis, we get a circle. If, instead of being perfectly at right angles, the plane subtends with the axis an angle of 89° 59′, we have an ellipse which no human eye, even when aided by an accurate pair of compasses, can distinguish from a circle. Decreasing the angle minute by minute, the ellipse becomes first perceptibly eccentric, then manifestly so, and by and by acquires so immensely elongated a form, as to bear no recognisable resemblance to a circle. By continuing this process, the ellipse changes insensibly into a parabola. On still further diminishing the angle, the parabola becomes an hyperbola. And, finally, if the cone be made gradually more obtuse, the hyperbola passes into a straight line, as the angle of the cone approaches 180°. Now, here we have five different species of line,—circle, ellipse, parabola, hyperbola, and straight line—each having its peculiar properties and its separate equation, and the first and last of which are quite opposite in nature, connected together as members of one series, all producible by *a single process of insensible modification*,"—*i.e.*, Evolution; of which the last italicised line is the new definition.

But the process of *general evolution* is clearly illustrated by the *special evolutions* in the life-history of each plant and animal. "Each organism exhibits, within a short space of time, *a series of changes* which, when supposed to occupy a period indefinitely great, and to go on in various ways instead of one way, give us a *tolerably clear conception of organic evolution in general*." *

"What can be more widely contrasted than a newly-born child and the small, semi-transparent, gelatinous spherule constituting the human ovum? The infant is so complex in structure that a cyclopædia is needed to describe its constituent parts. The germinal vesicle is so simple that it may be defined in a line. Nevertheless, a few months suffice to develop the one out of the other; and that, too, by a series of modifications so small, that were the embryo examined at successive minutes, even a microscope would with difficulty disclose any sensible changes. *Aided by such facts, the conception of general evolution may be rendered as definite a conception as any of our complex conceptions can be rendered.* If, instead of the successive minutes of a child's fœtal life, we take successive generations of creatures—if we regard the successive generations

* Biology, vol. *i.* p. 349.

as differing from each other no more than the fœtus did in successive minutes; our imaginations must indeed be feeble if we fail to realise in thought, *the evolution* of the most complex organism out of the simplest. If a single cell, under appropriate conditions, becomes a man in the space of a few years; there can surely be no difficulty in understanding how, under appropriate conditions, a cell may, in the course of untold millions of years, give origin to the human race."

We are not now engaged in the study of the correctness or incorrectness of this theory of development. We are engaged in the task of examining Mr. Spencer's theory of the unification of knowledge, and we fail to see how his new definition of the term Evolution affords the requisite explanation. It is, indeed, a kind of all-inclusive generalisation, but it does not give any organic unity to our knowledge, such as that aimed at but not effected in the Formula of Evolution. It is only a vague description of the external appearance of Evolution. It supplies us with no key to its processes.

The idea of *graduality of change* and of the *increment of differentiations*, as containing the meaning of Evolution, is carried on throughout the chapter, and indeed throughout the whole work.

"Evidence that all organic beings have gradually arisen through the actions of natural causes. . . . May we not, from the small known modifications produced in races of organisms by natural agencies, similarly infer that from natural agencies have *slowly arisen* all those structural complexities which we see in them? The hypothesis of Evolution, then, has direct support," &c.*

Thus we see that the problem of Biology as a part of Evolution is not to understand the process viewed as a deduction from the interrelations of original factors, but merely to form an opinion favourable to the theory of graduality of change and development by natural laws, as opposed to the contrasting theory of Special Creation. Nevertheless, frequent reference is made to the truths of Evolution as taught in the "First Prin-

* Biology, vol. i. p. 352.

ciples." Accordingly, when Evolution is referred to we do not know which of the several meanings is intended. But the unification of knowledge is scarcely effected by the inclusion of the various modes of knowledge in the different meanings of one word. Such an unification is merely verbal.

(*f.*) *The Theory of "Additional Factors."*

There is still another misleading idea against which it is necessary to guard ourselves in our studies of the "Biology." It is the theory of "additional factors." Reference is made to it in the discussion of the relations of Biology and Psychology in a passage occurring in the latter work.

"§ 55. The admission that Psychology is not demarcated from Biology by a sharp line, will perhaps be construed into the admission that it cannot rightly be regarded as a distinct science. But those who so construe the admission, misconceive the natures of the relations among the sciences. They assume that there exist objectively those clear separations which the needs of classification lead us to make subjectively. Whereas the fact is, that beyond the divisions between the three fundamental orders of the Sciences, Abstract, Abstract-concrete, and Concrete, there exist objectively no clear separations at all: there are only different groups of phenomena broadly contrasted but shading off one into another. To those who accept the doctrine of Evolution,* this scarcely needs saying; for Evolution, being a universal process, one and continuous throughout all forms of existence, there can be no break—no change from one group of concrete phenomena to another without a bridge of intermediate phenomena. . . . Astronomy and Geology are regarded as distinct. But Geology is nothing more than a chapter, continuing in detail one part of a history that was once wholly astronomic. . . . The separation between Biology and Geology once seemed

* "Evolution is 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."—*First Principles*, p. 396.

impassable, and to many seems so now. But every day brings new reasons for believing that the one group of phenomena has grown out of the other. Organisms are highly-differentiated portions of the matter forming the earth's crust and its gaseous envelope, and their differentiation from the rest has arisen, like other differentiations, by degrees.* The chasm between the inorganic and the organic is being filled up. . . . Thus the distinction between Biology and Psychology has the same justification as the distinctions between the concrete sciences below them. Theoretically, all the concrete sciences are adjoining tracts of *one science*, which has for its subject-matter the continuous transformation which the universe undergoes. Practically, however, they are distinguishable as successively more specialised parts of the total science—parts further specialised by the introduction of additional factors. The Astronomy of the solar system is a specialised part of that general Astronomy which includes our whole sidereal system; and becomes specialised by taking into account the revolutions and rotations of planets and satellites. Geology . . . is a specialised part of this special Astronomy . . . Biology is a specialised part of Geogeny, dealing with peculiar aggregates of peculiar chemical compounds formed of the earth's superficial elements—aggregates which, while exposed to these same general forces molar and molecular, also exert certain general actions and reactions on one another. And Psychology is a specialised part of Biology," &c.†

From this it is quite clear that all the sciences are to be worked through from the original laws of Physics and Chemistry, and are explainable thereby; and the change of the argument attempted by Mr. Spencer in the passage we have quoted is utterly unjustifiable. Let us, however, proceed with our present quotation, since it discloses a peculiar notion of the process of Evolution which does not harmonise with the authoritative Formula of Evolution, and since it also leads up

* Notice here that it is not said to be a continuation in detail of the history of Geology, but is vaguely stated to be a differentiation "by degrees," which may mean a differentiation of kind.

† Principles of Psychology, vol. i. p. 135.

to a new and curious theory of Evolution expounded in the "Principles of Biology" which we are about to consider. Mr. Spencer proceeds to say, "Psychology," p. 138 :—

"But this *introduction of additional factors*, which differentiates each more special science from the more general science including it, fails in every case to differentiate it absolutely, because the introduction of the additional factors is gradual."

The only factors we know under the Formula of Evolution are Matter and Motion; therefore the only additional factors whose introduction is allowable are specialised differentiations of Matter and Motion, and these are new factors only in the sense of being newly formed compounds, but as to the nature of their relations to previously existing combinations of Matter and Motion, they are included in the same general laws. Under these circumstances, it seems a mistake to call their formation under the evolutionary process an "introduction of new factors." A real introduction of a new factor would be such as the introduction of the factor of feeling—a totally distinct agent, which takes its part in future changes and growths; but to admit this or any other really new factor would invalidate the formula under which we are working and the process of reasoning with which we are now occupied.

If we endeavour to ascertain from Mr. Spencer's subsequent remarks what he means by "a new factor," we are unable to gather anything more from them than the gradual increment of differentiations due to the continuous process of evolution, and if evolution is merely the mechanical operation described in the Formula of Evolution, these gradual increments of differentiation must all be of the same order, and be due to the properties of the original factors. He treats in the first place of "the new properties of the order we call chemical, as is shown by their changed affinities for the molecules of other substances." What is the meaning of the word "properties" under the Formula of Evolution, and what is the interpretation of "chemical changes"? Mr. Spencer defines "a truly chemical change" as the "union or disunion of unlike molecules." Is this not to be explained mechanically? If not, then chemistry is not included in the Formula of Evolution; and even here, at this early stage, the unificatory proposition fails. It would seem that Mr. Spencer recognises an occult "property," or rather an endless number of individual properties, by virtue of which elementary bodies have special affinities and degrees of affinity with other elementary bodies, which property or agent or factor, called "chemical affinity," is unexplainable and ultimate, and is not derivable from any wider and more general law; is not a corollary from any proposition, nor capable of being included in the merely mechanical process of evolution defined in the formula.

Mr. Spencer says, "The new factor which differentiates chemistry from molecular physics, is the heterogeneity of the molecules with whose redistributions it deals. And the contrast hence resulting is too strongly marked to be obliterated by transitional cases."

Here it would seem that heterogeneity is the new factor. Of course this heterogeneity has been produced out of homogeneity by the Formula of Evolution. It was produced by the integration of some of the homogeneous units and the dissipations which would in this case be differentiations of their motions. Upon the production of this heterogeneity of molecules there result fresh relations and further integrations, being a fresh stage in evolution, which can be separately marked off in the classification of the sciences. But the new stage is conducted upon essentially the same principles as was the primary stage. The properties of the first-stage molecules are solely those of different attractions and repulsions, and are the *resultants* of the properties of the contained ultimate units. Amongst the first-stage molecules thus formed there will be considerable differences. Amongst these differences there will be some fitting them to form further combinations with others, according to their properties of attraction and repulsion, size, or motion (still mechanical attributes), and thus the second stage of evolution—chemistry, or the union of unlike elements—is attained. To call this a new factor is misleading; it is a further complication, a new condition; but there is no introduction of a new agency or property or affinity into the history of sequences. If chemical affinities can be explained on mechanical or physical principles, then no new factors are introduced. But if they are not so explainable, then not one new factor, but sixty or seventy new factors are introduced.

The introduction of a new factor, indeed, would destroy the value of the Formula of Evolution and upset the theory of the unification of knowledge; and if either Biology or Psychology introduce terms and properties that are not interpretable in the language and formulas of the one inclusive science, clearly knowledge is not unified, and Mr. Spencer's attempt is a failure.

It is therefore quite clear that the unification of knowledge here sought is to be attained by a unification of processes and sequences as deducible from certain original factors without the assistance of "additional factors." We recognise originally the Persistence of Force; we have to deduce somehow from that principle the two complementary forces of attraction and repulsion; we must then apparently deduce the formation of the elementary bodies, followed, according to the Formula of Evolution, by a concentration into solar systems. Geology is governed by the same laws as astronomy; biology is only a specialised form of geology; psychology and sociology, again, being specialised forms of biology. Therefore there is a dependence and coherency throughout the sciences which is interpretable by means of the rules of the primary science. If this science is placed in knowledge of the relations of the primary attractive and repulsive forces, then into the terms of this ultimate science, if the unification is complete, must all the terms of the subordinate sciences be translatable.

Mr. Spencer, however, says:—

"§ 23. But the truths which it is here our business especially to note, are quite independent of hypotheses or interpretations. It is sufficient for the ends we have in view, to observe that organic matter *does* exhibit these several conspicuous reactions, when acted on by incident forces: it is not requisite that we should know *how* these reactions originate." *

This passage we entirely dispute. It is a very common and correct thing to teach that man can never understand the ultimate *why* and *how;* but here the teaching is misapplied

* Biology, vol. i. p. 57.

to the evasion of a logical requirement. We do not know the *how* of gravitation, but we know its law, and we are able to predict its operation on any body under any given circumstances. In the case before us—namely, a unification of all knowledge *similar to* the unification of the special knowledge of the motions of bodies given us by the law of gravitation—although we can never know the *how* of primary active principles, yet if we know their law we are bound to find its application to all the included sequences, and to be able to predict, and thus to account for, all the changes included in the items of our knowledge. If we fail of this, it shows that our pretended unification is not complete. It does not do to turn round and say, "We cannot see the application of our law in this instance; we cannot account for it; all the same we are certain that it is unified by the general law." If we do not see the application of the unificatory law, if the unificatory proposition does not grasp this particular case, the law or the proposition is not—to us—unificatory. To fall back upon a primordial mystery to fulfil our unificatory proposition is clearly a logical evasion, and an admission of the insufficiency of that unification.

We would further ask the reader to compare the above quotation with "First Principles," p. 541, giving the criterion of a Philosophy, as quoted by us at the commencement of the present work.

It appears, therefore, that Mr. Spencer introduces us to the study of Biology quite unprepared with scientific conceptions as to its place in any definite history of the cosmos. Our principal requirement at the commencement of our deductive study is to know the factors with which we have to deal, so that we can thereafter recognise in all their sequences and combinations the interrelations of these original factors, and of these alone. If we could do this, then Biology would be complete in itself. If in addition we could see that these original factors themselves were no more than relations of certain knowable ultimate units, then we should recognise that all biology, as immediately the resultant of its special factors, and mediately the resultant of the primordial factors, would fall into its place in a system of unified knowledge. This preliminary science is not thoroughly expounded. Nor do its difficulties of explanation as between mechanical properties and those of affinity seem to be clearly appreciated. But notwithstanding this default of clear initial definitions, Mr. Spencer enters upon the study of Biology as a part of the cosmic process, involving the argument from the outset in such obscurities of thought that he and his readers are ready prepared to fall into any sort of delusion as to the unification of knowledge being effected, even to the extent of accepting "additional factors."

(g.) *An Intelligible Explanation only to be Attempted by the Physical or Concrete Method.*

Let us now approach the only method by which Biology, freed from the confusing intermixture of Feeling and additional Factors, is to be affiliated upon the Unification of Knowledge. This is to be done by regarding knowledge as the knowledge of one universal history; and this universal history is to be regarded as the history of a process. This process, again, is to be conceived of as commencing in the comparatively simple conditions of a primordial nebula in a state of fervent heat, composed of the chemical elements in certain proportions and distributions. We call it primordial, because it is the furthest point to which scientific imagination can carry us and to which scientific investigation points,—a state of things actually precedent to the solar system. It is a theory apparently accepted by Mr. Spencer. If he has theories of states precedent to this, they are only effective as explanatory of this; and since they have to pass through it on their way to the present, they are in every way bound by it. Or if they do take part in present histories, then let it be stated, and we shall know that our deductions from the postulated nebula are manifestly insufficient to explain post-nebular things. The affiliation of Biology upon Evolution in general must consist in showing how out of the primordial material organisms arose, and how they developed into all the different forms with which we are acquainted. It is not enough to be conversant with the facts of

Biology and the details of its processes; it is not enough to know something of genesis, growth, assimilation, reproduction, heredity, decay, death; it is necessary also to know their rationale. It is not sufficient even to be convinced of Mr. Darwin's great scientific generalisations; we have to give them such an explanation as will show them to be natural results arising out of precedent physical conditions. The biological developments must be shown to be physical developments; and if the task is to be done well and thoroughly, it must be wrought out in terms of physics and mechanics alone.

Our work, then, as limited to an examination of the "Biology," consists in the inquiry if it is complete in itself, and how far it harmonises with the "First Principles." It will be seen from this point of view that it is a task which need not necessarily require a special acquaintance with the science of Biology. Many literary people hesitate to controvert Mr. Spencer on account of their scientific deficiencies, while scientific men, immersed in the details of their vast studies, are not apt at encountering his philosophical and psychological positions. The examination now proposed, however, is the work not of the scientist but of the logician. The task is one requiring assiduity of comparison between general principles and details, —a patient following of lines of reasoning to see that there is no breach of continuity—a cold marking off of deficiencies of comprehension within a proposition,—a rigid appraisement of postulates of reasoning and factors of processes,—a stern exposure of any mixing up or changefulness in the meanings of terms and the purport of propositions—a strict supervision of the use of words, for we must remember that:—

"There are also idols formed by the reciprocal intercourse and society of man with man, which we call idols of the market, from the commerce and association of men with each other. For men converse by means of language, but words are formed at the will of the generality: and there arises from a bad and unapt formation of words a wonderful obstruction to the mind. Nor can the definitions and explanations with which learned men are wont to guard and protect themselves in some instances afford a complete remedy,—words still manifestly force the understanding, throw everything in confusion, and lead mankind into innumerable controversies and fallacies" ("Novum Organum," Book i., Aph. xliii.)

It will not be necessary for us to criticise throughout Mr. Spencer's detailed treatment of the science of Biology: his work on that subject is a very valuable treatise, apart from its logical dependence upon the "First Principles," and apart from the theory of the unification of knowledge expounded both there and in the "Principles of Psychology." We shall examine it merely on the ground of its logical connection with these two works and with the unificatory theories which form the gist and essence of Mr. Spencer's Philosophy taken as a whole—an interdependence for which Mr. Spencer himself strenuously contends, and which is supposed to form the crown and glory of all his labours. But we shall see that if the unification of knowledge consists in an unificatory explanation of processes by which all differentiations, including all organisms and the interrelations of the organic and inorganic worlds, are accounted for from their origin in the homogeneous, then the proposed explanation advanced in "First Principles"—namely, the Formula of Evolution—is wholly inadequate; for immediately Mr. Spencer sets seriously to work with it, he has to abandon its terms, and implicitly to substitute for it a definition which is merely descriptive of its external aspect, abandoning all real explanation as outside the possibility of human thought. If, again, we take unification as consisting in the methods proposed in the "Psychology"—say in the finding of a congruity between our primordial experiences and all other dicta of our consciousness, or in the fact that all our experiences can be translated into experiences of the feeling we call resistance, or in the resolution of all experiences into those of subject and object; then what have Biology, Geology, Astronomy, and Physics to do with it? Do any of these supposed unificatory propositions form the one universal science of which Astronomy, Geology, Biology, Psychology, and Sociology are successively dependent parts? If not, whence the systematic organisation and interrelation of these sciences? In fact, unification is so bandied about from one ultimate unificatory proposition to another, that when it is finally thrown upon The Unknowable, we feel it must stay there, at least for a time.

Mr. Spencer thus states the problem of the affiliation of Biology upon evolution in general :—

"The point at issue is, how this inscrutable Cause has worked in the production of living forms." *

"The task before us is to deduce the leading facts of organic evolution, from those same first principles which evolution at large conforms to." †

And again :—

"To say that functional adaptation to conditions, produces either evolution in general, or the irregularities of evolution, is to raise the further question—Why is there a functional adaptation to conditions?—why do use and disuse generate appropriate changes of structure? Neither this nor any other interpretation of biologic evolution which rests simply on the basis of biologic induction, is an ultimate interpretation. The biologic induction must itself be interpreted. Only when the process of evolution of organisms is affiliated on the process of evolution in general, can it be truly said to be explained. The thing required is to show that its various results are corollaries from first principles. We have to reconcile the facts with the universal laws of the redistribution of matter and motion." ‡

The result of our study of Mr. Spencer's "Principles of Biology" will be to show that it is a constructive system carried on mainly upon the lines of the physical relations of certain concrete factors and their aggregates amongst each other and in relation to their physical environments; that this is aided in its simulation of explanation, although not in its reality, by certain metaphysical abstractions and false supraphysical laws; that the sense of accomplishment is increased by identifying "harmony with truths" with "corollaries from truths," as well as by certain verbal ingenuities such as "additional factors;" and that even teleology has to be called in at last to make up the still remaining deficiencies. And although, therefore, the main examination

* Biology, vol. i. p. 332. † Ibid., p. 402. ‡ Ibid., p. 409.

will be upon the lines of the physical inquiry, yet we shall have perpetually to diverge according as we come upon one or other of these misleading influences.

§ 2. *The Data of Biology.*

The study is best commenced by a perusal of Chapter VII. on "The Scope of Biology," with the preceding six chapters, which are there summarised. The first three treat of the factors of Biology; the latter three are devoted to a discussion of the definition of Life. We will begin by examining the factors of Biology.

The first criticism we have here to make is with reference to the difficulty the reader experiences in properly realising Mr. Spencer's position and his inability to understand the terms employed. This is due to Mr. Spencer's omission of a work on the precedent inorganic evolution, an omission which he, indeed, explains, though such a work, as being the foundation of all the others, must be judged an indispensable preliminary. The deficiency in question is partly supplied in the Appendix to vol. i. of the "Biology," which contains an account of the origin of "organic matter." This account formed the subject of a very close examination in our previous work, to which we would now refer the reader. The result of our studies was to show that the only change which took place in the evolution described was a gradual increase of complexity, and a consequent increase of mechanical sensitiveness and instability of the most highly complex and comparatively large molecules. Mr. Spencer characterised these molecules as displaying motions approximating more and more to those of organisms, so that in the end the only distinction between inorganic and organic molecules was one of degree of complexity, and consequent changefulness under the influence of the environment.

The four chief elements which so combine into these complex and changeful molecules termed "organic" form, therefore, the starting-point in biological evolution. As Mr. Spencer argues, "It follows from the Persistence of Force that the properties of a compound are *resultants* of the properties of its components —*resultants* in which the properties of the components are severally in full action, though greatly obscured by each other." It is, therefore, necessary to enter upon a study of the properties of these four chief factors. Mr. Spencer does not, however, give a full account as a chemist would do of the properties of oxygen, hydrogen, nitrogen, and carbon. He rather treats them with regard to their physical characteristics. One of the leading properties of each substance is its degree of molecular mobility. We scarcely think Mr. Spencer makes out his case in proving that the solid and liquid forms of compounds derived from these gases, which possess molecular mobility in a high degree, themselves possess this same molecular mobility, however much their action is naturally obscured. As we remarked before, the work requires a precedent study of inorganic evolution. In such a preliminary treatise, the modifications of molecular mobility would have been properly explained, together with the meaning of the proposition that actions can proceed yet can mutually obscure each other. It would also have been explained how such a fact would harmonise with the Formula of Evolution, which asserts that when substances integrate, motion is transferred to other substances. In the next few pages frequent references are made to the distinctions between "chemically" and "physically," between "chemical activity" and "molecular activity," between "chemical energy" and "chemical inactivity," all implying a previous inorganic evolution by which the various substances were differentiated physically and chemically. Besides, no sufficient account is given of the main distinction between chemistry and physics, nor is the theory that the former is a branch of the latter at all discussed.

Throughout the whole course of this examination we shall find occasion to deplore this initial omission; for not only in the points just specified shall we feel the want of it, but also when we have to consider the action of Mr. Spencer's great constructive agencies, Polarity and Equilibration. To understand these operations properly would require a preliminary elucidation, from Mr. Spencer's point of view, in abstract mechanics, and it is to be hoped that he yet may be able to write it. In it would have to be specified in a clearer manner than appears in his works the place which the Formula of Evolution maintains in all these operations. However, one thing is clear, namely, that when Mr. Spencer speaks of matter it is the chemical elements he refers to. Organic matter, from which all living organisms are constructed, consists of oxygen, nitrogen, hydrogen, carbon, &c., and, as we shall see shortly, the forces which work amongst them are those classed by physicists. This is to guard against Mr. Spencer's reply to the effect that by Matter and Force he only means the symbols x and y, symbols which stand for modes of the Unknowable, and to which if we attach any definite conceptions we can only be landed in ultimate contradictions of thought.

Amongst the ambiguities abounding in these first three chapters is the employment of the term "force" and the plural "forces." Chapter II. treats of the actions of forces on organic matter, the latter forming part of or being altogether an organism, whether plant or animal. Chapter III. is concerned with the reactions of organic matter on forces, which we find very difficult to translate into terms of Matter and Motion: sect. 18 in particular we cannot understand in the defined language of Evolution. For instance, "forces at work among the molecules," "the force which . . . is that which causes the union of different substances with each other," &c. Sect. 21 contains an allusion to "nerve force;" this also requires translation into the recognised language of Evolution. Sect. 22 gives an account of sensible motion as a "reaction called forth from organisms by surrounding actions."

There is great ambiguity throughout all these chapters for want of a definite meaning to the term "forces." Among these are included "chemical affinity," "nerve force," and "sensible motion." There are also curious uses of the word "force;" such as, p. 39, "a sudden and great evolution of force;" p. 57, "these evolutions of force are rigorously dependent on these changes of matter;" p. 42, "these units, reacting differently on the different parts of the force," &c. It is an easy and common error, after expending great care in the delimitation of the meaning of words for scientific purposes, to descend from the high philosophic platform and employ the terms so set apart in their ordinary colloquial usage. This carelessness and obscurity of language, though apparently of trifling effect, really vitiates cumulatively all Mr. Spencer's reasonings. In so often calling attention to these defects, we fear we may be thought captious; but we hold it to be an essential criticism of Mr. Spencer's works, as these obscurities and this changefulness of meaning are so all-pervading as to form a complete network of error, from which the cautious reader is constantly endeavouring to free himself, and in which the undiscerning student may become hopelessly and completely entangled.

Amidst all this use of the term "forces" we are at a loss to apply the scientific statement of the doctrine of the Conservation of Energy as taught by Professor Balfour Stewart. Therein we learned to distinguish between forces and energies, the latter of which terms in particular was well defined, and its interchanges of mode expounded in detail. How are they to be applied to the interrelations of the constituents of organic matter and their relations with modes of energy?

At the same time we do not know whether Mr. Spencer confines himself to this account of the Conservation of Energy, for in his footnote to the chapter on "The Persistence of Force" he seems to object to the term "Conservation of Force," because it does not imply the existence of the Force before that particular manifestation of it with which we commence, and he even regards this term Persistence itself as faulty because it has not such an implication; yet what is the use of this implication for scientific purposes, or even for the purposes of philosophy, which is but the higher science?

Section 5 is supposed to furnish us with the principles of General Physics, both Molecular and Molar, which shall enable us the better to understand the preceding sections, and supply the want before expressed. Here we find that the molecular mobility of a substance is not a constant property upon which other sequences depend, as we would have supposed from the first section, but a variable property, dependent upon other properties of a substance, as follows: — Firstly, upon "the inertia of its molecules" (query, atoms?). But what is inertia? —motion, or rest, or continuance of either? Is, then, inertia a constant property of any molecules or atoms? Secondly, "on the intensity of their mutual polarities." Is the substance in question homogeneous or heterogeneous? Say homogeneous, since we are investigating the nature of the molecular mobility of oxygen, for instance. The atoms of oxygen, then, have mutual polarities, and differ from the atoms of say gold in that these polarities have different degrees of "intensity." This must mean that they attract each other less and repel each other more, so that they remain at fixed but varying distances, according to the intensity of the polarity. But this is a matter of position or distance, and does not refer to activity or mobility at all, except in the recovery of the relative normal position after the removal of constraint. To anticipate, on the next page (p. 15), we are told that polarity itself is ascribable to contrasts of dimension, so that in tracking molecular mobility to its ultimate source we find it due to relations of dimension. Thirdly, the molecular mobility of a substance depends upon the "mutual pressure" of its molecules, "as determined by the density of their aggregation." But we have just been considering mutual pressure and density of aggregation as due to degrees of intensity of polarity or mutual attraction and repulsion. Fourthly, "on the molecular mobilities of their component molecules." Here we find that, after all, Mr. Spencer had in view a heterogeneous substance, whereas we had in view an elucidation of the molecular mobility of those constituent substances of which all organic compounds are the *resultants*, so that, understanding our original factors, we would be able to calculate the results. Does not this latter sentence imply a fixed molecular mobility as a constant property of the constituent molecules, or rather atoms? and does not the whole passage imply that these are modifiable amongst themselves, or as the effect of chemical union with other substances, so that the result is not the *resultant* of the original molecular mobilities, but a confusion of terms out of which no progress can be made, or out of which any progress can be made? Can any one understand the inference that, "any three of these remaining constant, the molecular mobility will vary as the fourth"? However, it results in this—"Other things equal, therefore, the molecular mobility of atoms must decrease as their masses increase," &c.; from which it appears that the large-atomed substances are not the resultants of their constituents, or else that it is not a property of the original constituents to be possessed of "great molecular activity" as a fixed property. Page 15, treating of polarity, distinguishes between simple attraction and polar attraction. The question is, What are the original properties from which all others are *resultants*, and what are dependent and variable properties? In turn we think each is the fixed original factor, and afterwards we find it to be dependent.

However, it is not our design to criticise the biological progress in every detail; suffice it to point out the obscure treatment of the preliminaries. The general result of the first chapter is to the effect that the materials employed in the construction and processes of living organisms are in every way fit for the purpose. At the same time we naturally ask what of constructive efficacy appears in the account?

The constructive or formative process would appear to consist of simple attraction, chemical affinity, and polarity. Equilibration does not yet make its appearance; but no doubt, as it is an universal process, although it fulfils a larger function later on, it must have a place in the more minute rearrangements of molecular physics. In view of the large part taken by Polarity and Equilibration in the constructive processes of Biology, we have given them separate study in later sections of this chapter, and would recommend the reader to take them out of their proper order at this point of the study, as they form the main operative factors throughout the work, which we find it convenient to treat on other lines of arrangement. However, in this first chapter the factor of Polarity is distinctly brought forward, and the foundation laid for much constructive work in the establishment of colloidal molecules, which possess at the same time two incompatible properties—the property, that is to say, of definite polarity, by means of which (like crystals) they have the power of aggregating into definite forms, and the property of plasticity, by which they adapt themselves with great readiness to their environment. This wonderful combination will be found of enormous potency in biological construction, for a substance which can sometimes determine structure, and on the other hand can easily adapt itself to structure—a substance which can originate function and which can also adapt itself to taking on any function, is capable of accomplishing almost everything with the assistance of Equilibration. The difficulty is to understand the coexistence of definite constructive polarity and of plasticity in the same molecule.

§ 3. *The Actions of Forces on Organic Matter, and the Reactions of Organic Matter on Forces.*

Let us now take a broader view of the factors of Biology. The first class, as already seen, consists of the so-called elements —oxygen, hydrogen, nitrogen, carbon, and a few others. The second class consists of everything else that in any way becomes related to molecules of the above, or to aggregates of them. These are the external factors, and are treated of in Chapter II., entitled "The Actions of Forces on Organic Matter." They comprise: (1.) Incident mechanical force, (2.) Quasi-mechanical force, *i.e.*, (*a.*) Capillary affinity, (*b.*) Osmose, (*c.*) Heat, or a raised state of molecular vibration, (*d.*) Light, (*e.*) Chemical affinity, (*f.*) Induced changes, such as fermentation. The chief criticism on this chapter is, that it does not seem correct to speak of the actions of external forces such as chemical affinity, without taking into account the fact that the organic matters themselves possess affinities of this kind, and that the action is therefore mutual. Thereupon Mr. Spencer has a chapter upon "The Reactions of Organic Matter on Forces." We can understand the reaction of the organic substances upon substances external to them only in the sense of mutuality of action, in which it is just as correct to speak of the operation of either as action or reaction. The actions, being mutual action and reaction, are contemporaneous and therefore identical. But we must say that we cannot understand the reaction of organic matter on such forces as heat, light, electricity, &c., and much less can we understand the reaction of organic matter on nerve force and sensible motion, which are not external forces at all to be reacted upon. But as a matter of fact, Mr. Spencer has quitted the consideration of the relations of unorganised organic matter, and is really treating of the reactions of *organisms* on—well, it is difficult to say on what. The first illustration is with respect to heat. Now heat, as applied to the end of a dry stick, causes it to burn, and then the reaction on heat is said to be that the end causes the middle to burn, and from the middle it spreads to the remaining end; therefore the organic matter of the wood has reacted upon the force called heat which burned up one half of it, by itself sacrificing the other half. One would think that the whole event was a single process; at any rate, the reaction of the organic matter upon the force called heat is not made apparent.

The second illustration is thus stated:—

"Among the forces called forth from organisms by reaction against the actions to which they are subject is light—*i.e.*, phosphorescence."

We presume that phosphorescence of vegetables and animals is a consequence of antecedent factors, internal and external, but we scarcely see that it is a reaction against anything. It seems to us merely a joint product, like the results of the chemical affinities before discussed.

Nerve force (§ 21) and sensible motion (§ 22) are classed as reactions upon forces. In the first place, we are outrunning our studies to speak of nerve force and sensible motion at all. These are the very things we wish to have explained. They are said to be "reactions called forth from organisms by surrounding actions," which is begging the question at issue. In § 23 Mr. Spencer says that these are truths of induction quite independent of hypotheses, and it is not necessary to know *how* these reactions originate. But it seems to us, if we are to understand them as *resultants* of original factors, we must see that what is produced is really an outcome commensurate with those factors.

Mr. Spencer says of Chap. II.: "This chapter will have served its purpose if it has given a conception of the extreme modifiability of organic matter by surrounding agencies." * To this estimate of its value no exception can be taken. It is otherwise with Chap. III., in which amongst the reactions of *organic matter* are classed the known reactions of *organisms* called nerve force and sensible or muscular motion. These are evidently amongst the results of biological evolution, but we are not in a position to say that they are amongst the *properties* of that combination of some of the elements which we have agreed to call *organic matter*, nor can we assert that owing to this fact the same reactions are conspicuous in the completed organism. Indeed, the reactions referred to are only possible in a completed organism, and cannot be said to appertain in any way to the constituent organic matter. Also it is clear that whatever reactions organic matter may exert, they are not reactions upon things called Forces; but that all Mr. Spencer refers to are the changes in the organism itself consequent upon the impingement of incident forces.

§ 4. *The Definition of "Life."*

A state of equilibrium is one in which two or more forces acting upon an intermediate body are so equal as to produce no motion. Strictly speaking, it is a term of the science of mechanics, but it can be and is frequently applied to conditions coming within the other physical sciences, and even to circumstances comprised in the domain of chemistry. In these wider applications it refers to the state of quiescence due to the equal balance of any forces or energies.

Mr. Spencer very often teaches us that all physical changes are to be understood as stages in a process towards a state of equilibrium, and he looks forward to a time when all the energies of nature will be so mutually balanced as to produce universal quiescence or death. This process is called *equilibration*, and it evidently rules all the physical changes of the cosmos. In this view it is clearly co-extensive with the ordinary law of universal causation in the production of physical changes. Every chemical process and every physical action in all classes

* Biology, vol. i. p. 41.

of sciences are simple equilibrations of various energies on their way towards a state of balance or quiescence.

We have now, however, to consider another and altogether distinct idea of Equilibration.

Physical processes are simple equilibrations having results due to the direct and calculable relations of the properties of the bodies or motions in interaction. Biological processes, though coincident to a certain extent with the former, are yet not wholly so, but exhibit a power on the part of certain aggregates of developing fresh rearrangements, which shall counterbalance these direct equilibrations and prevent them from accomplishing their due and direct effect; and this with the definite object of self-preservation. Thus, a creature's rate of food-assimilation is increased in consequence of a decrease of temperature, or else it is changed in kind, or the energy expended is lessened by a state of torpor, or by the thickening of its fur, so that the altered relation in the surrounding medium may thus be protectively counterbalanced. The aggressive forces, which by simple equilibration would destroy the aggregate, are, by means of the law of special biological equilibration, met by the rearranged forces of the aggregate, and being thereby counterbalanced, the aggregate is preserved.

Contrast these instances with the phenomena exhibited by a storm-glass. "Outside there is a constant change; inside there is a change of atomic arrangement. Outside there is another certain change; inside there is another change of atomic arrangement. But, subtle as is the dependence of each internal upon each external change, the connection between them does not, in the abstract, differ from the connection between the motion of a straw and the motion of the wind that disturbs it. In either case a change produces a change, and there it ends. The alteration wrought by some environing agency on an inanimate object, does not tend to induce in it a secondary alteration, that anticipates some secondary alteration in the environment." *

But it is altogether different with living organisms possessing the power of *anticipatory* counterbalance.

* Biology, vol. i. p. 78.

"It is manifest *à priori*, that since changes in the physical state of the environment, as also those mechanical actions and those variations of available food which occur in it, are liable to stop the processes going on in the organism; and since the adaptive changes in the organism have the effects of directly or indirectly counterbalancing these changes in the environment; it follows that the life of the organism will be short or long, low or high, according to the extent to which changes in the environment are met by corresponding changes in the organism." *

If we now recur to the account of the Origination of Organic Matter given by Mr. Spencer in the Appendix, we must resume our study of it on the understanding that matter is inorganic so long as it acts according to simple equilibration, and becomes organic when it acts according to the law of special biological equilibration—that is to say, when, acting in antagonism to threatened destruction by processes of simple equilibration, it sets up rearrangements to counterbalance the external forces, and so ensures its own self-preservation. We shall therefore find that Mr. Spencer's account of the origin of organic matter fails in that it places the attainment of the organic stage in the degree of complexity, mechanical sensitiveness, changefulness, and plasticity to which some chemical compounds attain. Only when certain molecules or several molecules banded together, attain the power of rearranging their forces or processes, so as to counterbalance external adverse influences, can they be properly called organic.

The affiliation, therefore, of biological processes upon preceding inorganic evolution depends upon our ability to affiliate this anticipatory biological equilibration upon general physical processes. The problem is to account for this physical law as derived from wider and more universal laws. We can scarcely say that the biological action is *for the purpose* of self-preservation, for that is teleological. It implies a foreseeing mind, and action towards a given end, whereas all evolution is simply from a beginning. Development is wholly dependent upon antecedents. We must look at every existence as a resultant of preceding circumstances—

* Biology, vol. i. p. 82.

not of expected ones. Hence we have to look for the warrant of the special biological law in antecedent modes of activity.

Can we say it is a law of nature that all actions produce not simple physical reaction, but counter preventative action? Scarcely! Mr. Spencer himself holds to the special differentiating character of the biological equilibration, and repudiates it as universal. Still he regards it as a true physical law, and explains it as the law by which moving equilibria sustain themselves against destructive forces.

Having thus stated the problem of affiliating Biology upon Evolution in general, we leave the discussion of it together with the general treatment of its application to a separate section. We shall also have to consider whether the subjective feelings or consciousness arise by way of equilibration, and to see that the term equilibration is truly applied in a developmental and not in a teleological sense. With regard to Objective Psychology or the science of the nervo-muscular apparatus, Mr. Spencer states in Chapter VII. that it clearly falls within the range of biological study. Subjective Psychology, dealing with its direct or indirect subjective concomitants, is not included in it.

It now only remains to note that the three chapters devoted to the differentiation of biological processes are not clearly wrought out in terms of this central idea, but that the exposition is obscured by the employment of such indefinite terms as "correspondence" and "correspondences." It is evident that all biological counterbalances are correspondences; but to end a clear explanation by adopting indefinite language is apt to widen its application beyond its legitimate capacity, and enable it to explain things that are not included in it; such, for instance, as feelings, memories, and the subjective aspect generally, and perhaps many purely physical arrangements as well.

§ 5. *The Inductions of Biology.*

The next part of Mr. Spencer's work, after the statement of the factors, gives a summary of the Inductions of Biology, that is to say, the known general processes which are the things to be explained, this statement being itself accompanied by partial explanations. The full explanatory exposition is, however, reserved for Parts IV. and V. in the second volume, entitled respectively "Morphological Development" and "Physiological Development," in which Mr. Spencer undertakes to deduce all the recognised effects of biological history from the original factors to which we have just given our attention.

The part devoted to the Inductions of Biology is therefore preparatory in character, and in a criticism like this, which is of a general rather than of an exhaustive nature, we cannot undertake to follow the various chapters with any closeness of detail. We must not attempt to do more than indicate the principal formative agencies. The most effective of these, namely, "Polarity" and "Equilibration," being separately treated, we shall do no more here than note their main applications.

Growth.—There is an essential community between organic and inorganic growth; they both result in the same way. There is the same segregation or union of like units and the same parting of unlike units. The deposit of a crystal from a solution exhibits this segregation, and since a plant is surrounded by elements that are like the elements of which it is composed, they are attracted to and segregate with it. Nor does the animal fundamentally differ in this respect from the plant and the crystal. But there is, also, a distinction: the aggregation of inanimate matter is produced by simple attraction, and the process may continue without end, whereas the aggregation of organic bodies is produced by polar attraction, and is of a definite kind which appears to have fixed limits; nevertheless, the aggregation of inorganic crystalloids is also limited and definite. The main thesis at this point becomes rather confused. The proposition advanced at the commencement was to the effect that inorganic growth and organic growth are similar. There are various modes of inorganic growth. There is simple non-selective physical accretion; there is crystallisation; there is the union produced by chemical affinity. Inasmuch as organic bodies are composed of chemical substances and possess all the physical properties of inorganic bodies, they will exhibit all the physical properties and modes of inorganic growth, and therefore similarities will be found. The question rather is whether, in addition to these modes, organisms possess special modes of growth? And the inquiry will resolve itself into this question—whether the growth of inorganic aggregates is not the result of the physical and chemical properties of their constituents, and whether, on the other hand, organic growth is not the production and adaptation of physiological units out of the raw material of the environment by the organism for its own growth? It will be found that Mr. Spencer himself adopts this latter view, and so overthrows the proposition of the identity of the two modes of growth. He recognises an essential distinction between them.

In this chapter it would have been well if Mr. Spencer had devoted some space to the consideration of growth as variously exhibited by crystalloids and colloids. It can easily be understood that the accretions of the former must assume definite forms, and the growth will be a definite result due to the particular shapes of the constituent molecules. But since organisms are mainly composed of colloids of protean form, it would have been very instructive to have considered their modes of accretion, and to have inquired how far the results were determined by their molecular structure. For it would seem *à priori* that protean colloids could not produce aggregates of definite shapes.

Development.—Development means increase of structure, not increase of bulk, and the study of development means the study of the variations from and additions to structure. The chapter is devoted to a description of the great varieties of organic structure and to a very interesting classification of the modes of development from rudimentary centres or axes. The point of interest to us is the deductive warrant for development from either. This consideration Mr. Spencer necessarily has to postpone till he comes to the fourth and fifth divisions of his work.* At the same time he says that "the general law of development as displayed in organisms, is readily shown to be necessary, if the initial and terminal stages are such as we know them to be."

* Biology, vol. i. p. 150.

We are at a loss to know what place the terminal stage holds in a process of deduction. The real question is as to the deductive warrant for the terminal stage regarded as purely the result of the initial factors. Passing over the inconsistent proposition of a "homogeneous organism," Mr. Spencer betrays himself when he says, "Grant that each organism is at the outset homogeneous, and that when complete it is relatively heterogeneous; and *of necessity it follows*" (*from the two facts, not the initial one only*) "that development is a change from the homogeneous to the heterogeneous—a change during which there must be gone through all the infinitesimal gradations of heterogeneity that lie between these extremes." Mr. Spencer does not specify whether the "homogeneous organism" he refers to is the germ of an embryo or some prehistoric mass of protoplasm. However, he pursues the argument through the terms found in the Formula of Evolution, and the conformity of the process with Evolution in general is self-evident, whatever may become of the postponed deductive interpretation.

Development is assisted, if not initiated, by growth or assimilation. Like units tend to segregate, and this universal physical truth is held to demonstrate *à priori* the necessity for selective assimilation. Therefore, *taking for granted* that organs have already been developed, we can understand why "Each organ, at the expense of the organism as a whole, integrates with itself certain special kinds and proportions of the matters circulating around it. . . . So that the organs are qualitatively differentiated from each other, in a way analogous to that by which the entire organism is qualitatively differentiated from things around it." *

This argument is taken from the section meant to show the deductive interpretation of development. The special result arrived at is "that organs are qualitatively differentiated;" the reason given is that they, the organs, being already qualitatively differentiated, segregate to themselves divers matters in the environment. But this does not explain the origin of the qualitative differentiation, it only explains the growth of organs.

* Biology, vol. i. p. 151.

It does but illustrate the truth "that the pre-existence of a mass of certain units" (*an organ?*) "produces, probably by polar attraction, a tendency for diffused units of the same kind to aggregate with this mass, rather than elsewhere."

Function.—This chapter, taken as a portion of the Inductions of Biology, must be regarded mainly as a description of some general results of biological evolution requiring explanation rather than as an argument to be examined from a deductive point of view. Nevertheless, it is necessary to translate the general facts of function into the language of the precedent inorganic evolution, in order that at the proper time the problem of the origin of function may be suitably dealt with, and in order that clear conceptions of what is meant by the term from the deductive point of view may be elaborated. For such a purpose the first and last sections of the chapter call for more special attention.

We must always and clearly remember that the distinction between an organic and an inorganic action, although both are purely physical, is a difference of mode. The latter takes place by simple equilibration, the former takes place as an adaptation or adjustment within an aggregate of its constituent material particles or their motions, in order to preserve its own continuity of existence against some external force; it is an action of counter-balance. It is supposed to be purely of a physical character, and is specially considered by us elsewhere. The question we have now to ask is this—Is this counter-balance or adaptation to be called a structural change or a function? Upon it depends the question as to the relation of structure and function.

A molecule of organic matter differs from a molecule of inorganic matter in being a moving equilibrium able to present to its environment a counter-balance. Since it is composed of smaller molecules or atoms, this counter-balance can only be one of rearrangement of parts or rearrangements of their motions. It is to be presumed that the former would be called a structural change and the latter a functional adaptation; but since it is probable that both changes would be effected simultaneously, it is to be judged that the adaptations of structure and function go together. Therefore the precedence of either is not a point worth discussing. Nevertheless Mr. Spencer decides that function precedes structure. But he does not show what place "function" occupies in inorganic science, from which organic science is held to be deducible.

Questions more to the deductive purpose of our studies are those regarding the origin of moving equilibria, their aggregation, and the validity of the law of counter-balance on a purely physical basis.

Waste and Repair.—After considering the facts of waste and repair as biological inductions, Mr. Spencer regards the deductive interpretation of repair as by no means easy. He does not consider the tendency of an organism to return to a state of integrity when it has undergone the waste due to activity as manifestly deducible from first principles, although it appears in harmony with them. If in the blood there existed ready-formed units exactly like in kind to those of which each organ consists, there would be no difficulty in accounting for it as ordinary segregation. An explanation is, however, suggested in the hypothesis that complex molecules possess the power of manufacturing out of the fluid bathing their surface other similar molecules, which are then fit to assimilate with the mass. The consideration of this subject generally, as treated of in §§ 65 and 66, throws the onus of explanation upon Polarity, and receives examination from us in the chapter bearing that title.

Adaptation.—As an induction of Biology, the phenomena of adaptation are of remarkable interest, and in the hands of Mr. Darwin they have achieved a position of immense historical importance. With the individual facts we are all more or less acquainted, while the grand import of the accumulated results and of the general principle is every day becoming more and more recognised. Mr. Spencer's account of this matter is a very fair and adequate representation. Nor, granted the validity of the previous deductive explanations, and granted a further satisfactory deductive warrant for genesis and heredity, is the deductive interpretation of the various modes of adaptation difficult. But until these precedent deductive explanations are properly settled, there is not much satisfaction in pursuing the beautiful ramifications of reasoning by which organisms can thereupon be ideally reconstructed.

Of the modes of adaptation, there are several for which Mr. Spencer offers suggestions of explanation. There is the adaptation by which excess of function is compensated for by increase of bulk. There is, however, a limit to this process both in the changes of individuals and in the adaptations of a race, and the consequent reconstruction is not maintained unless the increase of function is permanent. But this chapter on Adaptation, treating rather of the changes in organisms after they have established their existence, is of comparatively less importance to us than the study of the origination of organisms; and although the same principles apply at the end as at the beginning, and in the beginning as at the end, we must, in a deductive interpretation of the histories of biology, carefully define our initial conceptions of adaptation as a physical counter-balance by a moving equilibrium to destructive forces. This view of adaptation will be considered in our studies of Equilibration.

§ 6. *General Causes of Physiological Development.*

Reserving our main examination of Mr. Spencer's method for affiliating physiological development upon Evolution in general, we will now ask the student to form for himself a general idea as to the problem before him and its mode of treatment by a review of Part V. The problem is thus stated in Chapter I.:—

"The problems of Physiology, in the wide sense above described, are, like the problems of Morphology, to be considered as problems to which answers must be given in terms of incident forces. On the hypothesis of Evolution these specialisations of tissues and accompanying concentrations of functions, must, like the specialisations of shape in an organism and its component divisions, be due to the actions and reactions which its intercourse with the environment involves; and the task before us is to explain how they are wrought—how they are to be comprehended as results of such actions and reactions."*

* Biology, vol. ii. p. 223.

"Here, as before, we must take into account two classes of factors. We have to bear in mind the inherited results of actions to which antecedent organisms were exposed, and to join with these the results of present actions. Each organism is to be considered as presenting *a moving equilibrium of functions*, and a correlative arrangement of structures, *produced by* the aggregate of actions and reactions that have taken place between all ancestral organisms and their environments." *

The succeeding chapters of this part contain a detailed account of a probable historical development from unorganised organic matter to all the highly organised forms with which we are acquainted, accompanied by a supposed deductive justification. This history reveals a process analogous to all other cosmical histories, and possesses characteristics which give it the outside appearance of uniformity with all other kinds of evolution. Physiological development is shown to display an advance from a state of incoherent, indefinite homogeneity to a state of coherent, definite, and complex heterogeneity. It is shown to exhibit features throughout in harmony with the "First Principles," and in the Instability of the Homogeneous, the Multiplication of Effects, Segregation, Rhythm, and the redistribution of Matter and Motion, it shows an agreement with Evolution in general. One cannot but admire the great ability displayed in the exposition of the progress of physiological development, and in the marshalling of the supporting facts; but after all, the question with which this criticism is more immediately concerned is not the inductive justification but the deductive validity of the argument.

The general summary of the deductive warrant for physiological development is given in a very excellent manner in Chapter X., to which we now direct attention. We would desire to quote this chapter *in extenso* were it not for the space required; but that consideration compels us to content ourselves with a brief outline.

"In summing up the special truths illustrative of this general truth, it will be proper here to contemplate more especially

* Biology, vol. ii. p. 224.

their dependence on first principles. Dealing with biological phenomena as phenomena of Evolution, we have to interpret not only the increasing morphological heterogeneity of organisms, but also their increasing physiological heterogeneity, in terms of the redistribution of matter and motion. While we make our rapid re-survey of the facts, let us then more particularly observe how they are subordinate to the universal course of this redistribution." *

The first step is to show how the "Instability of the Homogeneous" operates in initiating change in a homogeneous mass of organic matter. The general fact to which Mr. Spencer refers is no doubt a common principle of physical change; but his representation of it as the "Instability of the Homogeneous" is fruitful of confusion. In our present study he regards it as, "strictly speaking, the inevitable lapse of the more homogeneous into the less homogeneous." There are, however, no degrees of comparison in the "homogeneous;" a thing is either absolutely homogeneous or it is not homogeneous at all. The only degrees of comparison are as to heterogeneity. Probably there is no such state of homogeneity; but if there is, there is no reason to suppose that it would "lapse" into any other state. It would not be unstable; a self-generating cause of change is contradictory to the Persistence of Force.

The absurdity of this cause of Evolution we have exhibited in our previous work, and when we find Mr. Spencer himself characterising it on p. 385 as "but another name for the absence of balance between the incident forces and the forces which the aggregate opposes to them," we can only come to the conclusion that as the homogeneous means a perfect balance between incident forces and the forces of an aggregate, the condition of homogeneity never existed, and that if it ever did exist, it would for ever remain homogeneous. If the Instability of the Homogeneous was, as it is sometimes stated to be, the cause of Evolution, considered either as concentration of Matter and concomitant dissipation of Motion, or as organic growth and accretions of differentiations, this means

* Biology, vol. ii. p. 377.

that "the absence of balance" was the cause of Evolution, and thus "Absence of Balance" is elevated to the dignity of capital letters, and becomes the original power which initiated all subsequent changes, and was the cause of all inorganic and organic Evolution. Is "Absence of Balance," then, a corollary from the Persistence of Force? If so, then the tendency to equilibrium is not. Yet Mr. Spencer teaches elsewhere the tendency to equilibration, and speaks of an ultimate equilibrium to which all things tend. It would be interesting to know if equilibration is a corollary from the Persistence of Force. But again, it is not clear but that the law of Rhythm prevents equilibration, and keeps up the "Absence of Balance." In that case Rhythm would seem to be a corollary of the Persistence of Force. But as Mr. Spencer has not thoroughly worked out *à priori* the order of the corollaries of the Persistence of Force, we are all along left in a state of obscurity. At any rate, it is something to know that the Instability of the Homogeneous means nothing more than the "Absence of Balance."

Taken in this meaning, it is a condition and not a law. The action consequent upon such a state of things is the tendency to a balance or state of equilibrium, and thus we find physiological development to be part of the more general process of equilibration. Mr. Spencer expresses his conclusion thus :—

"Physiological development, then, is initiated by that instability of the homogeneous which we have seen to be everywhere a cause of evolution." *

The next section shows how physiological development has all along been aided by the multiplication of effects, how each differentiation has ever tended to become the parent of new differentiations. The ruling cause of changes under this heading is, however, found to lie in the operation of the process of equilibration—a tendency to a state of balance either by means of simple equilibration or by the special equilibration of the moving equilibrium.

Section 313 brings before us in a more direct manner the ruling principle of all change as operative also in Biology.

* Biology, vol. ii. p. 382.

"The general truth next to be resumed, is that these processes have for their limit a state of equilibrium—proximately a moving equilibrium and ultimately a complete equilibrium. The changes we have contemplated are but the concomitants of a progressing equilibration. In every aggregate which we call living, as well as in all other aggregates, the instability of the homogeneous is but another name for the absence of balance between the incident forces and the forces which the aggregate opposes to them; and the passage into heterogeneity is the passage towards a state of balance. And to say that in every aggregate, organic or other, there goes on a multiplication of effects, is but to say that one part which has a fresh force impressed on it, must go on changing and communicating secondary changes, until the whole of the impressed force has been used up in generating equivalent reactive forces." *

These considerations lead us in the following section to the affiliation of all these changes upon the principle which governs the universal process of equilibration. This is the Persistence of Force.

"§ 314. In all which universal laws, we find ourselves again brought down to the persistence of force, as the deepest knowable cause of those modifications which constitute physiological development; as it is the deepest knowable cause of all other evolution. Here, as elsewhere, the perpetual lapse from less to greater heterogeneity, the perpetual begetting of secondary modifications by each primary modification, and the perpetual approach to a temporary balance on the way towards a final balance, are necessary implications of the ultimate fact that force cannot disappear, but can only change its form." *

The general remark upon this doctrine is to the effect that all changes may be found in harmony with it; but that, nevertheless, this statement of the principles of change in general is not sufficient to explain any particular change. We saw, for instance, in our study of the "Conservation of Energy," under Professor Stewart, that the change from one kind of energy necessitates an equivalent increase in some other kind; but by

* Biology, vol. ii. p. 384. † Ibid., p. 387.

no effort of the deductive faculty could we deduce any special change from this abstract law. So in all other physical change, and so in all biological change, we can make no concrete deductions from abstract statements, but only from concrete antecedents, by applying to these given facts the known general properties or modes of relation thereof summarised in the abstract law. This remark will hold good as well of simple equilibrations as of the special biological equilibrations. They may indeed be discerned as being in harmony with the Persistence of Force, but they can never be derived from it in their special forms. This has to be done intermediately through special concretes. Thus we are thrown back upon our concrete study as carried on in the previous sections of this chapter. But since we found that all the processes therein dealt with depended upon certain views of equilibration, we shall best continue our study by examining the chapters in vol. i. of the "Biology" dealing with the causes of Organic Evolution.

§ 7. *How is Organic Evolution Caused?*

This is the question proposed by Mr. Spencer in Part III., Chapter VIII., and it receives an answer in the following chapters.

"The task before us is to deduce the leading facts of organic evolution, from those same first principles which evolution at large conforms to." *

"To say that functional adaptation to conditions, produces either evolution in general, or the irregularities of evolution, is to raise the further question—Why is there a functional adaptation to conditions?—why do use and disuse generate appropriate changes of structure? Neither this nor any other interpretation of biologic evolution, which rests simply on the basis of biologic induction, is an ultimate interpretation. The biologic interpretation must itself be interpreted. Only when the process of evolution of organisms, is affiliated on the process of evolution in general, can it be truly said to be explained.

* Biology, vol. i. p. 402.

The thing required is to show that its various results are corollaries from first principles. We have to reconcile the facts with the universal laws of the redistribution of matter and motion." *

How is this done? How is the process of the evolution of organisms to be affiliated upon evolution in general, by which this functional adaptation is to be explained?

It is done by taking for granted that organisms exist, and then proceeding to show how the conditions of their environment have been affected, first, by astronomical changes (§ 148); secondly, by geological actions (§ 149); thirdly, by consequent variations of the meteorological conditions (§ 150); fourthly, by changes in the incident forces which organisms exercise on one another (§ 151); and lastly, by the increasing complexity of the organism thus modified, which brings it into contact with a greater variety of environment, and so itself produces still further complexity in the future (§ 152).

This is clearly not an answer to the question proposed, for it presupposes throughout the existence of organisms, and thus begs the question at issue. Therefore, in Chapter X., we are brought to consider the "Internal Factors" thus acted upon, involving a reference to the first chapters of the work, giving an account of these factors, which we considered at the outset.

Mr. Spencer then proceeds—

"§ 154. Our postulate being that organic evolution in general commenced with homogeneous organic matter, just as the evolution of individual organism commences, we have first to remember that the state of homogeneity is an unstable state" ("First Principles," § 109).

"Hence the gravitation from a state of homogeneity, to a state of heterogeneity, will be conspicuously shown in proportion as the environment is complex." †

This is not saying much. "Organic matter" is nothing more than combinations of some of the chemical elements—*i.e.*, those which we now know to be the constituents of organisms, and whose compounds we therefore call "organic matter."

* Biology, vol. i. p. 409. † Ibid., p. 421.

Supposing a great quantity of this to be so formed and to be similarly constituted, it would be called "homogeneous;" and because it is "homogeneous" it does not remain so, but forthwith differentiates itself, because of the "first principle" that the homogeneous is unstable. If we ask why it is unstable, we are told that after all it is not because it is homogeneous, but because of external influences, and it becomes differentiated because these external influences are of diverse characters. This being so, we can understand that homogeneous organic matter should become differentiated.

But surely it is saying too much to call such changes "differentiations of structure." There are many changes produced in bodies by external forces; whether they are structural changes or not depends in great measure upon the properties of the constituents. We should judge from the modifiability of organic matter that it never possessed sufficient stability of character to be capable of assuming any definite structural arrangement. Thereupon Mr. Spencer, boldly assuming genesis and heredity, speaks of—

"This transition from a uniform to a multiform state, must continue through successive individuals. *Given a series of organisms*, each of which is developed from a portion of a preceding organism, and the question is," &c.*

Thus we see that—

"Omitting for the present those circumstances which check and qualify its consequences, the instability of the homogeneous must be recognised an ever-acting cause of organic evolution, as of all other evolution." †

We find that the multiplication of effects aids continually to increase that heterogeneity into which homogeneity inevitably lapses. ‡

Again, "One of the universal principles to which we saw that the redistribution of matter and motion conforms, is that in any aggregate made up of mixed units, incident forces produce segregation—separate unlike units and unite like units; and it was shown that the increasing integration and definiteness

* Biology, vol. i. p. 421. † Ibid., p. 422. ‡ Ibid., p. 423.

which characterises each part of an evolving organic aggregate, as of every other aggregate, results from this." *

Having thus passed in review the external factors and the internal factors, Mr. Spencer concludes—

"It is quite conceivable that aggregates should be rendered more heterogeneous by changing incident forces, without having given to them that peculiar form of heterogeneity required for carrying on the functions of life. Hence it remains now to inquire, how the production and maintenance of this peculiar form of heterogeneity is insured." †

§ 8. *Equilibration.*

(*a.*) *Introductory.*

We will now ask the reader to enter upon an inquiry as to Equilibration; and first let us glance at the terms in which this inquiry should be conducted. It is evident that if we commence our studies with one set of terms and end them with another, there may possibly be involved some change of thought. Mr. Spencer commences the investigation in terms of Motion and concludes in terms of Force. The completed doctrine and its application in the explanation of Biology receives its fullest exposition in the language of the Equilibration of Forces, whereas we commence our studies with an inquiry as to the Equilibration of Motions.

(*b.*) *Equilibration of Motion.*

From Mr. Spencer's treatment of the subject in "First Principles" it would almost appear as if he taught that all motion tended towards a state of quiescence or no-motion.‡ This, of course, would be contradictory to his theory of the Continuity of Motion. We have already given our reasons for supposing this theory to be incorrect; but we can scarcely expect Mr. Spencer to involve himself in the inconsistency of repudiating

* Biology, vol. i. p. 426. † Ibid., p. 431.
‡ First Principles, pp. 483, 484.

that which is one of the two essentials of the Formula of Evolution. We decide, however, that he has in view the theory of the Dissipation of Energy, which would be more correctly denominated the Degradation or Equalisation of Energy. This is an accepted scientific doctrine, recognising the universal tendency of all the forms of energy specified in Professor Stewart's list towards an eventual equal distribution in the form of universally diffused heat, when all energy should have lost its efficacy in doing work in consequence of having sunk to a dead level of uniformity of kind in a state of equal distribution. But even in this last resort the quantity of energy remains constant, and Mr. Spencer's theory of the Continuity of Motion need not suffer from it. Therefore if we confine our inquiry to the facts of Motion, we shall see that the processes are all towards an ultimate state of equal distribution.

(c.) *Equilibration and the Conservation of Energy.*

We have found, however,* that Motion is not continuous, that its various forms are only modes of energy, all of which are capable of being transformed into modes of Energy of Position, in which no actual motion takes place, although the Energy of Position is capable of reconversion into energy of motion. It is the sum of both kinds which is constant; and even should all suffer degradation by conversion into an universally diffused and equalised heat motion, still the total quantity would remain the same.

The changes which take place in the cosmos may possibly be spoken of as equilibrations of energy, so much of one kind being converted into so much of another kind. In this view equilibration becomes identical with the conception of Universal Causation, unifying the idea of the latter at the expense of the definiteness of the former. Whether it is advisable to regard all changes of dynamical relations, all physical incidents, all chemical processes, all actions of light and heat, all motions of liquids and gases, all electrical and other manifestations, as processes of equilibration, is a question well worthy

* Supra, chap. iii. § 1.

of study, as is also the question what is involved in such a mode of regarding the cosmos. The essential idea undoubtedly is the attribution of quantitative to qualitative relationship, and involves progression towards a state of universal rest or quiescence, or towards a state of universal uniformity of distribution —a state of homogeneity or equal balance from which no farther changes ensue.

(*d.*) *Equilibration and Force.*

Perhaps the more general acceptation of the term Equilibrium would be in the sense of an equipoise of force or forces. Probably the most typical of all modes of equilibrium is that of the scales or balance. The idea of opposing force by force, with the involved idea of relative proportion, must have entered very early into the range of human conceptions. But neither the vulgar notion of the play of forces, nor Mr. Spencer's equally vague symbol "*z*," is available for any scientific purpose, nor for our present special object, in ascertaining the meaning of equilibration. We are obliged always to resort to the concrete when we desire our reasoning to be effective in understanding the laws of concretes or in our practical dealing with them.

Take, for instance, a pair of scales. We may, if we please, consider that each side is drawn to the earth by a force, and for ordinary everyday thought there is no need to quarrel with the supposition. But for actual use, and in reasoning processes, we are obliged to consider the 1-lb. weight we place in the scale as the embodiment and measure of so much force, as in fact being itself "a force;" and if we place two $\frac{1}{2}$-lb. weights in the opposite scale, we have the conception of a force balanced by another and equal force, by which an equilibrium is attained. As thus used, "a force" would not be a vague abstraction, but a concrete body. Taken generally, a force would be a definite concrete, which, either from its motion or its position, would possess a definite quantity of "energy" capable of doing work.

Thus, we are not at liberty to indulge in vague notions of the force of chemical or other attractions, but in all cases we are obliged to regard heat or molecular motion, light or ethereal motion, chemical attractions, cohesive attractions, &c., as definite and measurable concretes.

If we choose to regard any aggregate possessing energy, or any part thereof, as "a force," we may do so. And if by reason of general distribution we refer to some of the modes of energy as "forces" or "external forces," again we may do so, bearing in mind, however, the necessity for detailed and definite statement of the relations of the energies referred to.

We shall therefore pursue our inquiry into the processes of equilibration by means of the strictly scientific set of terms afforded us in Professor Stewart's list of the modes of energy, and afterwards examine Mr. Spencer's looser expositions with the involved corollaries. As Mr. Spencer carries on the inquiry on the supposition that all changes are modes of equilibration of forces, and the object of our study is to examine the validity of this theory, it will be necessary for us so to employ the term, though we take exception to it.

(*e.*) *Equilibration as a Universal Process.*

Regarded in this light, all actions which take place in the universe, being incidents in the interrelation of modes of energy, are equilibrations, or processes towards a state of equilibrium. Some form of energy is being changed into some other form, on the way towards a state of general diffusion. Equilibration becomes thus a general name for the totality of the processes of the universe, and it takes the place of the general term Causation, but connotes rather their quantitative than their qualitative aspect. Obviously this is quite a different case from the conception of the mechanical equilibrium of the scales previously referred to, and their rhythmical motion when disturbed, which ends in a state of rest. But this latter process receives from Mr. Spencer a wider application as "equilibration." We have in this confusion of the mechanical and the general physical applications of the term a play upon two meanings of the word which pervades the whole of Mr. Spencer's reasonings with very confusing effect. We have now to consider it in its general physical application.

As an instrument of reasoning, however, it is not of much use. For if we are to postulate a state of equilibrium at the beginning of things, it is clear that in the absence of something to disturb that equilibrium there could have been no initiation of change. In this respect a state of perfect equilibrium is equivalent to a state of homogeneity; and to commence changes we should have to suppose the instability of equilibrium, or a self-determination to change similar to the instability of the homogeneous. Any reasoning from such a basis is ridiculous, and may be made to lead anywhere according to the fancy of the reasoner.

The commencement of our reasonings, therefore, must be in a state of want of balance, with a tendency towards an equal distribution of energy. Thereupon arises the suggestion of two modes of procedure towards a state of equilibrium. Taking the original state of which we can form any scientific conception as one of an incandescent nebula composed of the seventy so-called elements or their primitive constituents, we would conclude that under the law of equilibration they would all resolve themselves into their constituents and produce a uniform state of ultimate units of matter equally distributed. But since this is not the process which actually took place, we must suppose that these constituents, being unresolvable, each being a bundle of properties incapable of dissociation, the equilibration towards which they worked was one which would secure to all of them a state of rest or quiescence. This would take, in the first instance, the form of segregation according to the specific gravity and polarities of the various atoms, their position in the mass, and the general motion of the nebula itself.

Our conception of this process of cosmic equilibration, therefore, is limited to a conception of the equilibrations of the chemical elements, and thus we find our study is not capable of any treatment in terms of a general or abstract nature, but we are continually forced to a consideration of it as a complex concrete problem. The task before us is to deduce the universe as we now know it from some conception of an incandescent nebula composed of the chemical elements in certain quantities and distributions. To call these interactions by the general term equilibrations is not to effect any explanation. It may be of interest to know that mechanical, chemical, and other modes of energy are interchangeable, and we may think it adds to our knowledge to term these changes equilibrations; but the definite knowledge of any given change, evolution, or development must be knowledge of the relations of antecedent concretes, before it can take its place in any valid system.

The problem from beginning to end must be conceived of as a concrete inquiry and not as a problem of mere nomenclature of processes. We, however, still proceed with our inquiry in terms of equilibration, and would next study the various kinds of equilibration referred to by Mr. Spencer.

(*f.*) *Modes of Equilibration.*

Equilibration, of course, in principle is only of one kind, but for convenience sake it may be regarded as effectuating itself by various modes. Simple equilibration (sometimes called direct) is a term which may be applied to all interactions of energies, but is generally limited to those which terminate immediately and are not the beginning of a long series of changes. When a change is initiated in a complex set of conditions, the results are complex and set up long lines of change. Each little change in the series is a simple or direct equilibration, but viewed as a whole the process may be regarded as compound, complex, or indirect equilibration. These, however, are merely names given for our convenience, and do not indicate anything peculiar or varied in the modes of the process.

If we limit the use of the word Equilibration to the mechanical relations of masses, the term loses its general vagueness, and instead of being understood as co-extensive with causation in general, it becomes a term in the science of Mechanics. This science is usually divided into the three branches of Kinematics (Motion), Dynamics (Force), and Statics (Rest), the latter involving a theory of equilibrium. Whether all the processes of the universe, including the chemical, ethereal, electrical, and others, will ultimately be resolved in terms of mechanics is an open question; but until we are able so to deal with them we must hold the laws of mechanics as applicable only within the purview of that science. If we extend the use of the terms employed there into other sciences, we must understand that they do not carry with them the same meaning.

(*g.*) *Unstable Equilibrium.*

In mechanics equilibrium may be of three kinds. (1.) The body may be in such a position that if slightly displaced it tends to return to its original position, in which case the equilibrium is stable. (2.) Or it may tend to move farther away from its position, in which case the equilibrium is unstable. (3.) Or it may remain in its new position, in which case the equilibrium is neutral. A body when displaced assumes a position of unstable equilibrium in passing from one position of stable equilibrium into another. The potential energy or Energy of Position which a body in a given position possesses varies with its condition of equilibrium. In neutral equilibrium the potential energy is the same for all positions of the body. In stable equilibrium the potential energy is a minimum, in other words, the body is in the most unfavourable position for doing work; whilst in unstable equilibrium the potential energy is a maximum, and the application of the smallest force can at once convert this Energy of Position into Energy of Motion. A body in unstable equilibrium may be said, therefore, so far as its position is concerned, to be charged with the greatest amount of potential energy it can possess. *

The considerations herein involved are illustrated in books on mechanics by the relations of bodies, but it may be considered that they are applicable also to other cases of Energy of Position included in Professor Stewart's list—that is to say, to chemical separation, electrical separation, molecular separation, and so forth.

* Magnus, Lessons in Mechanics, p. 253.

(*h.*) *Moving Equilibria.*

In the preceding section we found it stated that a body when displaced assumes a position of unstable equilibrium in passing from one position of stable equilibrium to another. This is in truth an untenable proposition, for a state of unstable equilibrium is one of actual equilibrium, but one which is capable of being very easily disturbed. The body, in passing from one position of equilibrium to another, is never in a state of equilibrium, unless, indeed, a body in motion is to be regarded as at every moment of time successively in a state of equilibrium. In this case, everything at every instant is in a state of equilibrium, whether it be in rest or in motion, and all distinctiveness of meaning is lost. It is well to keep rigidly to the distinction between Equilibration, the process, and Equilibrium, the statical result. An equilibrium implies a balance of energy in place, exhibiting no motion. An equilibration is the process resultant upon the unequal relations of energies seeking an equality. The former implies rest, the latter implies motion. A difficulty certainly arises if we contemplate the final state of the cosmos as one of the universally diffused degraded energy of equal heat motion; but this is perhaps a merely speculative difficulty, to be got over by regarding the final state as one of uniform spatial relation, and need not practically be taken into account. An equilibration, in the widest sense, may be regarded as the passage from some state of Energy of Position through the state of Energy of Motion to another state of Energy of Position.

Our view of an equilibration is much affected by its relative length and simplicity. The fall of a body to the ground, the flow of a liquid, or an instantaneous chemical combination, affects our senses as a direct and simple equilibration. On the other hand, when we see a series of quick changes ending in a state of quiescence, the mind travels along the line of events, and regarding the beginning and the end, considers it as an indirect equilibration.

There is one class of equilibrations worthy of special study. If rotary motion be imparted to bodies of various configuration, with or without other relative motions, a complicated resulting process ensues. The body having this rotary motion may be placed upon the ground like a top, or projected through the air like a rifle-ball. Evidently we could produce illustrations, varying by insensible gradations from cases where the rotary motion terminated abruptly, up to cases where the rotary motion, having considerable initial energy and small amounts of resistance to overcome (like the Japanese spinning-top), might continue for a very considerable time. We direct attention to the latter case, and ask the question—Is it to be regarded as a process of equilibration, or are we to consider the top as in a state of equilibrium? We think there can be no doubt as to the reply: it is a case of protracted equilibration; it is absurd to call it a state of equilibrium. Yet the top is called, when in this condition, "a moving equilibrium." Now, these are terms of convenience which are quite justifiable when properly employed, but which, when extended to logically reasoned investigations of the unknown, are very dangerous; and as a large application is made of this term in Mr. Spencer's biological explanations, we would have it well understood.

Let us now pass on to another kind of rotation to which the same term is applied. It is that in which various bodies have related motions, forming altogether a complete system amongst themselves. The typical instance is that of the Solar System. Here we have quite a number of planets and asteroids circling round a central sun, with apparently inappreciable diminution of velocity; but the reasonings of astronomers lead them to predict a time when the motion of these bodies will be overcome by the resistance of the fine medium through which they pass, and all will be precipitated into the central mass. Evidently this also is a case of protracted equilibration, although it may be convenient in certain aspects to regard the solar system as a moving equilibrium. We do not know that this system is at all of a complicated character. The main movements of the members are so preponderatingly due to their initial motion and their relation to the sun, that their influence upon one another is quite a minimum, and the term system, if it implies complicated interrelationship of part with part, is almost inapplicable. The system, although to the eye possessing great complexity, is mechanically one of great simplicity. Nor does the fact of some of the members of the system having satellites affect our statement of the case.

There is another class of cases to which the term "moving equilibrium" is applied. It comprises all kinds of tools, machines, engines, or instruments designed and used by an intelligence for the intentional change of some kinds of energy into rearrangements of matter. The most conspicuous illustration is that of the steam-engine. The energy of position in the coal is transformed into energy of molecular separation of the water, which again finds a channel in the molar motion of the piston-rod, beam, wheels, &c., of the engine, and is finally expended in the production of some work. Altogether, this is a process of equilibration in the scientific sense of the term—but where is the equilibrium? To call an engine a "dependent moving equilibrium" may look scientific, but will not stand a moment's investigation. A "self-feeding" engine is in this respect to be regarded as identical with an ordinary engine.

The supposition has been advanced that "molecules," or perhaps more strictly "atoms," are systems of a construction something like the solar system, and are therefore "moving equilibria." This is a mere hypothesis, and all such suppositions are very difficult to work out to their extreme results. To do so we should have to decide whether they were merely protracted equilibrations or absolute moving equilibria. But to interpret chemical affinities, to explain the attractions of polarity, to understand the normal velocities of atoms, and to reason out the resulting combinations on the hypothesis of atoms as being either protracted equilibrations or absolute moving equilibria, transcends our knowledge and capacity at the present time.

(*i.*) *Equilibration and Structure.*

Yet Mr. Spencer undertakes to explain molecular structure by means of polarities and equilibrations. Are they more than mere words roughly symbolising some of the leading characteristics of the process, but very far from affording us a strictly scientific knowledge of each special formation? To know the mode of crystalloid aggregation, to be aware of polar attractions, to have discovered the laws of chemical combination, are great accessions to real knowledge from which we can reason; but we can only reason from the known factors and their known relationships. We are not justified in reasoning from general characteristics. We cannot satisfy the logical faculty by the lavish use of terms derived from actual physical processes but of unspecialised application.

There is no reason from analogy to suppose any similarity of structure between a chemical element and the solar system, but rather the reverse. The latter would undoubtedly lose its individuality if brought into union with another similar system, and could not be extracted thereafter from the intermixture; whereas an atom of a chemical element never loses its individuality, but can be separated and recovered from its various combinations. Therefore if it is a moving equilibrium it remains intact, and may practically be considered solely as operating according to its known modes, quite independently of the hypothesis of its being a moving equilibrium. Atoms as moving equilibria may be left out of account. Can the same be said of molecules?

With regard to crystalloid molecules, we have no reason to suppose that they aggregate otherwise than by mere attraction, the components being ranged by their polarities, and producing a general shape and structure resulting from the shapes and sizes of the constituents. With regard to colloidal molecules, the inquiry becomes more interesting and more obscure.

A moving equilibrium may be defined as a body or set of bodies having a maximum of motions in relation to itself or to each other, and a minimum of motions in relation to the environment, so that their initial mechanical energy is slowly expended in overcoming the slight resistances of the medium or the environment. We state it in purely mechanical terms, because we cannot imagine any other mode of stating a moving equilibrium which shall retain any special meaning. It accords with Mr. Spencer's examples, although he extends the application of the term equilibration so as to make its meaning identical with general causation.

If we begin with ammonia, NH_3, and replace one of the atoms of hydrogen by an atom of methyl, and produce methylamine, $N(CH_3H_2)$, what is the nature of the process? How are we to regard NH_3 in the first place? Is it simply an aggregate of atoms sticking together like small magnets, or is it a moving equilibrium composed of atoms having relative motions according to their bulk and velocities? Let us accept the latter supposition as more favourable to progress in the direction we wish. What must we suppose happens when an atom of hydrogen is extracted and its place is taken by an atom, or rather a molecule, of methyl? Granting this to be the removal of one member of a moving equilibrium and the introduction of others, we can only imagine that the system of motions has been readjusted according to the bulk and velocities of the new factor. Are we then to conceive of chemical combinations on the hypothesis of absolute permanent velocities of gases, and are we to regard the molecules formed from them as permanent moving equilibria which suffer no diminution of motion? There would in this case exist such things as absolute moving equilibria and not protracted equilibrations ending in a final equilibrium of dissolution. The theory of the absolute velocity of atoms and consequent absolute moving equilibria of molecules,—according to which each kind of chemical element in a gaseous condition has its characteristic velocity and perhaps mode of motion, which it never loses under any condition, and in virtue of which it enters into relation with other bodies,—contradicts all the recognised principles of mechanics and those processes of equilibration through which, according to the theory of the dissipation or degradation of energy, all motion eventually finds a dead level of equal distribution either in the form of energy of motion or equality of distance.

It would appear that an absolute moving equilibrium can have no relation to environment as such, for if it is thus, in relation it must lose energy and gravitate towards final equilibrium. Is there any reason to suppose that water is such a protracted equilibration, tending ever, but slowly, towards dissolution?

We think it is not so regarded. Yet if it were an absolute moving equilibrium it would not as such have any relation to the environment. We must therefore suppose that when part of it enters into combination with iron, this combination is effected otherwise than as the rearrangement of a moving equilibrium, more especially when such a recombination is selective in the throwing off, for instance, of the hydrogen and the preference for the oxygen. The explanation of preferential chemical affinities is to be sought rather in primary polarities than in the mechanical relations of moving equilibria.

Is there such a thing as the equilibration of polarities? That supposition is, we think, beyond the reach of conception. It escapes mental representation altogether. It would imply a quantitative equalisation of all attractions and repulsions, the despecialisation of all special affinities, and indeed of all the characteristics of the chemical elements.

Let us now return to a consideration of complex molecules as moving equilibria. Mr. Spencer speaks of their formation as "a change of the molecule into equilibrium with its environment." * In so using the term he cannot refer to the rearrangement of a moving equilibrium as above defined, but can only be employing it as a term connoting the quantitative aspect of qualitative causation. It is true he attempts to specialise it as "*an adaptation*, as it were, to new surrounding conditions;" but here he does not use the term "adaptation" in the biological sense we shall have to consider in the next section, but only in the sense by which every change whatsoever, chemical or physical or otherwise, may be termed an adaptation.

We have come to this point, then, that molecules however complex are not to be regarded as moving equilibria in the mechanical sense previously defined. They are to be regarded rather as specially arranged *positions* of atoms than as specially arranged *motions* of atoms, and are neither absolute moving equilibria nor protracted equilibrations subject to loss of energy and final dissolution.

If we can suppose the dissolution of complex molecules, not

* Biology, vol. i. p. 483.

from chemical attacks, but from their own expenditure of energy and final incoherence, how are we to imagine their original formation? It could not have been from their own resources, for that which formed them would hold them together. The hypothesis of the natural decay of molecules necessitates the supposition of a superior external agency in their formation, the influence of which restrains them for a period, and then, its coercive power being lost, allows the dissolution. But as there is no theory of the natural dissolution of molecules through failure of such internal energy, we must abandon the hypothesis of their being protracted equilibrations like the solar system. We have also found the theory of their being merely absolute moving equilibria untenable. Thus the purely mechanical theory of molecular relationship by which biological changes are effected in detail is found not to be true. We have now to see how it is sought to bring biological changes within the scope of mechanical laws, by means of the phenomena presented by "moving equilibria."

(*k.*) *The Motions of Moving Equilibria.*

We have two, possibly three, types of moving equilibria to consider, of which the spinning-top, the solar system, and the steam-engine may be taken as representatives.

A spinning-top has no parts moving in relation to one another, but is a single solid body, and even in its most eccentric motions these are all relative to other bodies, not to itself. When leaving the hand, it has two motions besides the rotary motion—one by which it travels a short distance from the operator, and a "wobbling" motion by which the plane of its axis inclines to one side or the other. The first motion is soon exhausted. The second motion is more slowly overcome until the rotary motion only prevails, and the top acquires the state of "sleeping." If the initial rotary motion is not great, while the thrust is great with a considerable declination, the top never acquires the steady rotary motion at all, and presently falls to the ground; whereas if care is taken to secure a minimum of these motions, the top will very speedily acquire the "sleeping" state, and will remain in motion a considerable time. It is an instance of protracted equilibration. The opposing forces are slight, the losses of motion slow. The principal point of interest in the matter is as to how the "wobbling" motion is overcome by the rotary motion and the language by which it is to be described. We think there can be no difficulty in ascribing the process to the class of cases in mechanics in which one powerful energy by sheer momentum nullifies a weaker opposite energy, and with slightly diminished or divergent force pursues its way. We do not think that there is any occasion to speak of counterbalance, of adaptation, or rearrangement. We find no such terms made use of in treatises on mechanics with regard to the case before us.

The next instance we shall take is that of the steam-engine. This case is extremely complicated in appearance but very simple in principle. A certain amount of Energy of Position is converted into an equivalent of Energy of Motion, which is either given off freely to the air and solid bodies in the form of molecular motion, or is reconverted into some other mode of Energy of Position or Energy of Motion. The engine itself has no motion except as the means of transfer. If its motions lasted a long time after receiving the energy, it would be a case of protracted equilibration; but that is not so. When the energy is removed, rest speedily ensues. The attainment of a state of rest is one of great simplicity. There is no complication in our thoughts as to counterbalancing, adaptation, and rearrangement of motion.

The case of the solar system requires greater consideration. Here we have quite a number of separate bodies, each with its own momentum and gravitative attraction towards each of the other members of the system. This is not a simple moving equilibrium like the spinning-top, but a complex one, and it leaves room for speculation. What, for instance, would happen were another planet to be introduced into the system? Startling as such a supposition might be, we make no doubt however that, given the size, momentum, and point of incidence of such a visitor, a mathematician would be able to calculate the amount and nature of the disturbance which it would set up within the system. The incoming mass might be as small as an asteroid, making no appreciable difference in the motions of the planetary system, or it might be of such magnitude as to destroy the general balance. But suppose a planet of medium size to be projected into the system—there would no doubt be some rearrangement of the motions of the various members till a normal rhythm was again attained. We believe the problem would be recognised as a purely mechanical one of the composition of motions. Possibly it would be fair to speak of such rearrangements as adaptations or counterbalances, but the terms would be understood in purely mechanical senses.

(*l.*) *Moving Equilibria—Waste and Repair.*

In the case of the spinning-top there is a loss of motion, but no loss of substance. In the case of the solar system there is again loss of motion, but no loss of substance. We do not know if this accords with the fundamental conception of waste. Of course there is no decrease in the quantity of energy in the cosmos, but each of these cases presents a local diminution of energy without loss of substance. Thus we may speak of waste of energy, but we apprehend the word "waste" usually implies loss of substance. Moving equilibria, so far as we are acquainted with them, are not subject to loss of substance, but only to diminution of motion. If a member of the solar system lost its motion, it would not be left behind or thrown out as waste; it would fall into the central sun, with results which it is not necessary to consider. Should, however, a member of the system be abstracted therefrom, there would be a rearrangement of mutual motions. Yet we cannot suppose for a moment that this missing planet would leave a hiatus which the system would endeavour to make good. The system would in its way be just as perfect and harmonious as before. It would not need repair nor seek completion of its former model. Thus a moving equilibrium does not imply loss of substance on the one hand, nor the replacement of lost substance on the other hand. The only meaning of a moving equilibrium is a continuous relative and rhythmic motion of bodies constituting a system of motions subject to constant, although perhaps inappreciable diminution, and thus subject to an eventual dissolution.

(*m.*) *The Evolution of Moving Equilibria.*

In Sub-section (*i.*) we considered the conception of atoms and the evolution of molecules as moving equilibria, resulting in an opinion adverse to that hypothesis. We have now to ask the student's attention to the evolution of systems of molecules as moving equilibria.

The radical weakness of all these speculations is that we know nothing whatever about the ultimate structure and motions of the chemical elements. This, in our judgment, is an absolute bar to all sound thinking from the *à priori* side. However far back we penetrate, we never get back far enough to reach the fundamental explanations; and if we begin our work at a later point, we find ourselves continually being thrown off at a tangent from the great cosmic circlings. Until we can penetrate to the very heart of the matter, no deductive reasonings will carry us far. If we enter upon such speculations, it is merely to show the futility of all such endeavours, including those of Mr. Spencer.

How, for instance, are we to set about the *à priori* study of the evolution of systems of molecules as moving equilibria? Are we to conceive of the completed result as a system similar to the solar system? And again, how are we to conceive of the molecules and of their aggregation? Are they brought together by polarity, and so arranged into certain forms of structure? Are we to suppose that in this concentration they acquire velocities which in the system they form result in relative rhythmic motions? and these motions, are they rotary, or those of mutual approach and retrocession? In all such cases there would be preliminary difficulties to settle as to the confinement of the term equilibration to the mechanical conception of the motions of bodies, or as to the enlargement of its application to the polarities of atoms and molecules. To disentange the conceptions of equilibrations of polarities is, however, beyond our powers of analysis. Another difficulty would lie in the conception of such a state of things as would allow the moving equilibrium of molecules any sensible time for its existence, so as to give it sufficient warrant in continuance to entitle it to be regarded as a protracted equilibration. It is supposed that the formation of a moving equilibrium of molecules could only take place in water of a certain temperature. But one would suppose that the friction and resistance of the water would very speedily subtract so much motion from the system as to lead to an almost immediate dissolution.

If we are to consider systems of molecules as moving equilibria from a purely mechanical point of view, there is no doubt of the above result. Can we then regard them from any other conceivable point of view? We cannot conceive of equilibrations of polarity otherwise than as the statical arrangement of structure involving the conception of relative position rather than the conception of relative rhythmic motion. Can we then form the latter conception out of any of the other energies of motion mentioned in Professor Stewart's list, such as molecular motion, electrical motion, ethereal motion, &c.? We fear we can form no conception of motion free from the mechanical limitations of body, momentum, velocity, and position.

If this difficulty attends the *à priori* synthesis of systems of molecules as moving equilibria, how much more difficult must be the synthesis of systems of systems of moving equilibria forming still more complicated moving equilibria?

Each fresh combination involves the double difficulty of considering the cause and nature of the combination. Is it merely segregation or simple polarity? Then what is segregation? Is it chemical affinity? Then what is chemical affinity? Is it polarity? Then what is the result of polarity beyond relative position? Is it mechanical equilibration? Then how are we to conceive of atoms and molecules and their correlations as purely mechanical relations? And when these systems of systems of moving equilibria are formed, how do they interact?

We ask all these questions, supposing them incapable of reply; but we do not forget that Mr. Spencer himself has given a hypothetical account of the evolution of such systems. Let us recur to it with the view of testing the deductive warrant and examining the language he makes use of in his reasonings.

We have to direct attention to the Appendix to vol. i. of the "Biology." The especial point to be kept in view in this account of the evolution of moving equilibria is not, as Mr. Spencer would imply, the growth of complexity and consequent susceptibility to change from the slightest alteration of incident forces. Nor is it the question how from the known chemical and physical properties of certain of the chemical elements the properties of their aggregations are to be deduced. In our previous criticism we animadverted upon the purely verbal process and verbal result. What we would now specially impress upon the student is that from first to last this process of reasoning should be carried on in terms of the conception of a mechanical moving equilibrium. We hold that any other special conception of equilibration is not possible, and the general conception of it as identical with universal causation is valueless as an instrument of definite thought.

The passage in question takes equilibration in this wide sense and altogether overlooks the treatment of the subject in the special mechanical sense. It is, therefore, ineffective in its explanations taken as preliminary to those subsequent higher combinations and events which are to be interpreted under the special aspect of moving equilibria. The second part of this Appendix deals with the evolution of physiological units, and is also characterised by the absence of any treatment of the subject in the terms of "moving equilibria" and by the constant introduction of "polarity." Here again the onus of the constructive process is thrown upon the known properties of the original chemical elements. The only special use made of the term equilibration is in the influence of parts upon parts in changes of the molecular condition of bodies. Otherwise it is employed in its universalistic sense.

(*n.*) *Moving Equilibria and Simple Equilibration.*

All direct physical actions, such as the fall of a body to the ground, the passage of a current of electricity, a chemical combination, &c., from one of Mr. Spencer's points of view, may be regarded as "simple" equilibrations. In what relation do they stand to "moving equilibria" if the latter exist in the shape of molecules or systems of molecules? How do simple equilibrations affect moving equilibria? or how do moving equilibria affect simple equilibrations? Do molecules or systems of molecules ever acquire such a characteristic corporate or co-ordinate existence as moving equilibria that they can nullify or coerce simple equilibrations; that is to say, render nugatory mere physical actions which are inimical to their own continuance? All these and many similar questions arise and require replies before the doctrine of complex molecules or systems thereof can be understood in the mechanical or any special sense as moving equilibria.

§ 9. *Mr. Spencer's Account of Equilibration.*

Mr. Spencer's account of equilibration is to be studied in "First Principles," Chapter XXII., and in vol. i. of "Principles of Biology," Part III., Chapters XI. and XII.

(*a.*) *The Equilibration of Motions.*

Mr. Spencer presents equilibration under the two forms indiscriminately of equilibration of motions and equilibration of forces. These are by no means identical, and the course pursued leads to confusion of thought and incoherence of argument. The primary concrete instances are rendered in terms of the former, whereas the reasoned extensions are all expressed in terms of the latter; besides which there is an implied reference to a method of equilibration in terms of the scientific doctrine of the equivalence of energies.

The simple mechanical equilibration of motion, by which an equal distribution of motion and an equal distribution of material substances is eventually attained, is identical with the doctrine of the dissipation of energy. According to this theory all the various forms of energy which from their heterogeneity of distribution are now capable of effecting work or change, constantly suffer degradation to a condition from which no work is to be obtained. There is a continued tendency to sink to a dead level of a uniform low state of molecular motion. The final outcome of this tendency would be a state of universal equal molecular motion from which no changes would ensue. Yet Mr. Spencer sometimes indicates that the end would be a state of universal quiescence, a state of the energy of position known as molecular separation rather than a state of energy of motion known as molecular motion.

"And if the actions observed be electrical or chemical, we still find that they work themselves out in producing sensible or insensible movements, that are dissipated as before, until quiescence is eventually reached." *

"Every motion being motion under resistance is continually suffering deductions; and these unceasing deductions finally result in the cessation of the motion." †

The consideration of the nature of this final state of things is, however, of no importance in our present inquiry.

The fundamental fault of Mr. Spencer's system of philosophy is its formal limitation to the terms Matter and Motion (the former having the mechanical meaning of resistance and extension only), whereas the actual elaboration of his constructive scheme is effected in terms of Forces. The formulas are all purely mechanical; the work done is very various. Thus if we are given a nebula to commence with, and treat it mechanically as having a tendency to equilibration of motion, we would naturally expect it to proceed directly upon a course of dissolution towards a state of homogeneity in equal distribution of matter and motion, even to the dissolution of the chemical constituents: instead of which we are met, firstly, by the instability of the homogeneous, which turns out to be change caused by external agencies, and, secondly, by segregation or changes caused by internal heterogeneity, which internal heterogeneity or want of balance is not expressible in terms of mechanics, but, setting the mechanical formula of equilibration at defiance, spontaneously initiates equilibrations of its own. These equilibrations are due to the specific gravity and affinities

* First Principles, p. 484.

† Ibid., pp. 484, 485. See also § 176 of "First Principles."

of the various constituents of the nebula, which quite overpower the merely mechanical redistributions of extension, resistance, and motion. How then shall we still say the ensuing general process is one of equilibration? Simply by calling the new classes of actions equilibrations also; and thus by a verbal ingenuity equilibration remains the ruling principle of the universe. Still it is not one process but two processes which are included under that name.

Mr. Spencer, in order to furnish us with an adequate conception of the process of equilibration, gives an account of its four different orders.* The first order includes the comparatively simple motions which, being quickly divided and subdivided into motions communicated to other portions of matter, are presently dissipated. The second order comprehends various kinds of vibration or oscillation exhibiting a visible rhythm which is soon lost in invisible rhythms. The third order obtains in those aggregates which continually expend as much motion as they receive, such as the steam-engine. The fourth order comprises all moving equilibria, such as the solar system, in which the resistance to motion being inappreciable, the equilibration is indefinitely protracted.

This account of equilibration, it will be seen, is purely mechanical. No reference whatever is made to those equilibrations of chemical affinity or polarity which do so much biological work, nor to the equilibrations of specific gravity, which with the chemical energies effect segregation both of colloid masses and crystalloid structures. All these, it is true, might be found to act mechanically in some fundamental science, but in the absence of such a science, or even with a correct conception of such a system of fundamental mechanics, it is clear that they do not act conformably to the idea of a mechanics of which the ruling principle is the equal distribution of resistances and motions.

(*b.*) *The Equilibration of Forces.*

The change of thought which is effected when, instead of speaking of equilibrations of motions, we speak of equilibrations

* First Principles, p. 487.

of forces, is very difficult to analyse. No doubt all the former changes can be conceived of vaguely as equilibrations of forces, since they are recognised as modes of energy in the scientific list; and modes of energy, in Mr. Spencer's phraseology, may be regarded as modes of force, and therefore we arrive at the notion of equilibrations of forces; but then, again, what may not be called forces? Thus equilibration loses all special meaning and becomes commensurate with universal causation. Mr. Spencer says—

"Every change is of necessity towards a balance of forces; and of necessity can never cease until a balance of forces is reached." *

"In all cases then, there is a progress toward equilibration. That universal co-existence of antagonist forces which, as we before saw, necessitates the universality of rhythm, and which, as we before saw, necessitates the decomposition of every force into divergent forces, at the same time necessitates the ultimate establishment of a balance." †

Taken in this sense, Equilibration is merely another name for the general interaction of factors resulting in a changed state. In this sense it is employed by Mr. Spencer under the term Simple Equilibration, and includes all the changes of one kind of energy in Professor Stewart's list into any other kind. It may be held to comprise all mechanical changes, all chemical or electrical processes, and to embrace all actions of heat and light. Nor can we exclude from it the processes of molecular construction and the action of what Mr. Spencer calls polarity, to whatever complexity and degree of mechanical sensitiveness we may in our studies arrive.

(c.) *Mr. Spencer's Interpretation of Moving Equilibria.*

The change of thought we have indicated is of peculiar interest when we come to consider the translation of mechanical moving equilibria into moving equilibria of forces. Of course mechanical motions among the members of a moving equilibrium may be regarded as forces; and the general constitution of this

* Biology, vol. i. p. 432. † First Principles, p. 484.

moving equilibrium may be described in terms of forces. Thereupon other things called forces may be substituted in the abstract statement, and new moving equilibria may be worked on the lines of the old ones.

The first thing is to render the mechanical moving equilibrium into abstract terms. The three concrete instances adduced by Mr. Spencer are the spinning-top, the solar system, and the steam-engine. We have already shown that the first is a very simple case of the mechanical relations of motions, and that the last is not a case of moving equilibrium at all. The case of the solar system is the purest case of all; and since it is an instance of a system of bodies having continuous relative motion, it affords the best concrete example for the object now in view. Mr. Spencer says of it:—

"For any system of bodies exhibiting, like those of the Solar System, a combination of balanced rhythms, has this peculiarity; —that though the constituents of the system have relative movements, the system as a whole has no movement. The centre of gravity of the entire group remains fixed. Whatever quantity of motion any member of it has in any direction, is from moment to moment counterbalanced by an equivalent motion in some other part of the group in an opposite direction; and so the aggregate matter of the group is in a state of rest. Whence it follows that the arrival at a state of moving equilibrium, is the disappearance of some movement which the aggregate had in relation to external things, and a continuance of those movements only which the different parts of the aggregate have in relation to each other." *

"This penultimate state of motion is the moving equilibrium; which, as we have seen, tends to arise in an aggregate having compound motions, as a transitional state on the way towards complete equilibrium. Throughout Evolution of all kinds, there is a continual approximation to, and more or less complete maintenance of, this moving equilibrium. As in the Solar System there has been established an independent moving equilibrium —an equilibrium such that the relative motions of the consti-

* First Principles, p. 488.

tuent parts are continually so counterbalanced by opposite motions, that the mean state of the whole aggregate never varies; so is it, though in a less distinct manner, with each form of dependent moving equilibrium." *

We do not here examine the various analogies suggested in continuation, as we wish to understand the working of the solar system first. Mr. Spencer proceeds to say:—

"And the fact which we have here particularly to observe, is, that as a corollary from the general law of equilibration above set forth, the evolution of every aggregate must go on until this *equilibrium mobile* is established; since, as we have seen, an excess of force which the aggregate possesses in any direction, must eventually be expended in overcoming resistances to change in that direction: leaving behind only those movements which compensate each other, and so form a moving equilibrium. Respecting the structural state simultaneously reached, it must obviously be one presenting an arrangement of forces that counterbalance all the forces to which the aggregate is subject. So long as there remains a residual force in any direction—be it excess of a force exerted by the aggregate on its environment, or of a force exercised by its environment on the aggregate—equilibrium does not exist; and therefore the redistribution of matter must continue. Whence it follows that the limit of heterogeneity towards which every aggregate progresses, is the formation of as many specialisations and combinations of parts, as there are specialised and combined forces to be met."

The question to be considered is whether this abstract statement is a correct representation of the history of the solar system, the only known instance of a mechanical moving equilibrium.

The first point concerns the evolution of the moving equilibrium. Mr. Spencer says that "the evolution of *every aggregate* must go on until this *equilibrium mobile* is established." Is it because "every equilibrium commonly regarded as absolute, is in one sense a moving equilibrium; because along with a motionless state of the whole there is always some relative

* First Principles, p. 489.

movement of its insensible parts"? Apparently Mr. Spencer means more than this, for this is the ultimate state, and he wishes to show that every aggregate must pass through the universal penultimate state of which the solar system is typical. This he endeavours to establish not *a posteriori*, but deductively. The reason he gives is: "Since, as we have seen, an excess of force which the aggregate possesses in any direction, must eventually be expended in overcoming resistances to change in that direction: leaving behind only those movements which compensate each other, and so form a moving equilibrium." We really cannot say that we understand the above passage. Is Mr. Spencer speaking of the solar system or of every aggregate? We are asked to conceive of "an excess of force." This excess of force cannot be that of molecular motion, nor light, nor chemical action, for the force spoken of is referred to as having a spatial direction, and it is expended in overcoming resistances to change again specified "in that direction"—giving the reasoning apparently a mechanical limitation. Moreover it is said to leave movements behind it, and these movements are compensatory of one another—thus establishing a moving equilibrium. We should be inclined to characterise this reasoning as a chaos of thought, without definite beginning, process, or result. The structural state reached simultaneously with this arrangement of motions must, Mr. Spencer says, "be one presenting an arrangement of forces that counterbalance all the forces to which the aggregate is subject." We will ask what are the forces to which the solar system is subject? The only force adduced by Mr. Spencer is the inappreciable resistance of the ethereal medium. We will, however, suppose it appreciable. What is the meaning of the solar system counterbalancing this force to which it would be thus subject? We presume the meaning of counterbalance is to render ineffective; the question therefore arises, Would the solar system alter its structure in order to render ineffective the increased resistance of the resisting medium? We cannot suppose any such thing.

Leaving the problem of the origin of moving equilibria unsolved, let us now take the case discussed in the chapter on "Direct Equilibration" in the "Biology."

"The case of the Solar System will best serve our purpose. An assemblage of bodies, each of which has its simple and compound motions, that severally alternate between two extremes, and the whole of which has its involved perturbations, that now increase and now decrease, is here presented to us. Suppose a new force were brought to bear on this moving equilibrium, say by the arrival of some wandering mass, or by an additional momentum given to one of the existing masses—what would be the result? If the strange body or the extra force were very large, it might so derange the entire system as to cause its collapse: by overthrow of its rhythmical movements, the moving equilibrium might rapidly be changed into a complete equilibrium. But what if the incident force, falling on the system from without, proved insufficient to overthrow it? There would then arise a set of perturbations which would, in the course of an enormous period, slowly work round into a modified moving equilibrium."

This statement will be accepted without question. It is a hypothesis in mechanics. The conception of the moving equilibrium is a mechanical one, and the conception of the incoming force must take the form of a mechanical one; and the result is expressed in terms of the rearrangement of the positions and motions of the members of the system. Can we make an abstract statement of this case in terms of modes of energy so as to comprise an account of a moving equilibrium of energy other than mechanical motion? It appears to us that failing a fundamental mechanical explanation of these modes of energy, such a task is impossible. The essentials of the statement are relative movements of bodies which form a system and have little if any relation with the environment. Again we fail to see that these rearrangements of position and motion can be spoken of as structural changes effected to counterbalance the incident force; they are only the direct result of that incident force.

Referring to the abstract statement that "so long as there remains a residual force in any direction, be it excess of a force exerted by the aggregate on its environment, or of a force exerted by its environment on the aggregate, equilibrium does not exist," we would ask, with reference to the solar system, what is its environment? Is it anything but interstellar ether? Is its excess of force molecular motion not possessed by the ether, and does the ether possess a force which it exerts on the aggregate nebula?

Mr. Spencer continues: "Whence it follows that the limit of heterogeneity towards which every aggregate progresses, is the formation of as many specialisations and combinations of parts as there are specialised and combined forces to be met."

In all these passages the thought sought to be evolved is that of *counterbalance*, with rearrangements of motion and position in order to effect it. In such a conception the idea of simple equilibration is lost sight of. The resulting rearrangements of the moving members of a system due in a most direct manner to an incident force, are regarded as counterbalancing that force; whereas the new force has really become an integral part of a new system. It has been amalgamated with it as a constituent. It does not nullify any amount of energy previously possessed by the system, but adds to it. There is no warrant for introducing the notion of any counteracting process or arrangement. The idea of oppositions, of attacks and defence, of a balance even against an intruding force, does not find place in the consideration of the case at all. But if the ensuing process is to be called by the names "adaptation," "adjustment," "counterbalance," &c., it must be on the distinct understanding that nothing more is meant than the calculable mechanical result of new dynamical relationships.

Mr. Spencer's conception of a moving equilibrium, in itself, and apart from the hypothesis of an external force impinging upon it, is that of a system of counterbalance. He says, "Whatever quantity of motion any member of it has in any direction, is from moment to moment counterbalanced by an equivalent motion in some other part of the group in an opposite direction." We do not know whether this description of the solar system is correct, but even supposing it to be so, any new incoming member would take its place in a similar manner to the others. There would be no general movement of opposition to it. It could not be treated as an object external to the system and its entrance resisted.

In one of the foregoing passages Mr. Spencer speaks of moving equilibrium as having a tendency to self-maintenance. Having the solar system in view as the typical case, let us examine the correctness of this theory. It is admitted that the solar system is a protracted equilibration. Are we to suppose that the solar system supplies itself with increasing energy to make good that which is expended in overcoming the resistance of the medium? Such a supposition cannot for a moment be entertained. Does Mr. Spencer mean, however, that it maintains itself, or could maintain itself, against any external attack? This cannot be, for he says:—"For the new motion given to the parts of a moving equilibrium by a disturbing force, must either be of such kind and amount that it cannot be dissipated before the pre-existing motions, in which case it brings the moving equilibrium to an end; or else it must be of such kind and amount that it can be dissipated before the pre-existing motions, in which case the moving equilibrium is re-established."* Thus if an attacking body should be relatively very large, or possess great momentum, the moving equilibrium would be destroyed, whereas if it should be relatively small, it would find its place as a member of a re-arranged system. To term the latter process a tendency to self-maintenance is merely a reference to the theory of the inertia of bodies.

Having now considered the nature of the only moving equilibrium of which we have any knowledge, let us next consider what is not included in it. It does not, for instance, as we have just seen, take any account of environment. In the first place, it has no environment to speak of. It does not seem to have any established "correspondence" with any other solar system; the only general relation it may have is that of movement round a common centre.

In the next place, beyond the faint mechanical connection just mentioned, it is not a member of a mutually dependent system. In this respect there is a distinct difference between a mechanical system and an organic system. Nor does it appear possible that the solar system could be brought into relatively

* First Principles, p. 516.

near contact with other similar systems so as to form an organic whole, and yet that each should maintain its separate existence. The only result that could be predicted would be a general destruction. This is to illustrate the difference between a mechanical moving equilibrium and the relations of atoms and molecules which can form chemical combinations without loss of individuality. Any attempt to treat chemical aggregations and processes upon the same theories as the equilibrations of the momenta—motions and mechanical aspects of bodies—must be a failure.

Again, we find in the solar system no reception of energy and no means for the storage of energy. Every individual change that can be imagined is one of simple and direct mechanical action.

Finally, we recur to the question how the conception of counterbalance, readjustment, &c., in the motions and positions of the bodies composing the solar system under a hypothetical incursion of a foreign body, is to be made applicable to any of the relations or changes of aggregates of the chemical elements under the conditions of Professor Stewart's list of energies. That these chemical substances act upon one another, and that they are affected in their relationships by heat, light, electricity, &c., is matter of ordinary knowledge; but their relations are altogether different from those of mass and velocity. Atoms and molecules are not related to each other as members of one unrelated revolving system, nor are they related to each other as one solar system would be to another in relative contiguity. There is a wide distinction between the purely mechanical relationships of the one and the "polarities," if such they are to be called, of the others. The theory and all the conceptions connected with "moving equilibria" are purely mechanical. The only common conception is that of quantitative relationship. If one mechanical force is relatively great, it will overcome the movements of another. If relatively weak, it will influence and finally balance with the movements of the other.

(*d.*) *Suggested Identical Interpretation of Organic Evolution.*

The foregoing considerations derive their importance from the fact that Mr. Spencer affiliates biologic evolution upon physical evolution by means of the laws of moving equilibria. We have given a very inadequate study of the ramifications of the argument as presented by Mr. Spencer, but we consider it wiser, on the whole, to afford the student a conception of the general position rather than to overwhelm him with a large bulk of detailed criticism. We now proceed to examine Mr. Spencer's interpretation of the origin and development of organisms. The question as to origin we shall postpone, on account of its obscurity, until we have fully considered the meaning of organisms as moving equilibria.

Organisms are regarded by Mr. Spencer as dependent moving equilibria. In this respect they are classed with the steam-engine which receives and expends energy. It cannot but be reckoned a very rough analogy, and we should be inclined to reject it altogether, for beyond the mere fact of receiving and expending energy there is nothing in common. Nor does the analogy play any important part in Mr. Spencer's argument. The specialty of the treatment is in the analogy with the protracted equilibration of the solar system.

"Now though instead of being, like the Solar System, in a state of *independent* moving equilibrium, an organism is in a state of *dependent* moving equilibrium ('First Principles,' § 130), yet this does not prevent the manifestation of the same law. Every animal daily obtains from without, a supply of force to replace the force which it expends; but this continual giving to its parts a new momentum, to make up for the momentum continually lost, does not interfere with the carrying on of actions and reactions like those just described. Here, as before, we have a definitely-arranged aggregate of parts, which we call organs, having their definitely-established actions and reactions, which we call functions. These rhythmical actions or functions, and the various compound rhythms resulting from their combinations, are in such adjustment as to balance the actions to which the organism is subject: there is a constant or periodic genesis of forces, which, in their kinds, amounts, and directions, suffice to antagonise the forces which the organism has constantly or periodically to bear." *

Here we have an attempt to establish an analogy between an organism and the solar system. We leave the question of the supply and expenditure of energy out of account, except in regard to the ascription of momentum. We think this is a proper term to apply to moving bodies, but an improper term to apply to chemical processes; and the use of it here is to be condemned as unwarrantably affording help to a verbal analogy which ought to be considered on its own merits. It is more to the point to consider whether the definite arrangement of parts called organs bears any analogy to the relations of members of the solar system, and whether their actions are related to each other like the relative motions of the sun and planets.

Evidently the organs of the body are not related to each other as the members of the solar system, for they are not separate, nor do they revolve round one another in free space. Nor is the method of equilibration the same, for in one case it is due to the slight resistance of the resisting ether, and in the other case it is due to the giving off of molecular motion and other forms of energy. It is difficult to say in general terms what the relations of the actions of the organs may be to each other, but they are certainly not the purely mechanical relations of the movements of the solar system. Is the analogy furthered by calling these actions of the organs "rhythms?" We fear not. Rhythm means a recurrence of action or position in a definite time. It is applied to vibrations, oscillations, revolutions, &c., all forms of the movements of bodies visible or insensible. Organic actions may have times of recurrence, but the main characteristic of an organ is the nature of the work done rather than its periodicity. The special function of the liver is to secrete bile rather than to act rhythmically. The latter term may be truly applied to the revolution of a planet, and its differ-

* Biology, vol. i. p. 433.

entiation from the movement of another planet may be explained in terms of rhythm; but the differentiation of the liver from the kidneys could not be so explained. If we take the case of an organism which is an accumulator of energy only and not an expender, if such should be the correct description of a plant, we do not see that the analogy is at all facilitated, for in this case we have the reverse of a protracted equilibration, such as is exemplified in the expenditure of energy by the Solar System. Nor do the parts of the plant hold similar relations to each other as do the bodies composing the Solar System.

The most suggestive point, however, is the alleged analogy between the mutual readjustments of motion in a solar system on the hypothetical intrusion of an invading body and the actions of an organism with regard to its environment. Where the analogy lies we are at a loss to discern. We have already seen that the solar system has practically no environment with which it is in relation except the retarding ether; and if we suppose a new body brought within the sphere of its influence, we find that it becomes part of a readjusted system and no longer remains an element of the environment. In fact, we do not think that the solar system, as such, ever could have an environment. It is not an organic whole capable of self-maintenance, and therefore every environment must become part of itself, its own individuality must be lost in the environment. But in an organism we find an entirely different characteristic, rendering analogies of action utterly impossible. An organism presents "a constant or periodic genesis of forces, which in their kinds, amounts, and directions suffice to antagonise the forces which the organism has constantly or periodically to bear." The solar system does nothing of the sort, nor under any conceivable circumstances would it ever do so.

The analogy is here left as we have rendered it, and further confirmation is sought in two ways only—Firstly, in *à priori* reasonings from the persistence of force, conducted in such a manner as to include in one and the same final statement the actions of solar systems and organisms :—Secondly, in a rendering of the histories and actions of organisms in terms of mechanics, in order to give the semblance of an analogy with the solar system, more especially by emphasising the supposed resemblance between the interior counterbalance possessed by the latter and the counterbalancing or antagonising of exterior forces by the former.

And first as to the *à priori* reasoning. It really appears to be a double process—one *à priori*, the other concrete. Thus, reasoning from the Persistence of Force never proceeds alone, but is always illustrated by some concrete matter or motion. We have terms of both combined in propositions, and we never know whether our thought is being pushed forward by the one or the other. The *à priori* reasoning showing the necessary origin of dependent and independent moving equilibria and the necessary condition of their conservation in self-maintenance is given from § 176 of "First Principles."

The postulate is, "Phenomena are interpretable only as results of universally co-existent forces of attraction and repulsion," these being "complementary aspects of that absolutely persistent force which is the ultimate datum of consciousness." The reasoned conclusion is that equilibration must proceed until equilibrium is reached. In this process of equilibration, moving equilibria must arise, because the motions of an aggregate are dissipated by the resistances they encounter, and these being brought to a close, others will continue longer. But Mr. Spencer does not show how moving equilibria necessarily arise; he begs the question, and continues by speaking of an unaccounted for "diversely moving aggregate," out of which arise dependent and independent moving equilibria, the latter of which may reasonably be held to apply to the solar system as evolved from the nebula, leaving the former, stated in mechanical terms, neither accounted for nor applicable to any concrete existence whatsoever.

We now approach the study of the special law which constitutes biological change.

Several kinds of equilibration contribute to biological evolution. We have already seen that all chemical, physical, and mechanical changes may be termed equilibrations; while all the processes in the growth of so-called organic molecules studied in the Appendix to "Biology," vol. i., as well as all methods of aggregation, selective or otherwise, all manufacturing of molecules, and all direct chemical and physical relations of the organism with its own constituents or with the environment are to be reckoned simple equilibrations. But as such they are not of any biological character or import. As the fundamental *material* for the construction and processes of the organism it is difficult to conceive of them as acting otherwise than according to the special proclivities of each atom or molecule; but the hypothesis is that such is not the case, for if it were, the origin and history of organisms would be one to be worked out from the relations of the chemical elements aggregated and influenced in a direct manner by the physical relations of the environment.

But this is not the theory. The theory is that these atoms and molecules are governed in their arrangements and movements by a higher power, namely, the balance of the organism as a whole. The nature of this governing principle we are now about to examine. It must first, however, be distinctly recognised that no change which is not thus influenced is a biological change, and that the special characteristic of biological action lies in this coercive influence together with the adaptation to the environment.

The question naturally suggests itself whether the development of organisms cannot be worked out completely by means of simple equilibration alone; and whether Mr. Spencer in his own detailed explanations of waste and repair, growth and consequent adaptation, does not in reality accomplish all that he does accomplish in this manner, rather than in the manner to which he more prominently calls our attention? On this we remark, that if biological explanations were left completely upon the ground of the simple equilibrations above specified, we do not think they would be effective; but a special work would have to be written on the lines of the deductive method and under these limitations, before we could be in a position to judge how far that might be the case. In all probability the attempt would prove ineffective, and we take it that Mr. Spencer so regards the question, since he supplements this simple scheme by the special theory of biological equilibration.

When referring, a little above, to the power of the organism regarded as a balance having an influence as such upon the simple equilibrations which perform the detailed constructive work, we proposed considering this theory independently of the view which regards this same balance as a balance with external forces. In this aspect the question for consideration would be—Is the organism, as a whole, a balance of forces of such sort that if one of its parts falls out of balance there is set up throughout the system on the one hand an endeavour to restore that part to due symmetry, or on the other hand a reduction of the whole system to the reduced proportions of the failing member, bearing in mind that this readjustment would itself have to be effected by means, after all, of simple equilibrations?

We do not think that such a theoretical balance could even be conceived. No doubt the interdependence of organs can be shown and to a very considerable extent explained; but from any *à priori* conception of the mechanical relations of balance we fear no biological deductions could be made. The fundamental notion of balance is equal relation. The tendency of a balance disturbed by any addition to or subtraction from its factors is towards a readjustment in accordance with the new proportionate distribution of forces, and is not towards a restoration of its former condition, to which it has no proclivity whatsoever.

From these considerations we perceive that the fundamental biological idea is not the restoration of a disturbed balance, but a readjustment of balance in accordance with the introduction of new factors. According to Mr. Spencer's illustration of the solar system, this adjustment is purely receptive and assimilative of the whole incident force. On the other hand, his account of the biological equilibration implies that the moving equilibrium seeks to secure self-maintenance by warding off the natural effects of the incident forces. It endeavours to receive from the environment only such forms of force as it can assimilate and expend in this contest for self-maintenance.

Here we find that the conception of counterbalance is not that referred to in the account of the solar system, where perturbations caused by the incoming of a new member would produce counterbalances of interior rearrangement by which the new member would find its place in the readjusted system; but it is the conception of a counterbalance by which the entry of incident forces into a system is met or combated,—antagonised in such a manner as to prevent their entry. And if such a principle be admitted in biology, there is no end to the changes which this counterbalance could effect.

We will first present the matter in its full aspect as given by Mr. Spencer, and then consider the position in which the argument stands.

Mr. Spencer says, in continuation of the quotation given on p. 344:—

"If then there exists this state of moving equilibrium among a definite set of internal actions exposed to a definite set of external actions, what must result if any of the external actions are changed? Of course there is no longer an equilibrium. Some force which the organism habitually generates, is too great or too small to balance some incident force; and there arises a residuary force exerted by the environment on the organism, or by the organism on the environment. This residuary force—this unbalanced force of necessity expends itself in producing some change of state in the organism. Acting directly on some organ and modifying its function, it indirectly modifies dependent functions, and remotely influences all the functions. As we have already seen (§§ 68, 69), if this new force is permanent, its effects must be gradually diffused throughout the entire system, until it has come to be equilibrated in working those structural rearrangements which produce an exactly counterbalancing force." *

The conception aimed at in this description is that of a moving equilibrium which combines the properties of the solar system and of the steam-engine. Are we to suppose that this combination produces unique results, or are the changes limited to the analogies of the solar system, the analogy of the steam-engine merely relating to the supply and expenditure of energy, while the actual changes are due to the properties of the former

* Biology, vol. i. p. 434.

system only? Or, on the other hand, do the steam-engine analogies assist the analogies of the solar system in effecting changes which the mere renewal of their energies alone would not accomplish? In these considerations we find ourselves endeavouring to form a mechanical conception perfectly unique and of a most complicated character,—a conception which finds no concrete representative except the organism itself, for which we are trying to put forth an abstract mechanical statement. We fail, in the first place, to apprehend an organism as a moving equilibrium either upon the model of the solar system or upon the model of the steam-engine; and we further fail to amalgamate the two in thought.

It is suggested that an incident force will act, not on the organism as a whole, but upon a particular part of it. Is there any reason to suppose that the incoming force would apply itself to the restoration of this part? In thus talking, we find our endeavour towards an abstract conception fail; for we cannot think of a part which is not a part of some whole,—in this case, of a mechanical moving equilibrium having other parts. Mr. Spencer says the moving equilibrium in question has "a definite set of internal actions," but he implies that it is an equilibrium, not as regards the balance of the internal set, but as regards its balance with "a definite set of external actions." We therefore have to consider what is meant by a moving equilibrium of forces, not only internally balanced, but also balanced with the environment. We can only take the meaning to be the negative one that such an equilibrium is not being interfered with, and so continues in existence. But this cannot be the meaning intended, because there is interaction. In this case the meaning can only be that the actions of the environment upon the moving equilibrium are not such as to destroy it. Are the actions then such as to become amalgamated with it? No; they tend—some of them at any rate—to destroy it. Their destructive action, however, is met or counterbalanced, so as to counteract their prejudicial influence. But whence comes this counteraction for the purpose of retaining continued existence on the part of the moving equilibrium? This property of organisms has no analogue in abstract mechanics. Mr. Spencer asks, "What must result if any of the external actions are changed? Of course there is no longer an equilibrium." Nor was there before in any true mechanical sense. There was a process of equilibration in the sense of general causation; there was an aggregate of connected equilibrations in progress. The connection of the interdependent equilibrations is affected by a change; still, there is no special tendency in a consensus of equilibrations to restore one of them, but simply to accept the direct results of the new action even to the extent of dissolution of all the connections. The conception of setting up a counterbalance for mutual protection is foreign to all mechanical theories and experiences. Mr. Spencer's explanation is given in terms of forces—"Some force which the organism habitually generates" . . . "is too great or too small" . . . "to balance some incident force." This is not the equilibration of general cause and effect, nor is it the equilibration of the reception and amalgamation of force, such as would be exhibited by the reception of a new member in the solar system, but it is an opposition to the incident force in order to antagonise its effects. We have the conception of a moving equilibrium composed of forces which balance incident forces of the environment. The balance is not merely an interior balance, but a balance with the exterior. If there is a new incident force, then there is a want of "balance," which the moving equilibrium forthwith proceeds to supply by a counteracting force.

It is quite clear that this is merely an attempt to represent the changes in an organism in mechanical language, under the belief that the mere employment of such language enables us to frame for ourselves a good mechanical conception, and thus renders organic evolution capable of affiliation upon physical evolution. We have to submit that there is no analogy whatever in any purely mechanical process or conception for the organic processes so described.

Can we further our object by endeavouring to form a conception of an equilibrium of forces? In these terms Mr. Spencer seems disposed to speak of an organism. Each organ may be regarded as a force, and the total as an equilibrium of forces. But how is it a moving equilibrium? Certainly not in the sense of mechanical relationship. Is it in the sense of the reception and expenditure of energy? But this is not the sense which would effect change of mutual relationships of balance. Then, again, the whole has to be regarded as in counterbalance to external forces. We must confess ourselves unable to form any conception in the description of which the abstract term "force" finds a place. The mutual equilibrium of an aggregate of forces, which itself is a counterbalance to an environment of forces, and which generates new forces in counteraction to new incident forces, is a formula incapable of conception, and incapable, too, of application to any concrete save that from which it was derived. Thus the method fails to effect any such general affiliation as would accomplish a genetic union with universal evolution.

We have purposely avoided making an inquiry as to the genesis of such an equilibrium of connected forces. If all molecules are to be regarded as forces, how do some of these become united so as to effect an internal equilibrium, and that a moving one? From what does it happen that, when so constituted, if the presumed circumstances in the environment which brought them together change, they should change not in correspondence but in antagonism? For the essence of biologic action is not the change of simple equilibration, but a change in antagonism to simple equilibration, in order to avert its destructive consequences.

But passing over this question of origin, Mr. Spencer proceeds to show how there has been continually going on "a rectification of the equilibrium" according to the alteration of surrounding circumstances, thus producing, by modification upon modification, structural and functional changes of great heterogeneity.

"Any fresh force brought to bear on an aggregate in a state of moving equilibrium, must do one of two things: it must either overthrow the moving equilibrium altogether, or it must alter without overthrowing it; and the alteration must end in the establishment of a new moving equilibrium." *

This is a good statement of abstract truth as applied to moving

* Biology, vol. i. p. 435.

equilibria like the solar system; but it is not applicable to a moving equilibrium which antagonises or counteracts the new force brought to bear upon it. It would appear that Mr. Spencer does not distinguish between the two cases, and the question arises, Does he mean any more by the phraseology indicating the latter than the facts belonging to the former? Yet we think he does clearly teach the theory of the self-protective balancings of a moving equilibrium, as distinct from and very often in resistance to the purely assimilative process of effecting equilibration.

This antagonistic tendency may be regarded as the specially characteristic feature of biologic change. Without it, the change is not biologic; with it, the change belongs to that class. It confers on an aggregate the coherence and continuity which constitute life. We have already seen that Mr. Spencer regards life as continuance of correspondence; but the correspondence intended is not the general correspondence which characterises all the direct relationships of an aggregate with its environment; it must be of the kind which is able to maintain such correspondences in spite of new incident forces tending to destroy it.

As we proceed with our studies this specially characteristic law of Biology becomes more and more pronounced, as thus:—

"Whence we found it to follow that the final structural arrangements must be such as will meet all the forces acting on the aggregate, by equivalent antagonistic forces. What is the implication in the case of organic aggregates, the equilibrium of which is a moving one? We have seen that the maintenance of such a moving equilibrium requires the habitual genesis of internal forces corresponding in number, directions, and amounts to the external incident forces—as many inner functions, single or combined, as there are single or combined outer actions to be met." *

All this reasoning, it will be noted, is on the supposition that the maintenance of the moving equilibrium "requires," &c. But what requires the maintenance of the moving equilibrium? We merely note this feature in the argument at present, reserv-

* First Principles, p. 501.

ing for separate treatment the use which Mr. Spencer makes of the necessity for the maintenance of organisms and of species.

(*e.*) *Statement of the Argument.*

Let us now review the position of the argument. Our object is the unification of knowledge, and we seek to accomplish this object by a process of reconstruction from the supposed contents and conditions of the primordial nebula. This is a deductive process, and it has to be carried on from our knowledge of the properties of the constituent factors, and of the general laws of their interrelation.

The evolution of organisms by gradual change in the manner taught by Mr. Darwin we accept on *à posteriori* grounds. This advance in heterogeneity, this growth of modification upon modification by gradual and natural response to change of environment, is acknowledged; and since these organisms are composed of some of the chemical elements, and are surrounded by others, we cannot doubt that ordinary laws of physical and chemical action prevail among them, and help so far to affiliate them upon preceding inorganic evolution.

But there are many things that cannot be explained; for if the modes of development are *à posteriori* understood on the supposition of original undifferentiated organic matter, still the origination of such organic matter having the specially characteristic biologic function is unexplainable either *à priori* or *à posteriori*. How did it ever happen that a moving equilibrium having the tendency to oppose new arrangements in order to antagonise the destructive influence of external forces first came into existence? To this question no answer can be found. The finding of moving equilibria which receive and assimilate incident forces is not the slightest assistance to us in understanding the origin of moving equilibria which resist the reception of incident forces. A still greater difficulty arises when amongst the interior forces thus generated in the organism is that of feeling and consciousness.

It will thus be seen that our quarrel is not with Evolution as set forth in Mr. Darwin's truly scientific teachings, as far as they go. We accept these on the understanding that they do not pretend to explain the origin of life nor the affiliation of organic upon inorganic existence. Our contention is that Mr. Spencer's attempt to accomplish this latter object has not succeeded.

(*f.*) *The Origin and Maintenance of Moving Equilibria.*

Mr. Spencer nowhere gives us a satisfactory account of the *à priori* necessity for moving equilibria. Nor does he attempt to explain their origin out of the chemical elements. It is true, in the Appendix to vol. i. of the "Biology," he gives a hypothetical account of the genesis of organic molecules, but he only deals with them as regards their attainment of a high degree of complexity, great modifiability, and extreme sensitiveness to change, which cause them to manifest more and more those characteristics that we call vital; he never treats of them as regards their attainment of the special characteristic of biologic function just elaborated. Evidently it was his duty to consider their constitution as moving equilibria before he could apply to them the term "organic," and to have shown how they or the primitive body which several of them might form became a moving equilibrium. He should have shown why the circumstances which formed them did not enable them to retain the individuality so reached; and why, on the contrary, this continuance of individuality entailed an expenditure of force requiring constant renewal. All this should have been set forth in explanation of their origin as moving equilibria before he began to treat of those counterbalances with the forces of the environment which constitute biology proper.

It must be clearly understood, therefore, that in all our subsequent investigations we take the origin of moving equilibria for granted, and continue our studies with the full consciousness of this great initial hiatus between inorganic and organic evolution.

We must also take for granted the *à priori* necessity for the maintenance of moving equilibria, whether the conviction of this necessity be derived from a consideration of their constitution or furnished by our own minds. For our part, we think the essential idea of a moving equilibrium involves the continual expenditure of energy, and therefore its tendency is not towards self-maintenance but the reverse. Nevertheless, if there were no necessity for the continued individuality of a moving equilibrium there would be no necessity for antagonising those external forces which are detrimental to its existence.

Properly speaking, we ought to enlarge our conception of the biologic problem by admitting the complementary process of adaptation for the assimilation of such forces in the environment as would assist in the maintenance of the equilibrium, thus initiating changes of structure to this end. We do not understand, since this is one of the main features of biologic change, why Mr. Spencer has not brought it forward in full prominence for *à priori* interpretation. It may be that he regards the assimilation of forces tending to the continuance of the moving equilibrium as coming within the scope of simple equilibration; but then it appears to us that organisms show adaptations for the reception and assimilation of favourable forces quite as much as they exhibit arrangements to guard them from the effects of destructive forces. And since many of the external forces may be regarded as either favourable or unfavourable to the maintenance of moving equilibria according to their varying amounts, the question of the balance to secure an adequate quantity and to guard against a destructive excess becomes a complex one. But regarding the problem in the abstract, can we at all conceive of a moving equilibrium of bodies, or of forces, of such a nature that it not only so arranges itself as to counterbalance incident forces which imperil its continuance, but accommodates itself in the manner of balance or counterbalance to incident forces which favour its continuance? Such a suggestion is inconceivable. We cannot conceive of a solar system which adapts itself to receive motion, nor of an equilibrium of forces expending force in rearrangements for securing a commensurate reception of force. The thought is altogether foreign to the idea of the balance of forces. We can find no concrete instance whatever which throws any light upon such a conception. If we consider the steam-engine as a case in point, the steam-engine is but an inert mass of metal, incapable of any adaptation either for the reception of force or for warding off injurious attacks.

Therefore if we find in Biology structural arrangements as well for securing forces favourable to the maintenance of the moving equilibrium as for protective purposes, we must understand that the *à priori* explanation is to be sought in other ways than by an abstract theory of balances and counterbalances.

(*g*.) *General Survey of the Counterbalances.*

In order to attain a general conception of Biology, considered as a system of counterbalances to external forces, let us now briefly review the list of forces presented to us by Mr. Spencer in his works as effecting those antagonisms of structure and function which we desire to have explained.

As indicated in the preceding sub-section, the study is not by any means a simple one, for organisms have had to adjust themselves to the presence or absence, the excess or defect of various forces. Now, viewing the biologic function as a counterbalance to an external incident force, it is not possible to conceive of a counterbalance to a force which is not present and in action. Yet Mr. Spencer proposes to overcome this difficulty by regarding the negations themselves as forces. The absence of a force is a force which has to be counterbalanced. As in old times cold was classed in the same category as heat, so Mr. Spencer regards cold as a force which has to be counterbalanced by changes of structure and habit. Doubtless Mr. Spencer veils this representation under the form of "changed conditions," necessitating change of structure; but on the special biologic theory of counterbalance, the force in this instance is decreased molecular motion. As a counterbalance to this "force" we find a great variety of rearrangements of organisms. The thickening of the fur of some animals on the approach of winter is a case in point. Absence of food, again, is thus transformed from the negative aspect into a positive force, which has to be counterbalanced in the organism by structural arrangements to secure food. Hence the necessity for counterbalances of locomotion to search for, and counterbalances of appliances to secure and assimilate, the forces necessary to maintain the moving equilibrium. If the absence of water is a force, is there not the counterbalancing cistern of the great desert tortoise?

It may be that the changes in organisms produced by absence of heat, absence of food, absence of enemies, &c., may all be explainable in various ways; but we think that, considered as a method of logical explanation, it is not *à priori* correct to say that these changes are counterbalances to the presence or absence of external forces in relation to a moving equilibrium.

Another curious exigency of the argument is the counterbalancing by an organism of a *future* force. This future force itself may be either of a positive or of a negative kind. Thus the thickening of the fur on the approach of winter is anticipatory to change of temperature rather than occurring in direct response to such change; and various animals counterbalance by anticipation the force of absence of food by laying up stores of provender to secure their existence during the inclemencies of winter. Cases of precautionary counterbalance are also to be found in the means taken for the protection of the embryo and the young animal. The shell of an egg is a counterbalance to future external mechanical forces. In all the apparatus for self-defence we find the same principle to prevail. In those floral defences by which plants protect their pollen from the incursions of the wrong insects we also notice a counterbalance to an anticipated external incident force. The wonderful variety of methods by which seeds are protected exhibit the same remarkable prevision of counterbalance.

It is not to be denied that all these are cases of equilibration in the sense of equivalence of relation, and presumably they are cases of that biological counterbalance which Mr. Spencer is at such pains to explain; but since it is evident that the principle of a moving equilibrium adjusting itself to forces not in actual relation, but only going to be, cannot be maintained, we shall have to search for some other explanation of these adaptations.

A third difficulty occurs in regard to the evolution of Feeling and Consciousness. According to Mr. Spencer's biological theory these must arise in the organism as counterbalances to the forces of the environment. Their *raison d'être* lies in the preservation of the moving equilibrium, ostensibly by way of a counterbalancing force acting against some force detrimental to its continuance, but also, in a wider view, to assist in the assimilation of forces which will aid this continuance.

Various corollaries result from this. In the first place, it follows that feeling and consciousness are not merely concomitants of physical change, but that, as feelings and consciousness, they take an active part in the counterbalances of Biology. If the merely mechanical arrangements of nerves and their motions were sufficient to provide this counterbalance, they alone, according to the theory, would have been evolved without any concomitance of a subjective aspect. But since the subjective aspect has been evolved over and above the physical arrangements, all the feelings which animals possess must have been essential in the *consensus* of antagonistic forces which did battle for existence with the environment. They are not merely lookers-on in the strife, but active agencies. For if feelings as feelings were not essential in the activity of the organism, then the biologic work, either of the protective character or of the assimilative, would be done by physical arrangements without the accompaniment of feeling. This we judge to be the case, both from the fundamental conception of the moving equilibrium derived from the solar system and steam-engine, and from the actual facts of biology. In organisms we find that feeling only accompanies those actions which are directly related to changes of the environment, whereas much work is done by organs in an unconscious manner. The difference existing between the conscious and the unconscious actions of organism is only explainable by the theory under consideration, on the ground of the concomitant consciousness of the former being an essential and actual factor in the counterbalances which the organism presents to the external world.

This, again, implies the possible conversion of physical energies into modes of feeling, and the possible conversion of feeling into modes of muscular action.

Thus we are forced to the conclusion that feeling and consciousness have been actual factors in biological evolution; that any account of this evolution which omits these as factors and explains its developments by merely physical interrelations must be conspicuously deficient.

(*h.*) *Feeling and Consciousness as External Forces.*

Reserving the full consideration of the theme broached in the last subsection, let us next consider the recognition, in the structure of plants and animals, of feeling and consciousness as forces in their environment. We wish to inquire whether in their adaptations to the external world organisms exhibit not merely counterbalances to physical forces, but also adaptations which clearly imply a recognition of feeling as such in the environing organisms.

Take the sense of smell to commence with. The skunk, when pursued by an enemy, projects upon him a most offensive fluid. This is evidently a means of defence. Is the action to be interpreted by the mechanical or chemical operation of the juice upon the nervous system of the enemy, through which certain molecular changes are set up, eventuating in motions of retreat? Or are we to suppose that the subjective sensation is essential to the result? In accordance with the argument contained in the preceding sub-section, the subjective feeling is an active factor in such a case, and is recognised in the structure and functions of the skunk.

So, also, there are some plants and animals which derive their protection from bitterness of taste.

On the other hand, many plants and insects display in their structure and functions a recognition of external sentiency to attractive tastes and odours. The flowers which provide feasts of honey for the bee and moth and butterfly seem to imply an acknowledgment of the subjective. The sweet scents which pervade the summer air surely have more than a mechanical effect, and indicate the relations of the floral world to the olfactory sensations of the animal environment.

But by far the most important instance of the recognition of external sentiency registered in the structure and functions of organisms refers to the sense of sight. Whence all the bright hues of flowers but for the sentiency of the insect retina? The same relation seems to hold between the colours of fruits and the eyes of birds. The glorious plumage displayed by the latter bears reference often to the appreciative taste of the opposite sex. Sometimes, however, the colourings of the bird may be of a protective character; and this introduces us to the wonderful and interesting study of mimicry.

The whole *rationale* of animal mimicry, both of form and colour, is to be found in the recognition by organic structures of the subjective sense of sight on the part of surrounding animals, together with the recognition of the colour and forms of the inanimate surroundings. In response or counterbalance to these forces of the environment, and more especially to the fact of the presence of enemies having the sense of sight, fishes adjust their colourings to the adjacent masses, moths and other animals make themselves indistinguishable from the rocks and walls upon which they rest, and the stick and leaf insects, both in form and colour, simulate the refuse of the forest.

We cannot, however, here do more than briefly indicate the nature of an argument which might be amplified to almost any extent.

If it can be made out that all these instances of natural adaptation on the part of animals and plants are explicable simply as the direct results of motions in ether, or air, or of other physical properties of the environment acting upon a mechanical nervous system, our suggestion fails; but we think these arrangements all imply not only a subjective counterbalancing force, but also a recognition of feeling as an external or objective factor over and above the physical interrelation, more particularly when taken in connection with the argument of the preceding sub-section.

(*i.*) *Feeling and Consciousness as Counterbalance.*

In § 174 of "First Principles" Mr. Spencer undertakes to explain the equilibrations of nervous actions. But it will be found that the phenomena there explained are not the equilibrations by which the nervous system attains its structure as a counterbalance to external destructive forces, but those mechanical equilibrations by which motions are dissipated and brought to a close. This idea receives a changed import in an account of the daily rhythms by which the force expended during the period of mental activity is compensated by forces renewed during the state of rest. The argument proceeds by pointing out how to all external associations there arise answering internal associations, showing a progress towards equilibrium between the relations of thought and the relations of things. It is pursued further by showing the attainment of moral and social equilibrium. But it is evident that these processes of equilibration are not identical with the biological equilibration which finds the genesis of structural and functional arrangements in the fact that these are counterbalances to external destructive forces. It is indeed merely the verbal process of representing all correspondences and all social relations as equilibrations.

Mr. Spencer anticipates one objection to his exposition, but in reality there are two. The first objection is that the physical structure of the nervous system is not explained upon the special biological principle. To this he does not reply. But, considered strictly as a physical arrangement of material molecules, and as a moving equilibrium having a varied *entourage* of forces, we hold that the nervous system is not shown to be the outcome of that biological law by which structure originates as a force in counterbalance to an external force, which it proceeds to antagonise.

The second objection, and the one to which Mr. Spencer replies, is that the explanation he affords is purely materialistic, and does not account for the subjective concomitant. The reply, however, is exceedingly defective. It is based upon the "double-aspect" theory. What we know objectively as modes of force we know subjectively as states of consciousness; "so much feeling is the correlate of so much motion;" "the performance of any bodily action is the transformation of a certain amount of feeling into its equivalent amount of motion." The latter sentence, indeed, implies the mutual transformation of feeling and motion—a doctrine altogether different from the "double-aspect" theory. The final statement is—

"And thus the ultimate state, forming the limit towards which Evolution carries us, is one in which the kinds and quantities of mental" (*query—subjective?*) "energy daily generated and transformed into motions, are equivalent to, or in equilibrium with, the various orders and degrees of surrounding forces which antagonise such motions." *

This passage tends to confirm the supposition that in Mr. Spencer's opinion modes of physical energy can be transformed into feeling and retransformed into modes of physical energy, having in these transformations quantitative relations. They are thus able to take their places as active agencies in the biological counterbalance, by which preservative forces are assimilated, or by which destructive forces are antagonised. And if so accepted, they must be recognised as active agencies in the biological development.

On no other view can their existence be accounted for and justified. On reviewing the organic arrangements, we find that some of the work done by the organism is of such a character as not to require the accompaniment of subjective sensation. Accordingly, the necessary physiological processes are automatic. The liver, the spleen, the kidneys perform their normal functions without the accompaniment of feeling, which, indeed, would be detrimental to the general balance; but we find that these organs and others manifest pain when the normal functions are not properly performed, thus exhibiting an active agency of the subjective kind when requisite for the safety of the organism. Apparently the merely physical arrangements of the eye, ear, nose, mouth, and fingers would not be able to do their work in this automatic mechanical manner. They seem positively to require differentiated modes of feeling over and above the currents of the nerves, by which a *consensus* of physical action is secured. Thus feelings and special modes of feeling *as feelings* are proved to be factors in biological action. The biological explanatory view implies their place as forces in action, as counterbalances to incident external forces, which would otherwise tend to destroy the moving equilibria of

* First Principles, p. 507.

which they form a part. The theory which regards them merely as a secondary aspect of physiological events which they have no power to influence, is insufficient to satisfy the biological law of the moving equilibrium, which necessitates the supposition that each fact in the organism is a potent acting force.

It is worth while to consider the position of those who hold the "double-aspect" theory in regard to the argument we are here pursuing. It is held by them that the subjective aspect is not "secondary" but complementary. The answer to this is that that aspect in which the relations of sequences present themselves, and by means of which the order of sequences is to be described and actually calculated as hypothetically conceived, must be regarded as primary; and a second aspect, if any, which is merely concomitant, and which does not disclose the order of sequences, must be secondary or dependent, whether the nature of that dependence is known or not. A complementary aspect can only be one which is necessary in the order of the sequences, and without which that order would be incomplete. But if it is shown that a development is completely explainable by a physical process, the concomitant subjective is not complementary. Thus, when biological development is held to be explainable in the same way that chemistry or the solar system is explainable, it is a purely physical explanation. And, again, when all the developments and differentiations of organisms are held to be explainable as counterbalances by which active factors of the organism are set up in antagonism to external forces, those feelings which we find to exist in organisms are bound to be considered as amongst those factors, not merely as concomitants, but as essential factors in the biological balance. This can only be done by co-relating them quantitatively with physical transformations, as Mr. Spencer has done, yet without thinking it necessary to explain the process.

But should Mr. Spencer go further, and say that the subjective aspect is primary—is the one thing known—the objective being inferential, then the explanation he proposes in the "Biology"—as being from certain chemical factors and certain external physical factors acting under the laws of moving equilibria in general—is propounded in the wrong language, and necessitates a theory of universal subjectivity co-extensive with the objective, so as to show that subjectivity does not appear by accident in a few organisms. But this Mr. Spencer does not attempt, and in it Professor Clifford has failed. All we are concerned with, however, at the present time, is to show how, according to the principles of the biological theory under review, all the facts of the organism are to be regarded as "forces" wrought out in the organism in antagonism to forces of the environment which they counterbalance, and that the "feelings" of organisms and their functions must so be ranged. They are thus brought into the circle of the modes of energy, which are not aspects of each other, but separate and mutually transformable modes of energy. Thus "feelings" are established as active factors in biology, this being their only *raison d'être.*

In § 168 of the "Biology" we find it stated of Indirect Equilibrations—

"It is scarcely possible too much to emphasise the conclusion, that all these processes by which organisms are refitted to their ever-changing environments, must be equilibrations of one kind or other. As authority for this conclusion, we have not simply the universal truth that change of every order is towards equilibrium; but we have also the truth which holds throughout the organic world, that life itself is the maintenance of a moving equilibrium between inner and outer actions — the continuous adjustment of internal relations to external relations; or the maintenance of a correspondence between the forces to which an organism is subject and the forces which it evolves. For, if the preservation of life is the preservation of such a moving equilibrium, it becomes a corollary that those changes which enable a species to live under altered conditions are changes towards equilibrium with the altered conditions." *

What these Indirect Equilibrations are we shall hereafter consider. At present we simply note the import of the above

* Principles of Biology, vol. i. p. 462.

passage in regard to the origin and place of feelings in the maintenance of the moving equilibria in which they occur, which is a vindication of their nature as acting factors over and above the physical organisation.

We now direct the attention of our readers to the chapter on "Pleasures and Pains" in vol. i. of the "Psychology," in which what we may by analogy term the functions of pleasure and pain are exhibited.

"§ 124. Let us first glance at the fact, sufficiently obvious and sufficiently significant, that the extreme states, positive and negative, along with which pains occur, are states inconsistent with that due balance of the functions constituting health; whereas that medium state along with which pleasure occurs, is consistent with, or rather is demanded by, this due balance. This we may see *à priori.* In a mutually dependent set of organs having a *consensus* of functions, the very existence of a special organ having its special function, implies that the absence of its function must cause disturbance of the *consensus;* implies, too, that its function may be raised to an excess, which must cause disturbance of the *consensus;* implies, therefore, that maintenance of the *consensus* goes along with a medium degree of the function. The *à priori* inference involved, that these medium actions productive of pleasure must be beneficial, and the extreme actions productive of pain detrimental, is abundantly confirmed *à posteriori* where the actions are of all-essential kinds." *

Thus we find that pains are the correlatives of actions injurious to the organism, while pleasures are the correlatives of actions conducive to its welfare.†

It is a corollary from this that the seeking of pleasures as such, and the avoidance of pains as such, have jointly tended to the maintenance of the moving equilibrium of organisms, and that they have therefore, *as feelings,* performed a very active part in the evolution of organisms, and in their structural and functional development. Spoken of in the abstract language of force

* Principles of Psychology, vol. i. p. 278.
† Ibid., p. 279.

or forces, they may therefore be regarded as taking part in the equilibrations of forces in the system of which they form a portion, and as affecting the actions of that whole, considered as an unit in its immediate environment and as an unit in an organised society. And thus they might be considered to fall into the general equilibrations of evolution at large, as well as to maintain their special characteristic as forces in a moving equilibrium antagonising destructive forces in the environment.

§ 10. *Mr. Spencer's scheme of biological reconstruction considered as the outcome of the laws of the moving equilibrium.*

We have now to witness the conversion of the abstract process into a concrete one. The abstract model was arrived at by an induction from the concrete instances of the solar system and the spinning-top, which are mechanical moving equilibria; and its formulation was effected by the substitution of forces for the separate members or motions of these systems. It is supposed that the conception of mutual mechanical movement is retained in this substituted idea because the mutual relation of forces implies mutual motion of some sort, and so implies a moving equilibrium. To this has to be joined the notion of the reception and expenditure of force, derived from the case of the steam-engine. The analogy of the counterbalance of opposite movements in the solar system is translated into a conception of counterbalancing forces, or of the generation of forces which shall antagonise external forces. Thus we reach at last the fanciful conception of a self-sustaining moving equilibrium, which adapts itself in a twofold way: firstly, by assimilating favourable forces, and, secondly, by generating forces which counterbalance any destructive forces of its environment.

This conception is supposed to be one derived from a study of the physical universe; and if by its means biological development can be explained, it is supposed that the latter is shown to be a mere continuation of the former, without any change of methods or introduction of new factors. Into this abstract mould the concrete processes of biology have now to be run.

The ideal outline has to be filled in with actual biological developments.

Whether the preliminary methods by which this conception is arrived at are justifiable or not we have just considered. We must, however, ask the reader to consider it as established for the sake of continuing the argument, and with the view of further considering its applicability—a task upon which we are now about to enter.

The course of our studies brings us to the account given by Mr. Spencer in the second volume of the "Biology" of morphological development and physiological development, with the view of ascertaining what part is played in these processes, not by that equilibration in general which is simply another name for the direct and free action of bodies upon each other in accordance with the natural relations of their properties, but by that special kind of biological equilibration which we have been considering, and without which no event can be classed as included in the science of Biology.

"The problems of Morphology fall into two distinct classes, answering respectively to the two leading aspects of Evolution. In things which evolve there go on two processes—increase of mass and increase of structure." *

"The task before us is to trace throughout these phenomena the process of evolution; and to show how, as displayed in them, it conforms to those first principles which evolution in general conforms to. Two sets of factors have to be taken into account. Let us look at them.

"The factors of the first class are those which tend directly to change an organic aggregate, in common with every other aggregate, from that more simple form which is not in equilibrium with incident forces, to that more complex form which is in equilibrium with them. We have to mark how, in correspondence with the universal law that the uniform lapses into the multiform, and the less multiform into the more multiform, the parts of each organism are ever becoming further differentiated; and we have to trace the varying relations to incident forces,

* Principles of Biology, vol. ii. p. 4.

by which further differentiations are entailed. We have to observe, too, how each primary modification of structure, induced by an altered distribution of forces, becomes a parent of secondary modifications; how, through the necessary multiplication of effects, change of form in one part brings about changes of form in other parts. And then we have also to note the metamorphoses constantly being induced by the process of segregation—by the gradual union of like parts exposed to like forces, and the gradual separation of like parts exposed to unlike forces.

"The factors of the second class, which we have kept in view throughout our interpretations, are the formative tendencies of organisms themselves—the proclivities inherited by them from antecedent organisms, and which past processes of evolution have bequeathed. We have seen it to be a necessary inference from various orders of facts (§§ 65, 84, 97) that organisms are built up of certain highly complex molecules, which we distinguished as physiological units—each kind of organism being built up of physiological units peculiar to itself. We found ourselves obliged to recognise in these physiological units powers of arranging themselves into the forms of the organisms to which they belong, analogous to the powers which the molecules of inorganic substances have of aggregating into specific crystalline forms. We have consequently to regard this polarity of the physiological units as producing, during the development of any organism, a combination of internal forces that expend themselves in working out a structure in equilibrium with the forces to which ancestral organisms were exposed; but not in equilibrium with the forces to which the existing organism is exposed if the environment has been changed. Hence the problem in all cases is to ascertain the resultant of internal organising forces tending to reproduce the ancestral form, and external modifying forces tending to cause deviations from that form.

"Moreover, we have to take into account, not only the characters of immediately preceding ancestors, but also those of their ancestors, and ancestors of all degrees of remoteness. Setting out with rudimentary types, we have to consider how, in each successive stage of evolution, the structures acquired during previous stages have been obscured by further integrations and further differentiations; or, conversely, how the lineaments of primitive organisms have all along continued to manifest themselves under the superposed modifications." *

In the Summary of Morphological Development we find—

"And here, indeed, we may see clearly that these truths are corollaries from that ultimate truth to which all phenomena of evolution are referable. It is an inevitable deduction from the persistence of force, that organic forms which have been progressively evolved must present just these fundamental traits of form which we find them present. It cannot but be that, during the intercourse between an organism and its environment, equal forces acting under equal conditions must produce equal effects; for, to say otherwise, is, by implication, to say that more force can produce more or less than its equivalent effect, which is to deny the persistence of force. Hence, those parts of an organism which are by its habits of life exposed to like amounts and like combinations of actions and reactions, must develop alike; while unlikenesses of development must as unavoidably follow unlikenesses among these agencies. And, this being so, all the specialities of symmetry and unsymmetry and asymmetry which we have traced are necessary consequences." †

If we turn now to the problems presented to us in the study of Physiology we find—

"The problems of Physiology, in the wide sense above described, are, like the problems of Morphology, to be considered as problems to which answers must be given in terms of incident forces. On the hypothesis of Evolution, these specialisations of tissues and accompanying concentrations of functions, must, like the specialisations of shape in an organism and its component divisions, be due to the actions and reactions which its intercourse with the environment involves; and the task before us is to explain how they are wrought—how they are comprehended as results of such actions and reactions.

"Or, to define these problems still more specifically:—Those

* Principles of Biology, vol. ii. p. 7. † Ibid., p. 217.

extremely unstable substances which compose the protoplasm of which organisms are mainly built, have to be traced through the various modifications in their properties and powers, that are entailed on them by changes of relation to agencies of all kinds." *

"Here, as before, we must take into account two classes of factors. We have to bear in mind the inherited results of actions to which antecedent organisms were exposed, and to join with these the results of present actions. Each organism is to be considered as presenting a moving equilibrium of functions, and a correlative arrangement of structures, produced by the aggregate of actions and reactions that have taken place between all ancestral organisms and their environments. The tendency in each organism to repeat this adjusted arrangement of functions and structures, must be regarded as from time to time interfered with by actions to which its inherited equilibrium is not adjusted—actions to which, therefore, its equilibrium has to be readjusted. And in studying physiological development we have in all cases to contemplate the progressing compromise between the old and the new, ending in a restored balance or adaptation." †

The plan of exposition favoured by Mr. Spencer is in both classes of development thus described :—

"Two ways of carrying on the inquiry suggest themselves. We may go through the several great groups of organisms, with the view of reaching, by comparison of parts, certain general truths respecting the homologies, the forms, and the relations of their parts; and then, having dealt with the phenomena inductively, may retrace our steps with the view of deductively interpreting the general truths reached. Or, instead of thus separating the two investigations, we may carry them on hand in hand—first establishing each general truth empirically, and then proceeding to the rationale of it. This last method will, I think, conduce to both brevity and clearness." ‡

The programme thus roughly sketched is very faithfully

* Principles of Biology, vol. ii. p. 223.

† Ibid., p. 224.

‡ Ibid., p. 9.

adhered to and very ably carried out by Mr. Spencer in this second volume of the "Biology." Each process of structure and function is set forth in considerable detail, and is followed by its suitable deductive warrant. These deductive warrants consist sometimes merely in the fact that the results are found harmonious with one or other of the corollaries from the Persistence of Force. At other times the reasoning is of a correctly deductive character, although the student will probably find that the *à priori* argument is conspicuously inadequate to account for the complicated concrete results sought to be explained by its means. But it is a characteristic of most of the explanations that they are drawn from the various corollaries of the Persistence of Force known as the Instability of the Homogeneous, Segregation, the Multiplication of Effects, &c., and that no single instance is ever adduced of the action of that special law of equilibration drawn from the abstract moving equilibrium to which we have given our attention, though that process is the one promulgated as specially characteristic of biological changes.

It is true that the term "equilibration" is very frequently brought into use, but it only appears in two several ways, neither of which implies any special power either of seeking to effect the assimilation of forces conducive to continuance, or of freshly arranging internal forces in antagonism to external destructive forces. The first use of the term to which we refer relates to the simple and direct action between forces according to their natural relations, and in this sense equilibration is merely another name for general causation, and is indistinguishable from the equilibrations or mutual relations of forces which are not of a biological character. The second use of the term is in the application of the expression "moving equilibrium" to the result of all these primary equilibrations aggregated into a complex consensus of relationship. But it is evident that the mere application of the term in this way is an indication of result rather than an explanation of process. If we find that the approach of winter is accompanied by the thickening of the furry coat of an animal, it is easy to say that this is the readjustment of a moving equilibrium, but it affords no explanation of the process. We are unable in thought, taking into account the decrease of molecular motion, to follow out the various steps from the conception of the moving equilibrium to the concrete result mentioned. Nor does Mr. Spencer ever seek to show how the necessity for balance and counterbalance does actually produce any of the changes and developments he has set himself to explain.

To effect these explanations he makes use of a variety of concrete knowledge and of the well-known mechanical laws; and his explanations must be appraised on their own merits. All we are concerned with at present is to divest the inquiry of all those speculative influences which we have just been considering. These, although exalted to the first place in constructive efficacy, are found in reality to be the outcome and not the cause of change. In their statement they present to our minds a semblance of analogy with some physical aggregates, but in reality they turn out of an entirely different constitution.

We have just remarked that the conception of organisms as moving equilibria is the result rather than the original cause of biological development. And it is singular that in Mr. Spencer's exposition we have no attempt whatever at an explanation of the origin of biological moving equilibria. The whole exposition takes organisms for granted, and then seeks to account for subsequent growth or development and for the modification of function. The question as to the origin of any such systematisation or co-ordination of parts accompanied by the habit of motion, which constitutes even the simplest life, is not even referred to. Mr. Spencer's scheme requires some simple organism to commence with. This given, he claims from the laws of equilibration to work out any and every process of development even to the highest complex forms. But the problem of the origin of this simplest biological form he does not attempt to solve. It is not to the purpose to say that it is a condition gradually attained by insensible modifications from the inorganic state. Slight though the distinction may appear to be between the highest inorganic molecule which acts towards its environment strictly in accordance with chemical and physical laws, and the lowest organic form which has a law of action overpowering the operation of the former and coercing them to the furtherance of its own preservation and continuance, that distinction nevertheless is a radical one. By no means can we convert the former into the latter, or derive the latter from the former as a mere continuance, a state into which it developed out of its own properties.

This we regard as a fundamental defect of Mr. Spencer's system, and one which entitles us, should we so decide, to declare that we need proceed no further with the consideration of his scheme.

We hold that Mr. Spencer's theory of an organism being a moving equilibrium, and, as such, governing the adaptation of its forces to meet those of the environment, and influencing the mutual balancings of its own parts with their accompanying functions, implies a theory of the coercive power of the moving equilibrium over the ordinary chemical and physical laws of its units. The moving equilibrium is, therefore, not the simple result of its constituents, but the necessity for its protection and sustenance produces coercion of the units. If this is not the case, and the moving equilibrium is to be considered as the result of its constituents, then the theory of the moving equilibrium as a cause of development has to be abandoned. With it would go all the arguments by which external forces are said to generate counterbalancing internal forces of structure and function, which are meet for antagonising particular external inimical influences. Casting this on one side, the special characteristic of biological change is obliterated, and what we call biological change is then really but a continuation of previous inorganic development, and the problem would be, from the known factors of chemistry and physical environment, to deduce the developments of vegetable and animal life free from the embarrassing associations of the laws of the moving equilibrium. As a matter of fact this is the course actually pursued by Mr. Spencer, thus practically abandoning and invalidating his elaborate arguments drawn from the presumed analogy between organisms and inorganic moving equilibria.

§ 11. *General Review of Mr. Spencer's Scheme of Biological Reconstruction.*

Thoroughly to perform the task indicated by the title of this section would require a separate book. Our intention, however, is rather to review the lines upon which the problem of biological reconstruction is attempted by Mr. Spencer than to criticise his actual performance in detail. At the same time, while we point out the difference between the actual methods employed and the method indicated in the preceding sections, we shall also have to show their inadequacy viewed even in themselves.

It will be convenient to divide our subject into two parts—one concerning the formative action of external agencies, and the other concerning the formative powers of the constituents of the organism itself. It is true, these have to be regarded as operating conjointly, but we do not think the inquiry will suffer from our taking it in the manner proposed. There is indeed a third agency, in the "need" for the continued existence of individuals and species; but as this is an inquiry beyond the reach of science, we reserve the consideration of it till a later period.

We have now to study the part played in the evolution of organisms by the well-known laws of motion, by the action of heat, light, moisture, &c., by chemical environment, and by other factors of an external kind.

It seems strange that our first endeavour should not be directed to an inquiry respecting the origin of organisms; but so it is. This subject is passed over by Mr. Spencer in silence. Organisms of some simple character being taken for granted, our study is limited to the less difficult task of ascertaining the laws of their modification, so that out of the nearest approach to homogeneity and the inorganic, we shall be able to evolve the most highly complex forms. It is true that in the Appendix to the first volume of the "Biology" Mr. Spencer gives a hypothetical account of the origin of "organic matter," verging indeed upon the origin of organisms; but in our previous work we have had occasion already to show that the endeavour, if it really aimed at the problem of explaining the origin of organisms, was not successful.

Mr. Spencer very properly from his point of view denies that any distinct line of demarcation ever existed between the organic and the inorganic. According to the doctrine of Evolution, the former must have acquired its differentiation from the latter by insensible degrees. Yet we cannot but think that there is one essential distinction between the very lowest organism and the highest complex inorganic molecule in the origin of its existence. As a matter of scientific fact, it is not known that any even of the simplest organisms ever come into existence otherwise than from the substance of preceding organisms of a similar character. And as a matter of theory, there is an essential distinction between the continuous existence of a highly complex molecule which does not expend energy nor require sustenance, and the temporary existence of an organism continually expending energy which has to be restored, and carrying with it the means of propagation in view of a certain termination to its own existence.

However, taking the case as it is presented to us, let us see how simple and homogeneous organisms can be developed into highly complex ones. We find the inquiry divides itself into two portions—namely, that relating to Morphological and that relating to Physiological Development. In pursuing these inquiries separately, Mr. Spencer takes all needful precautions for notifying their conjoint and contemporaneous action.

(*a.*) *General Principles of Morphological Development.*

We do not know how far Mr. Spencer may be justified in the use of the terms "morphological units" and "physiological units." If they are *ex post facto* terms, their use is limited to the later stages of scientific inquiry. If they are some of the things which have to be explained, we beg the question at issue by making use of them in our initial inquiries. However, they are so employed by Mr. Spencer; and we are asked first to consider the aggregation of morphological units. Presumably these morphological units are already differentiated and specialised in action as physiological units. They have various modes of aggregation, which form the first problem in morphological studies. The second problem of the science consists in the changes of shape that accompany changes of aggregation. Two sets of factors have to be taken into account.

"The factors of the first class are those which tend directly to change an organic aggregate, in common with every other aggregate, from that more simple form which is not in equilibrium with incident forces, to that more complex form which is in equilibrium with them. We have to mark how, in correspondence with the universal law that the uniform lapses into the multiform, and the less multiform into the more multiform, the parts of each organism are ever becoming further differentiated; and we have to trace the varying relations to incident forces, by which further differentiations are entailed. . . . The factors of the second class which we have to keep in view throughout our interpretations, are the formative tendencies of organisms themselves—the proclivities inherited by them from antecedent organisms, and which past processes of evolution have bequeathed." *

The class of changes referred to in the first portion of the above quotation receives from Mr. Spencer a very masterly and interesting treatment in the first portion of the part entitled "Morphological Development." Here are explained the differentiations of structure which must ensue from differences in morphological units, and from different modes of their aggregation. Afterwards Mr. Spencer exhibits in great detail the differentiations which must naturally ensue in organisms according as they are similarly or differently exposed in their parts to the action of the environment. This is accompanied by an account of the manner in which changes of shape and arrangement are affected by pressures and strains of various characters, whether caused by gravitation, action of wind or water, or contiguity of growth. As the study becomes more advanced, and the structure of the plants and animals attains greater complexity, the surrounding conditions produce still greater variety. Thus abundant or diminished food-supply

* Biology, vol. ii. p. 8.

may play a part in morphological change, and the different exposures of different parts in competitive growth may produce great variety of development.

In all this morphological evolution, however, the prime fact to be borne in mind is the internal power of growth. It is this which does the work; and all that can be said of the agencies just referred to is that they possess the power of modifying the action of that interior force. It is not suggested that the interior forces are called into being by the external forces, but only that their action is modified by them. The action of the inner power is restrained for instance by gravitation, while, on the other hand, its natural tendencies may be heightened by the heat and light of the sun. It is therefore evident that the main interest of the inquiry must be concentrated on these inner formative powers, which, indeed, throws the inquiry back upon the study of the origin of organisms. How comes it that such an arrangement of inorganic molecules is attained as to form an aggregate which expends energy for the purpose of securing and assimilating energy, so as to prolong an existence which would otherwise come to a speedy termination? And however much we may be convinced of the fact of a gradual evolution, and however much the stages of this evolution may be known or reasoned out, the extent and beauty of the harmonies thus brought under our notice should not cause us to overlook the need for mastering this primary element of the problem.

(*b.*) *The Morphological Development of Animals.*

The study of the action of external agencies upon the morphological development of plants is comparatively simple. That of animals is more complex. In the latter case, a new factor makes its appearance.

"This new factor is Motion—motion of the organism in relation to surrounding objects, or of the parts of the organism in relation to one another, or both. . . . What, among plants, is an inappreciable cause of morphological differentiation, becomes, among animals, the chief cause of differentiation." *

* Biology, vol. ii. p. 166.

We have to remark here the introduction of a new factor without any explanation of its appearance. We are elsewhere told that the organs of locomotion are generated by the necessity for seeking food when that food is not in perpetual contiguity, but is diffused in the neighbouring environment; and hence they seem to have no explanation other than in the hypothetical need for the continuance of existence. But granted the capacity for motion on the part of animals, we can discern the modifying effects which surrounding agencies would have upon them.

"Animals that are rooted or otherwise fixed, of course present traits of structure nearest akin to those we have been lately studying. . . . But animals which move from place to place are subject to an additional class of actions and reactions. These actions and reactions affect them in various ways according to their various modes of movement. Let us glance at the several leading relations between shape and motion which we may expect to find.

"If an organism advances through a homogeneous medium with one end always foremost, that end, being exposed to forces unlike those to which the other end is exposed, may be expected to become unlike it; and supposing this to be the only constant contrast of conditions, we may expect an equal distribution of the parts round the axis of movement—a radial symmetry." This instance is expanded, and leads up to a conclusion reasoned out *à priori;* after which Mr. Spencer passes on to a consideration of the facts presented by science, in order to show how this conclusion is confirmed *à posteriori.*

Needless to say, this account is of the greatest interest, and tends to confirm our belief in the gradual evolution of organised beings. The main question, however, remains—Do we know all the factors and understand the processes fully, so as to be able to say that an explanation of them has been effected? It is true, we discern some of the conditions and some of the factors concerned in this great history; but however vast the proportion of our attention that we concentrate upon them, and however much we elaborate them in printed books, there are some things which remain unexplainable, and some factors unknown which are essential to our calculations.

(*c.*) *Mr. Spencer's Exposition of Physiological Development.*

Let us take for granted the fact of the existence of organisms, let us take for granted, too, the power of motion possessed by animals, and let us leave out of consideration altogether the factor of Feeling. Then the task of accounting for physiological development as presented to us by Mr. Spencer involves the study of the manner in which previously existing organisms must have been modified by alterations in their relation to the environment.

This account is very able, and it cannot be denied that the proof of gradual evolution and the impossibility of finding lines of demarcation between various developments of a particular class is so well set forth that the representation carries with it the force of conviction. But it is a conviction wrought in our minds by inductive evidences rather than by *à priori* reasoning. For instance, the account given by Mr. Spencer of the tegumentary appendages shows very clearly the unity of nature between hair, feathers, scales, and the other clothing of animals, together with the horny appendages; from which can be recognised the fact of their development from a common origin. But the account of their origin is quite hypothetical. Having arrived at a stage of development when the organism is possessed of a skin—a skin subject to waste and possessing the power of repair—we have to suppose the growth and casting off of horny cells all over the skin in general. Next, we have to imagine a small pit formed in that skin, or rather a number of small pits. Then from the larger area of the surface of the pits compared with the area of the apertures there is a proportionately increased production of horny cells, which from the limited area of the cavity are condensed or integrated into rudimentary hairs.* Thus established, it is easy to work out the process of their extrusion beyond the surface of the skin and their subsequent modification into the great variety of forms mentioned above.

* Biology, vol. ii. p. 301.

We have selected this case because it takes us back to the initial physiological development presented by Mr. Spencer in the differentiations between the outer and inner tissues. We are reminded * that this is a differentiation common also to inorganic masses whose outer parts are differentiated from the inner by oxidisation, by drying, and by the action of light, moisture, or frost. In the same manner an originally homogeneous portion of protoplasm will acquire a skin. Evidently this skin is formed of the substance of the protoplasm, and is hardened, not for the purpose of protection, but as the direct and simple effect of the action of the environment. Here ought to be introduced the *à priori* explanation of the fact of waste and repair. Inorganic surfaces are not subject to waste; and should abrasion take place, there will be renewed action of the environment upon the exposed surface, with resulting similarity. If it is argued that the case of an organism is identical in principle, there is nothing more to be said. But if it is advanced that there is a natural waste which is supplied from the organism itself, or that the abraded surface is re-formed by the action of the organism, then we are introduced to a process which finds no analogue in the inorganic world, not even in the self-repair of a crystal. It is evident, however, that in order to account for the various clothing and appendages of animals we require to have a continuous expenditure of energy and a continuous repair of waste. It is not our intention to discuss this question at present; we only wish to show how the notion of the expenditure of energy and the necessity for fresh assimilations of energy are the fundamental fact and the fundamental difficulty of Biology.

It follows that, if this fundamental principle be taken for granted, as in the above instance, vast progress can be made even in *à priori* reconstruction; while the principle materially assists us in appreciating the facts of gradual change brought under our notice in our inductive studies.

As indicated in our notice of "Morphological Development," the main process is one of inner growth modified by external influences. The inner forces are not called forth in response to

* Biology, vol. ii. p. 226.

the action of the environment, but in their tumultuous growth are cabined, cribbed, and confined by the restraints of the opposing environment; or on the other hand, should the environment be favourable, then the inner forces make use of it for the continuance of the organism's existence.

The development of the organs of sense is by means of differentiations of the outer tissues. This is a truth arrived at by inductions from various sources.* The question is whether it can be deduced *à priori* from a consideration of the relations between a moving equilibrium of organic matter and the surrounding light, aërial vibrations, and floating particles of matter? Mr. Spencer thinks that possibly light may have aided in setting up certain modifications by which the nervous parts of the visual mechanism are formed, and that the complexities of the sensory organs are thus explicable. These must have arisen by the natural selection of favourable variations.

The development of the means of locomotion Mr. Spencer does not mention. Locomotive organs are evidently produced by the action of the inner forces in seeking food, aided by the subsequent necessity of escape from enemies; and they are not *à priori* deducible from the action of the environment. In the chapter on the "General Shapes of Animals" in the preceding part, Mr. Spencer has shown how "the one ultimate principle that in any organism equal amounts of growth take place in those directions in which the incident forces are equal, serves as a key to the phenomena of morphological differentiation. By it we are furnished with interpretations of those likenesses and unlikenesses of parts, which are exhibited in the several kinds of symmetry; and . . . we are enabled to comprehend, in a general way, the actions by which animals have been moulded into the shapes they possess." †

But this view is subordinate to the question concerning the origination of that habitual motion which constitutes an organism, of the consequent necessity for repair of waste, and of the origin of locomotion.

In the chapter treating of the "Differentiations of the Inner

* Biology, vol. ii. p. 303.

† Ibid., p. 189.

Tissues of Animals," we find the same course pursued. The study is mainly an inductive one, with hypothetical explanations of differentiation and development from a common origin,—certain essential primary stages in the evolution of an organism being taken for granted. The first class of developments comprises those which take their origin from a simple intestinal canal. Out of this, by varied causes, arise differentiations in the successive parts of the canal. Firstly, the different conditions of the food in its passage produce different states, and finally different arrangements of its parts. Hence originated the stomach with its secreting juices. Hence also can be explained the gizzard, the arrangements for the storage of food by ruminants, and the crop possessed by some birds. The liver, the pancreas, and various smaller glands are not to be accounted for in the same way, but by the segregation which takes place amongst mixed colloids and crystalloids even in inorganic mixtures, the tissues giving ready entrance to the substances that decompose them and ready exit to the substances into which they are decomposed. The question is one as to the excretion of waste and the specialisation of organs for that purpose. In some cases, this is determined by the mechanical actions of organisms; in others, by facilities for escape. In the case of the liver, the waste products of which are utilised, "natural selection" will determine the most beneficial spot.

The respiratory system is one of the means by which an animal organism is supplied with some of the necessary constituents for prolonged action. Mr. Spencer traces its origin inductively to a differentiation in the alimentary canal. How is this differentiation deductively established? By the hypothesis of fish swallowing air-bubbles, and the consequent change in the forces acting upon the alimentary canal causing special differentiations to suit that new circumstance. The habit of taking in air-bubbles is likely to become established, and the organs for utilising them developed. The relative effects of direct and indirect equilibration in producing this further heterogeneity must, as in many other cases, remain undecided.

Mr. Spencer next proceeds to consider the differentiations that take place in those truly inner tissues which lie between the external tegumentary system, exposed to the action of external objects, and the internal tegumentary system, exposed to the action of food. The first set of tissues to come under notice is the vascular system. This is found to arise primarily from the osmotic action which must go on between two dissimilar fluids separated by an intermediate diaphragm. The osmotic action, however, is not a simple one terminating in a state of equal distribution; but since there is an abstraction of nutritive liquid either for growth or function, more nutritive liquid will be forced towards the point of utilisation, which is the direction of least resistance. This osmose is a cause of redistribution which is at work even before any central organ of circulation exists. Changes of internal pressure will tend to increase the circulation. Other causes assist those differentiations which eventuate in the complicated vascular system as we now know it in the higher organisms.

The osseous structure is determined by the strains to which the body is subject in the mutual actions of the environment and the moving organism. These strains cause hardening in some of the gelatinous constituents; such constituents harden into cartilage, which again in the parts most exposed to strains or pressures harden into bone. The process is completed by the deposit of some of the calcareous elements contained in the food; and thereafter the problem is merely one dependent upon the action of waste and repair, and the modifications due to increments of repair, wrought by excessive actions in certain directions, on the one hand, and deficiencies of repair, occasioned by the non-exercise of other parts, on the other hand. The osseous structure is due mainly to direct equilibration of a mechanical character, although some of its parts appear rather to be due to indirect equilibration.

The question as to the probable origin of nerves and the cerebral system is treated of by Mr. Spencer both in the "Psychology" and in the "Biology." In the former our attention is primarily directed to the abstract laws of dynamics set forth in "First Principles," which are supposed to rule the formation of the nervous system.

"In 'First Principles,' Part II., chap. 9, we found that in all cases 'motion' follows the line of greatest traction, or the line of least resistance, or the resultant of the two." We also saw "that motion once set up along any line becomes itself a cause of subsequent motion along that line, equally when the motion is that of matter through space, that of matter through matter, and that of molecular undulations through an aggregate of molecules."

As this is to be our instrument in reconstructing the Genesis of Nerves, wherewith goes the concomitant of Mind, it is essential that we should clearly understand the materials with which we have to deal, and the laws of Motion which affect them. "Motion follows the line," &c.; of course this means that Matter in motion or the motion of Matter "follows," &c.; for we cannot dissociate Motion from Matter. Either Matter means, firstly, combinations of ultimate units of attraction and repulsion, each aggregate and combination of aggregates having properties deducible from the shapes, sizes, modes, and rates of motion of its constituents, and their modes of combination. Or else, secondly, Matter means the seventy so-called elements as known by us. With these meanings, the first enunciated principle can be accepted.

We now come to the principle "that motion once set up along any line becomes itself a cause of subsequent motion along that line"—a proposition which, to say the least, is ambiguous. Let us refer to Mr. Spencer's own statement in "First Principles." It is all contained in one short paragraph on p. 226.

"Movement set up in any direction is itself a cause of further movement in that direction, since it is the embodiment of a surplus force in that direction."

Here we have an assertion and the reason for that assertion. The reason is founded on the conception or the fact of there being such things as "surplus forces." Mr. Spencer's system of Philosophy, founded as it is upon Force, is deficient in not having a chapter "On Abstract Laws of Force and their Interrelations." If we had this, we could tell what was meant by "a surplus force." Failing it, we must guess. We suppose that the changes of the cosmos, being incidents in a process of equilibration, are such by virtue of the imparting by some matter to other matter of motion when the former has it in excess of the latter, so as to establish an equality between the two, much as water finds its level. In this case the excess of the motion in the former over the average of the two would be called surplus motion or surplus force. Is this what Mr. Spencer means? When he speaks of "surplus force" we presume he does not speak of force pure and simple, which we do not know, but of some manifestation of it which we do know. Yet we are not able to understand what state of things other than this Mr. Spencer refers to when he speaks of "surplus force" and "surplus motion."

Let us take the case of steam out of the spout of a kettle, or what is much the same thing, the steam waste-pipe from an engine. The surplus force or motion is shot forth into the still air—is this to be called "the embodiment" of a surplus force "in that direction?" If the force or motion of the steam and air is in a given direction, is the continuance of the force or motion in that direction, on account of the continuance of the conditions, an embodiment of surplus force in that direction? We are unable to argue the question in the abstract and without recourse to concrete instances. Here Mr. Spencer advances as the reason why movement once set up in any direction becomes itself the cause of further movement in that direction, "because it is the embodiment of a surplus force in that direction." The fact is, Mr. Spencer does mean something accurate, but not coming into contact with actual discussion, his statement is not clarified by criticism. Absorbed in his own studies, and expressing himself by his own phraseology, he does not realise the difficulty which other people have in understanding him, with the momentous consequence that the greatest of all scientific questions, namely, that as to the genesis of Mind, is left in doubt owing to the obscurities of half a page of his book.

Mr. Spencer proceeds to say that this law holds good of the transit of Matter through space. We suppose Mr. Spencer refers to interstellar space. This implies that if a body was projected in a certain direction, then a similar one, projected in a like manner, would take the same direction. This, no doubt, would be the case from the parity of conditions; but it is not to be supposed that the first would compel a second mass to follow it in the same direction. For how would it be if the second mass were projected at an angle from the course of the first? Would the previous event exercise any influence upon the succeeding one? Certainly not. Mr. Spencer's illustration merely exhibits the law of inertia, and it amounts to this:—Motion in any direction is a cause of its own continuance. The motion of the earth round the sun one day is a cause of its continuing its journey the next, and its circuit one year is the result of its previous circuit. Its revolution upon its axis is caused by previous revolutions.

The next illustration is the transit of matter through matter. Let us take the example given. "Any breach made by one solid through another, or any channel formed by a fluid through a solid, becomes a route along which, other things equal, subsequent movements of like nature take place." Notice here that Mr. Spencer says the subsequent movements "take place," and not that they are caused by the previous movements. In fact, he says that other things must be equal, *i.e.*, that the causes of the first movement must be present to ensure the like result in the second, and the conclusion is that the repetition of movements in a given direction requires the same set of causes as produced the movement in the first instance, and not that "motion once set up along any line becomes itself a cause of subsequent motion along that line."

We have next the case of "molecular undulations through an aggregate of molecules." We do not see that this case differs in the least from the flow of water through accustomed channels. We may find that certain vibrations are hindered in their passage through a body by the irregular constitution of that body, and they may be able by their own motions to effect such a readjustment of the molecular condition of that body as to facilitate the transmission of subsequent vibrations. Thus the conditions under which future movements will take place are changed, and the facilities for their transmission improved, if they should come, but the new arrangement certainly does not cause them. The same causes which determined the first determine the second. Indeed, we know very little about the passage of undulatory motion.

The only illustration in the non-biological world which Mr. Spencer can find to illustrate his meaning is drawn, not from cases of molecular motion, but from the science of hydrodynamics, and will be found illusory. The passage of water down a hillside or through almost level country is accompanied by a process of washing away the portions of the ground in the lower levels along which the water pursues its way, in obedience to the law that motion takes the line of greatest traction and least resistance. In pursuance of the same law a second sheet of water will follow the same course, and with greater facility, because of the previous removal of obstructions.

But this is not a parallel case at all with the propagation of undulatory motions through a mass of organisable protoplasm. The action of the water is disintegrative; the action of the latter is supposed to be formative. The former removes obstructions by means of its mechanical momentum; the latter is supposed to place molecules in lines—a process in which no doubt the polarities of the molecules play a part—a process which might perhaps more fitly be placed under the class which Mr. Spencer calls "Segregation."

Mr. Spencer would undoubtedly draw a parallel between the formation of a river system and the formation of a nervous system —between a disintegrative system and a formative system. But we cannot admit the analogy, more particularly when we take into account the fact that nervous systems are double, having both a system for the reception of motion and a system for the expenditure of energy, the origin and development of which Mr. Spencer does not sufficiently explain.

Let us now summarise the instances that have been adduced. We have seen that the passage of a solid through a solid does not cause or set up movement in a similar direction; we have seen that the movement of bodies through space does not cause movement in the same direction; we have seen that the movement of gases through gases does not cause movement in the same direction. The only valid instance affording any presumption in favour of the supposed law is the flow of water down declivities to its level, by means of channels previously formed, thus obeying the law of movement in the line of the greatest traction and of least resistance. But we do not find that movement set up.

Having thus discussed the preliminaries, let us now approach the practical problem, as dealt with by Mr. Spencer.

We find the examination of Mr. Spencer's explanation of the genesis of nervous systems more difficult than anything we have yet undertaken, on account of the obscure and complicated lines of thought pursued. The first difficulty arises from the circumstance that he does not define his starting-point. It would appear from p. 512 of the "Psychology" that we have to start from an "undifferentiated organism." We do not understand how there can be such a thing as an "undifferentiated organism;" for it is a contradiction in terms. And next we are referred to "a living animal" and an "organism" which possesses different parts. This is begging the question.

We find, however, a better and clearer explanation in § 302 of the "Biology," which is really very plausible. It is too concise to summarise and too long to quote. We must ask the student to refer to it himself. It amounts to this; in a mass composed of various kinds of protoplasmic molecules, an incident force impinging upon it at any point will cause molecular change, which change will propagate itself continuously in suitable molecules, and thus form a continuous line of similar molecules, changed and placed by the motion in segregated order, which constitute the rudiments of a nerve. The obscure part of the statement is that the incident force is not named. We presume it must not be a general force equally distributed over the surface, such as heat or light, but a force incident upon some particular point, such as a mechanical strain, or a ray of light or heat falling upon a point, or a vibratory motion, or something else of a local nature.

It is quite possible to imagine that a mechanical arrangement of differentiated molecules in continuous lines is a conceivable occurrence in a mass of protoplasm under the action of external forces such as heat, light, and mechanical motion, simultaneously with the segregation of other kinds of protoplasmic molecules.

It is possible to imagine such a result, although we may not be able to work it out *à priori* in all its complications. But when it is complete it is but a mechanical arrangement. Mr. Spencer, however, goes beyond this, and takes one step which appears quite unwarranted by the terms of the problem, namely—

"Every repetition will help to increase, to integrate, to define more completely, the course of the escaping molecular motion—extending its remoter part, while it makes its nearer part more permeable—will help, that is, to form a line of discharge, a line for conducting impressions, a nerve." *

The unwarranted step is to call the incident force "a stimulus," and the line of molecules, "a line for conducting impressions," instead of a line for the conduction of motion. This is followed up in the succeeding section by speaking of irritability as a property of protoplasm, and by inference a property of the mechanical molecules arranged in a line.

We must ask here if this stimulating property, this quality of irritability, this power of transmitting "impressions," is objective language; and if so, is it language which could up to this point be applied to any of the combinations of Matter and Motion, or to the ultimate units out of which all molecules are built? Or does this mark the transition of the objective into the subjective? If so, it would seem to imply that the subjective is not only dependent but consequent upon a certain combination of the objective when molecules are formed in lines by incident motion, and in an aggregate are variously changed according to the varieties of incident motions. Hereupon would arise irritability, impressions, feelings, and afterwards an organised consciousness. Both "irritability" and "sensitiveness" have definite objective meanings, but inasmuch as they have subjective connotations also, it is necessary in the study of a physical process to restrain their meaning to the mechanical limits of the problem, lest inadvertently the verbal guise should cover an undetected transition of thought answering to an explanation of the origin of the subjective.

* Biology, vol. ii. p. 351.

"From beginning to end, therefore, the development of nerve results from the passage of motion along the line of least resistance, and the reduction of it to a line of less and less resistance continually. The first opening of a route along which equilibrium is restored between a place where molecular motion is in excess and a place where it is in defect, comes within this formula."

We have no room to consider the evolution of ganglia, the storage of nervous force, and the development of efferent lines for its discharge, nor for the study of the development of the directive machinery of the nervous system. We only observe that the evolution is accomplished by a process with which feelings and consciousness have nothing to do; and if it takes place at all as described, it is effected upon purely mechanical and physical principles.

Our next inquiry concerns the development of muscular tissue. Contractility as well as irritability is a property of protoplasm or sarcode, and it is not improbably due to isomeric change in one of its component colloids. But the question remains, "What causes the specialisation of contractile substance? What causes the growth of colloid masses which monopolise this contractility, and leave kindred colloids to monopolise other properties? Has natural selection gradually localised and increased the primordial muscular substance? or has the frequent recurrence of irritations and consequent contractions at particular parts done it? We have, I think, reason to conclude that direct equilibration rather than indirect equilibration has been chiefly operative. The reasoning that was used in the case of nerve applies equally in the case of muscle. A portion of undifferentiated tissue containing a predominance of the colloid that contracts in changing, will, during each change, tend to form new molecules of its own type from the other colloids diffused through it: the tendency of these entangled colloids to fall into unity with those around them, will be aided by every shock of isomeric transformation. Hence, repeated contractions will further the growth of the contracting mass, and advance its differentiation and integration." *

* Biology, vol. ii. p. 354.

To conclude, Mr. Spencer resumes the study of the problem of the repair and growth of the differentiated tissues.

"When treating inductively of that restoration which takes place in worn organs, it was admitted that little in the way of deductive interpretation is apparent—nothing beyond the harmony between the facts and the general principle of segregation."

However, Mr. Spencer is able to point out relations and conditions of osmotic exchange, which render it clear that the amount of exchange must be proportionate to the amount of consumption and decomposition; so that the materials for consumption and reintegration of tissue must be supplied in proportion to the demand. To this must be added the circumstance of osmotic distension, by which the nutritive fluid is thrust to the parts where there is the greatest escape for it —*i.e.*, to the parts in which it is absorbed by local expenditure of energy.

Although this hypothesis is a reasonable one so far as the operations of existing organisms are concerned, we fail to see the origin of such a self-maintaining process in any combination of inorganic molecules; and the theory therefore seems to lack deductive warrant. The originally homogeneous portion of protoplasm is merely due to segregation, and the causes which originated it would also naturally lead it to retain its aggregation intact. We are not to suppose that it immediately commences to expend energy in order to retain its aggregation, and that the energy so expended has to be replaced. If its outer surface has become differentiated from its inner, we do not see any necessity for the process of osmose: nor do we see the applicability of the theory of repair when there is no expenditure of energy.

We have thus shortly summarised these important chapters for the purpose of forming a judgment on the methods employed, and have come to the conclusion that they contain a system of hypotheses suggested by the scientific inductions which lead us to the conviction that all organisms have arisen by insensible modifications from some simpler forms. These hypotheses are all of a concrete character, and they are applied to some hypothetical simple organism already possessing the essential characteristic of animal life. It has the property of motion, which means the expenditure of energy, and implies the power of seeking, or at any rate of assimilating fresh energy from its environment for the purpose of self-sustenance. It exhibits the phenomena of waste and repair. All the developments are effected by means of these original powers of the organism; and Mr. Spencer's system is essentially one relating not to the origin but to the development of organisms. And seeing that it is deficient through this immense initial hiatus, it is merely Mr. Darwin's great work put into another form. It is not a system going behind that work and giving to it an explanatory or deductive connection with the general order of physical sequences. It is merely commensurate with Mr. Darwin's work, and fails of the attempted extension into antecedent histories.

(*d.*) *How Organic Development is Affiliated upon Evolution in General.*

The affiliation of morphological and physiological development upon Evolution in general must be managed by proving their conformity with "First Principles." It is asserted* that this can be done in terms of the redistribution of matter and motion. This is evidently a reference to the Formula of Evolution. On this we have to remark, that the terms matter and motion cannot be regarded as mere symbols like the symbols x and y, as asserted by Mr. Spencer in his reply to our former criticism. They must be held to refer to the chemical substances adduced as factors in the early chapters of the "Biology," namely, oxygen, nitrogen, carbon, hydrogen, &c., in relation with various substances and motions of their environment. It is worthy of remark that no reference is made anywhere to the concomitance between integrations of matter and dissipations of motion, thus showing the inutility of the Formula of Evolution for any practical explanations. However, the harmony with "First Principles" is exhibited in other ways.

The instability of the homogeneous is endlessly exemplified in the changes wrought upon the homogeneous by incident forces. The multiplication of effects has also been exhibited,

* Biology, vol. ii. p. 377.

and we have been given innumerable cases of equilibration. These equilibrations have in many cases been due to the simple and direct operation of natural chemical combinations and physical relations. All the biological changes we have contemplated are but incidents in a progressing equilibration.

With respect to this point, however, we have to raise the inquiry previously suggested—Does Mr. Spencer mean the mechanical equilibration suggested by implication in the Formula of Evolution—or, again, a physical equilibration of energies on the way to an universal state of dissipation or degradation of energy? Or does he only mean by equilibration an equivalent to general causation regarded quantitatively? In this latter aspect we are inclined to regard Mr. Spencer's use of the term. If it has a more limited meaning, it is insufficient for an explanation of Biology; but if it is used in this larger sense, it is too vague for scientific purposes.

Mr. Spencer concludes the summary of biologic affiliation by terming the completed organism "a moving equilibrium." This, however, is evidently but a name descriptive of the results of biologic evolution—that is to say, of the direct and indirect equilibrations of the chemical components with their physical surroundings—and not a name for the cause of such evolution.

He then winds up with the usual reference to the Persistence of Force.

"In all which universal laws, we find ourselves again brought down to the Persistence of Force, as the deepest knowable cause of those modifications which constitute physiological development; as it is the deepest knowable cause of all other evolution." *

It is impossible to follow this process of reasoning, more particularly if Force is merely a symbol. We can only argue that if Force manifests itself in modes, then when one mode changes it must be into another mode. But why the first should change, and what are the conditions of its change, cannot be deduced *à priori;* it can only be understood *à posteriori*

* Biology, vol. ii. p. 387.

from inductive studies. The warrant for the perpetual lapse of the homogeneous (?) into the heterogeneous, for the multiplication of effects, for segregation, for equilibration of both orders, lies in experience,—in the very experience of which they are supposed to be the *à priori* explanations.

§ 12. *Indirect Equilibration.*

It must be remembered that the line of thought we are now following is in pursuance of an examination into the argument set forth in the latter portion of Part III. in the first volume, with regard to the question "How is organic evolution caused?" In answer to this question we first of all considered rather elaborately what was meant by equilibration, and more particularly by the special laws of biological equilibration. In the preceding section we have shortly reviewed the more detailed account of morphological and physiological development presented to us in vol. ii. so far as the external factors are concerned. We now propose returning to the principal course of the argument in vol. i. by considering the chapter on "Indirect Equilibration," as preliminary to a study of the operation of the internal factors given in the same account of morphological and physiological development.

The chapter on "Direct Equilibration" suggested certain explanations as due to this process; but it was there stated that many biological developments were not so explicable; and these were relegated to consideration under the head of indirect equilibration. Among them were defensive appliances, respecting which Mr. Spencer says—

"These defensive appliances, though they aid in maintaining the balance between inner and outer actions, cannot have been directly called forth by the outer actions which they serve to neutralise; for these outer actions do not continuously affect the functions of the plant even in a general way, still less in the special way required . . . since the individuals devoured could not bequeath changes of structure, even were the actions of a kind to produce them; and since the individuals that perpetuated themselves, would be those on which the new incident force had not fallen." *

Another class of organs similarly circumstanced are those of reproduction.† A third class consists of the precautionary arrangements for the protection of embryos and seed-vessels, an instance of which is adduced by Mr. Spencer ‡ in the case of the secretion of an egg-shell round the substance of an egg in the oviduct of a bird,—a fact quite inexplicable as a consequence of some functionally wrought modification of structure, immediately caused by external conditions.

There are other peculiarities which again cannot be accounted for by direct equilibration, such as the lengthening of bones, as in the elongation of the metatarsals in wading birds.§

"Hence there must be at work some other process, which equilibrates the actions of organisms with the actions they are exposed to. . . . Besides direct equilibration, therefore, there must be indirect equilibration." ||

The first of these causes, as given in the chapter now under study, is "the survival of the fittest." Even in a race considered as a whole, since its various ancestors must have been exposed to slightly differing conditions, some differences must exist in relative proportions of different functions: and in the struggle for life those individuals which have been most fitted to the conditions of existence will survive and propagate—producing a continual tendency in the direction of greater correspondence to the permanent conditions. This is the same principle as that to which Mr. Darwin has given the name of "natural selection, or the preservation of favoured races in the struggle for life." The point to which Mr. Spencer would call attention is that by means of this principle, adaptations may not only be *maintained* but even *produced*,¶ and he quotes this as one of Mr. Darwin's greatest discoveries.

The instances given by Mr. Spencer as illustrations of this truth are, firstly, "A soil possessing some ingredient in unusual quantity, may supply to a plant an excess of the matter required

* Biology, vol. i. p. 438. † Ibid., p. 439.
‡ Ibid., p. 440. § Ibid., p. 441. || Ibid., p. 442. ¶ Ibid., p. 445.

for a certain class of its tissues; and may cause all the parts formed of such tissues to be abnormally developed." This is a case of direct equilibration: but the consequences of such development in the individuals of a species might be such as to secure them some advantage of propagation or otherwise in the struggle for life, whereby the new type of the race becomes established and the old type is crushed out of existence altogether.

In a similar manner Mr. Spencer thinks that the thick coverings of the mollusc or the tortoise might have been produced and established. "Thus, too, is it with the production of colours in birds and in insects; the formation of odoriferous glands in mammals; the growth of such excrescences as those of the camel. Thus, in short, is it with all those organs of animals which do not play active parts in the compound rhythms of their functions." *

A second class of indirect equilibrations consists in the changes brought about by the use and disuse of parts,† and the alterations initiated by such changes of habit upon the rest of the organism. Following upon this comes natural selection, which presupposes that some of these changes may give the possessor an extra chance of life. The acquired change will thus be transmitted to posterity,‡ although it is not to be supposed that the individual peculiarity is likely to be further developed by this means.

It can scarcely be claimed that the classes of development reserved from the preceding chapter have been satisfactorily accounted for in this. The protective appliances have been partially considered; the organs of reproduction have scarcely been noticed; the precautionary arrangements for the protection of the embryo and seed vessel have been very inadequately considered; and the elongation of bones has not been noticed at all.

Nevertheless, sufficient has been advanced to show us what is meant by Indirect Equilibration. Taking the term equilibration as merely a general name indicative of the interrelations of various substances and motions, we can well understand that as regards the relations of those aggregates which we call

* Biology, vol. i. p. 448. † Ibid., p. 449.

‡ Ibid., p. 454.

organisms there will have been formed some of a very complicated character; and under the influence of varying incident forces the consequences of some of these incident forces upon the organism will be very remote. These remote effects not being the immediate and direct results, are—if we may use such a phrase to indicate the relations of changes—indirect equilibrations, although the value of such exegesis must lie more in the proper understanding of the relations between the sequences than in the mere nomenclature of the general process.

Mr. Spencer proceeds, however, in section 167, to consider how this hypothesis may be expressed in terms of the general doctrine of evolution. "It remains to be shown that this process conforms to the same general mechanical principles as do all other equilibrations." *

We have to regard a species as "an aggregate in a state of moving equilibrium." "Its powers of multiplication give it an expansive force which is antagonised by other forces; and that through the rhythmical variations in these two sets of forces, there is maintained an oscillating limit to its habitat, and an oscillating limit to its numbers." Thus a species as a whole has a kind of existence analogous to the existence of an individual. It is, in fact, a moving equilibrium. We have therefore to "call to mind in what way moving equilibria in general are changed." † If, however, we recur to the only cases of moving equilibria recognisable in the inorganic world, namely, those of the solar system, the spinning-top, &c., we are afraid that Mr. Spencer's attempted analogy will not apply. To make it apply we must recall the ideal moving equilibrium of Mr. Spencer's own imagining—a moving equilibrium ostensibly drawn by induction from inorganic instances, but in reality drawn from organic life. In other words, we must place the parallel as an analogy with itself! In pursuance of this principle Mr. Spencer says—

"In the first place, the necessary effect wrought by a new incident force falling on any part of an aggregate with balanced motions, is to produce a new motion in the direction of least

* Biology, vol. i. p. 457. † Ibid., p. 457.

resistance. In the second place, the new incident force is gradually used up in overcoming the opposing forces, and when it is all expended the opposing forces produce a recoil—a reverse deviation that counter-balances the original deviation. Consequently, to consider whether the moving equilibrium of a species is modified in the same way as moving equilibria in general, is to consider whether, when exposed to a new force, a species yields in the direction of least resistance; and whether, by its thus yielding, there is generated in the species a compensating change in the opposite direction. We shall find that it does both these things."

Let us take the case of the protective appliances mentioned above. These are explained as due to increased supply and assimilation of food procured in a new habitat, and consequent survival of the fittest in competition with the old race. We do not see that the abstract rendering just given at all tends to make the explanation plainer or more reasonable. Nor do we see how it can be applied to the origination of the organs of reproduction, nor to the precautionary adaptations for the protection of embryos and seed vessels, nor to the elongation of the metatarsals in wading birds.

However, it appears that Mr. Spencer has quitted the consideration of these cases, and furnishes us with illustrative concrete instances in the case of species exposed to the attack of new classes of enemies. "The disappearance of those individuals which meet the destroying forces by the smallest defensive forces, is tantamount to the yielding of the species as a whole at the places where the resistances are the least." * But then our desire is to find an explanation for these defensive forces or appliances, and not to ascertain their subsequent relations to the offensive forces. To proceed, however. "Or if by some general influence, such as alteration of climate, the members of a species are subject to any increase of certain external actions that are ever tending to overthrow their equilibria, and which they are ever counter-balancing by the absorption of nutriment, which are the first to die? Those that are the least able to generate the internal actions which antagonise these external actions."

* Biology, vol. i. p. 459.

This conclusion is fully comprehensible quite apart from any theory of moving equilibria, which indeed does not assist us at all, and fails to render the process analogous to inorganic processes, as is essential in any cosmical interpretation. The succeeding section we reserve for consideration in our general review of the argument in § 14. We have therefore to conclude that "Indirect Equilibration" merely means the more distant effects of any sets of causes, but is not the enunciation of any definite formula or principle by which any special range of sequences is to be explained. Placed as it is in the series of biological explanations, it is assigned a rank to which it has not the slightest logical pretension.

§ 13. *The Inner Formative Forces of Organism—Polarity.*

(*a.*) *General Considerations.*

Why did not Mr. Spencer write a chapter on Polarity? We find it playing such an important part in the construction of inorganic and organic molecules, and in the further construction of crystalloid masses and of organisms, that a special study of the subject would seem imperative. Yet we are left to gather Mr. Spencer's opinions about it in a very fragmentary manner. Perhaps the best plan would be to collect them together in the first instance, and then consider them. After that, we should be able to look at the factor of Polarity in relation with the other established propositions of Mr. Spencer's philosophy.

For this purpose we shall take the two volumes of the "Biology," where the factor Polarity is most frequently brought into play.

We meet with Polarity at the very outset. We have firstly "ultimate units," some of which have "extreme mobility." Then comes the theory that "the properties of a compound are *resultants* of the properties of its components." Hence in some compounds molecular mobility follows from the extreme mobility of the ultimate units. But what is mobility? Does it mean that the ultimate molecules are in a state of rapid motion to and from each other? Does it mean that they are in a state of rapid rotation around each other, or each on its own axis? Or does it mean that their mutual relations of connection are so slight that they are easily separated from each other, or that their motions are easily altered in rate or direction by external increments or decrements of motion? The term mobility is a very indefinite one; it may mean "easily moved by an external force," as opposed to "immobility," or it may mean "possessed of rapid motion."

This is said to be a mechanical view of the matter. Then on page 14 we are asked to consider the organic elements "chemically instead of physically." What is the difference between chemistry and physics? The differentia would appear to lie in the doctrine of affinities. Some of the so-called elements are narrow in their range of affinities and low in the intensity with which they maintain them. Hydrogen, carbon, and nitrogen will combine with few other elements; and then the bonds are but weak. And if we consider further, we shall find between one of them and oxygen an extreme contrast in respect of "chemical activity." "Oxygen displays, alike in the range and intensity of its affinities, a chemical energy exceeding that of any other substance. . . . Nitrogen displays the greatest chemical inactivity."

Physics, then, is the science of the molecular mobilities (?) of ultimate units, and the resultants of their combinations; and chemistry is the science, not of ultimate units at all apparently, but of the affinities of the seventy or eighty so-called elements. The latter is a purely concrete science. The former has an abstract side in the theoretic study of those ultimate units from which the atoms of the so-called elements are composed, and a concrete side in the study of the actual "mobilities" of these atoms themselves.

It would follow that concrete physics and concrete chemistry relate to the actual properties of the seventy or eighty so-called elements, the former relating to their molecular mobilities, the latter to their affinities. Now of the former it may be said that the study of the mobilities of the elements is rather a vague inquiry. As before explained, "mobility" is a very indefinite term. Does this study reveal to us that oxygen has always a certain rate and mode of motion, and that nitrogen has another, and that these rates are fixed, forming an essential property of each? Again, does it reveal to us that this is a property of the element in itself, *i.e.*, in its own internal organisation, or that it affects the relations of atoms amongst each other?

Apparently the latter, for Mr. Spencer proceeds to note the relations of oxygen and nitrogen, the former having extreme mobility (?) and an extensive range of affinities, and the latter little of either. He asks us to suppose a mass of them. In trying to do so, we naturally suppose oxygen and nitrogen combining by mutual attraction. But how is union affected by the extreme mobility of one and the immobility of the other? That will depend upon what mobility means.

But Mr. Spencer says, "Let a force fall upon this mass." But this is too indefinite. What "force" are we to suppose? Shall we say heat or light? The result would be segregation; all the nitrogen would gather itself together, and all the oxygen would separate itself from the nitrogen. We cannot say that it is quite clear to us *à priori* why the incident force should produce this effect.

But there is a graver difficulty than this, referring to the distinction, if any, between chemistry and physics. Mr. Spencer does not sufficiently explain this distinction, nor show how they mutually affect each other, if there is any. How do the mobilities of the elements affect their combinations, and how far do they interfere with the combinations due to the affinities? and, conversely, how do the affinities affect the mobilities of the elements? Again, to which of them are due the phenomena of allotropism, isomerism, polymerism, atomic weight, &c.; or are there other properties of substances besides those of molecular mobility and chemical affinity? Are there properties, for instance, of relative weight (attraction of gravitation), shape, size, &c., which affect the combinations and dissociations of the elements?

In sect. 5 Mr. Spencer proposes the enquiry how "mechanical principles" may solve all these questions, and indicates the result of such a study.

Firstly, as to "molecular mobility," Mr. Spencer says that "the molecular mobility of a substance" (*say a cubic foot of water or a cubic foot of oxygen*) "must depend partly on the inertia of its molecules" (*inertia = continuance in the same state either of motion or of rest*), "partly on the intensity of their mutual polarities" (*polarities not defined*), "partly on their mutual pressure" (*intensity of mutual polarity?*) "partly on the molecular mobilities of their component molecules" (*molecular mobility is not defined, nor is it stated whether it is a constant or a changing property of the molecule*). Mr. Spencer says that any three of these four remaining constant—of which four molecular motion is one—the "molecular mobility will vary as the fourth." So that molecular mobility is really regarded as being a variable, and only the first three remain constant. Molecular mobility, then, is not an essential and fixed property of any substance, and the contrast heretofore made between oxygen and nitrogen in this respect does not hold good as an essential property of either. We cannot say that oxygen has extreme mobility, because its mobility depends upon inertia, mutual polarity, and mutual pressure. It is a variable quality dependent upon these. Molecular mobility of a substance decreases towards the centre of a mass, and thus the molecular mobility of oxygen is not a constant property; but a mass of oxygen would exhibit less molecular mobility towards its centre than perhaps would be manifested by the outside atoms of a mass of nitrogen. Therefore the contrast in this respect between the two substances would seem not to be an essential one, but dependent upon conditions.

The next conclusion to which Mr. Spencer would come, is derived from the application of a mechanical law known to hold good of masses to the case of molecules. This law is that "inertia and gravity increase as the cubes of the dimensions, while cohesion increases as their squares," by which "the self-sustaining power of a body becomes relatively smaller as its bulk becomes greater." From this it would result that large molecules are not as stable as smaller ones. Mr. Spencer then proceeds to say that this "must be accompanied by a decrease of those contrasts of dimension to which Polarity is ascribable."

Polarity, then, is to be considered under the heading of Mechanics. It is ascribable to contrasts of dimension. This is not very clear; does it mean that Polarity, in other places regarded as the attraction of Polarity, depends upon size and shape?

Simple mutual attraction results in a sphere, which is the figure of equilibrium. When, in addition to simple mutual attraction, there is polar attraction, then the result is different. Polarity being due to contrasts (or harmonies) of dimension, the spherical grouping will be overcome by the tendency towards some more special form, determined by the mutual polarities of the units. This will more especially be the case if the number of units or atoms is small. "But it is manifest that in proportion as an aggregate atom becomes larger, the effects of simple mutual attraction must become relatively greater; and so must tend to mask the effects of *polar* attraction. There will consequently be . . . a less distinct polarity than in simpler atoms. If this inference be correct, it supplies us with an explanation both of the chemical inertness of these most complex organic substances, and of their inability to crystallise."

Here the argument becomes confused. We have had so far three factors: Mechanics, or simple mutual attraction; Polarity, or special attractions apparently due to properties of dimension; and Chemistry, or the affinities of atoms. We found that increase of bulk meant the predominance of mechanics over Polarity, and consequent greater liability to rearrangements and decompositions of molecules. Then we had bulk-mechanics, overriding Polarity and resulting in chemical inertness and inability to crystallise. The latter may be impossible from the premises, but how can we possibly understand *chemical* inertness? Has chemistry anything to do with Polarity? Has chemical affinity anything to do with bulk? Are the affinities of oxygen affected by increase or decrease of bulk? Are they in inverse ratio to the bulk? What has chemistry to do with either simple mutual attraction, or with polar attraction, or with bulk?

Based upon these nebulous theories there follow some highly ingenious reasonings in the succeeding pages, which from the vagueness of the commencement it is difficult to follow and impossible to criticise. The conclusion is stated in sect. 9.

Here it is said that "the mutual affinities of the chief organic elements are not active within the limits of those temperatures at which organic actions take place." This implies a dependence of polarity upon mechanical motion. What are affinities? Are they forces or motions? What are temperatures? Motions? Then, how does Motion affect affinities so as to render them active? Again, complexity means instability. "And those most complex compounds into which all these four elements enter . . . have an instability so great that decomposition ensues under ordinary atmospheric conditions." But on the other hand we have already seen (p. 15) that we had an explanation "of the chemical inertness of these most complex organic substances" as due to colloidal sphericity.

Next we have the "tendency to unite in multiples." Then molecular mobility again, which gives a plastic quality fitting for organisation. And it is remarked of these compounds that "the absence of power to unite together in polar arrangement, leaves their atoms with a certain freedom of relative movement which makes them sensitive to small forces, and produces plasticity in the aggregates composed of them."

The distinction between a colloid and a crystalloid molecule seems to be that the latter is more simple in construction, smaller in bulk, and has a definite shape, while the former, in consequence of its bulk and complexity, loses the special polarities due to the shapes of its constituents, and its own spherical form is due rather to general or simple polarity (the attraction of gravitation), which holds the constituent atoms together by a loose and elastic sort of bond, with a liability to give way to pressure, to stretch out with tension, and to spring back to its original sphericity when relieved of the external force (p. 25). But notwithstanding this quality, which facilitates temporary alterations of form, it is a quality which also assists, strange to say, permanent alterations. Continued pressure destroys this inherent property of colloidal molecules, gradually diminishing and finally annihilating its power of resuming the outline it had at first. The fact is here stated, but the *a priori* reason for it is not given, and indeed it seems contradictory of the constitution and powers of the colloidal molecule as previously explained.

This chapter is a study having for its object an explanation of "polarity," but we have to take up other considerations by the way, to see how they stand with regard to it. On pages 25 and 26 various forces are mentioned which affect molecules, viz., quasi-mechanical forces, capillary affinity, evaporation of water, osmose, &c.; then again (p. 27), heat, or a raised state of molecular vibration; and finally light, or ethereal undulations (p. 28). On page 32 is set out a theory of the action of these ethereal undulations in effecting changes of molecular combination. The ethereal waves are treated as if they were waves of solid substance. One atom is held to another by a positive force (Polarity, presumably), and it is detached from it by the superior force or peculiar harmony of the rates of motion of the ethereal waves, and brought within the reach of other atoms with which it has some affinity, although a weaker one than that operating in the original combination; and thus, Polarity is overcome, and some other Polarity supervenes. Thus we see the relations of atomic polarities and ethereal undulations in changes of molecular combination.

We next come to chemical affinity, the agency of chief importance in the changes of organic matter. Organic matter is extremely modifiable by chemical agencies. We must presume that chemical agencies are the special polarities of atoms, and a chemical change is effected when a set of molecules come into contact with other molecules for which they have polar affinities, and pair off with them accordingly. This again is a process which propagates itself, and when a change of this sort is set up in a mass by some external force, the change will be continued in neighbouring similar matter, as in the case of fermentation. A slight local disturbance inducing more intimate combinations of contiguous atoms will communicate a motion of combination throughout a mass.

(*b.*) *Polarity, Growth and Development.*

The next important teaching of the author bearing upon the subject of our special study is in the chapter on "Growth." Here we find that the aggregation of matter produced by *simple attraction* may go on without end, but there appears to be a limit to that more definite kind of aggregation which results from *polar attraction.* Thus we find that each element or compound has its usual size beyond which there is a tendency to form new crystals rather than to increase the size of those already formed. The organic world is then surveyed to illustrate the same truth, leading to the inference that the limit of growth is there due to the same cause as in the case of crystals, which would imply polarity on the part of these colloid molecules, though we have already decided that they have no polarities. However, the tenor of the argument is immediately changed, and we lose sight of the influence of special polarities, and even of simple polarity in respect to growth and its limits. Organisation comes in as affecting the bulk of plants and animals, and other considerations supervene which do not concern our present study.

Our interest recurs in the relation of Polarity to Development (p. 151). Polarity is at the bottom of segregation, and segregation not only is the accretion of mass from suitable materials in the environment, but it also explains the interior differentiations of a mass of organic matter. So that polarity, possibly under the influence of externally communicated motions, such as light and heat, determines the gathering together within the mass of like molecules in one part, and diverse like molecules in another part. This implies a degree of unlikeness amongst the constituent units which negatives the conception of original homogeneity, and also contradicts the theory of the loss of polarity of colloids due to their bulk and sphericity.

The process is called "selective assimilation, and illustrates this general truth, that the pre-existence of a mass of certain units produces, probably by polar attraction, a tendency for diffused units of the same kind to aggregate with this mass, rather than elsewhere. . . . . Particular parts of the organism are composed of special units, or have the function of secreting special units, which are ever present in them in large quantities. The fluids circulating through the body contain special units of this same order. And these diffused units are continually being deposited along with the groups of like units that already exist. How purely physical are the causes of this selective assimilation," &c. Again, "Where the component units of an organ, or some of them, do not exist as such in the circulating fluids, . . . it is clear that the process of differential assimilation is of a more complex kind. Still, however, it seems not impossible that it is carried on in an analogous way. If there be an aggregate of compound atoms, each of which contains the constituents A, B, C, and if round this aggregate the constituents A and B and C are diffused in uncombined states ; it may be suspected that the *coercive polar force* of these aggregated compound atoms A, B, C, may not only bring into union with themselves adjacent compound atoms A, B, C, but may cause the adjacent constituents A and B and C to unite into such compound atoms, and then aggregate with the mass." However, this theory of the manufacture of its constituents out of the raw material is set forth only as a theory, and the hypothetical theory of a "coercive polar force" which does this work must be held in abeyance.

(*c.*) *Polarity and Function.*

Polarity apparently has nothing to do with Function, for it is not mentioned in the chapter on that subject. Yet they must be indirectly related. Function preceded structure (p. 167). Function is equilibration or the opposing of an inner force to meet, resist, or balance an external force. Equilibration in the sense in which it is applied to a moving equilibrium is the cause of structure. How then are equilibration and polarity related, more particularly as regards their dealings with masses of homogeneous organic matter? If we are to regard colloid molecules as destitute of polarity, polarity is out of court. The burthen of construction would consequently be thrown upon equilibration. What then is the relation of equilibration to the operations of simple and special polarities?

(*d.*) *Polarity and Waste and Repair.*

Mr. Spencer acknowledges that it is not easy to find a deductive interpretation of the phenomena of Repair.

"The tendency displayed by an animal organism, as well as by each of its organs, to return to a state of integrity by the assimilation of new matter, when it has undergone the waste consequent on activity, is a tendency which is not manifestly deducible from first principles, though it appears to be in harmony with them."

Is the difficulty got over by the theory of a "coercive polar force," as already partially discussed (§ 54), by which "groups of compound units have a certain power of moulding adjacent fit materials into units of their own form"? Is there not reason to think that such a power exists?

Mr. Spencer then proceeds to establish inductively the belief that there is such a power. It is shown that the blood has the power of forming blood molecules in specialised forms, and the same power is claimed for each organ.

"Indeed the assertion of this power is little more than an assertion of the fact, that organs composed of specialised units *are* capable of resuming their structural integrity, after they have been wasted by function. For if they do this, they must do it by forming from the materials brought to them, certain specialised units like in kind to those of which they are composed; and to say that they do this, is to say that their component units have the power of moulding fit materials into other units of the same order.

"The repair of a wasted tissue may therefore be considered as due to forces analogous to those by which a crystal reproduces its lost apex, when placed in a solution like that from which it was formed. In either case, a mass of units of a given kind, shows a power of integrating with itself diffused units of the same kind: the only difference being, that the organic mass of units arranges the diffused units into special compound forms, *before* integrating them with itself."

There are two ways of looking at this statement—firstly, as regards its deducibility from first principles. It is manifestly a hypothesis arrived at inductively, and possibly a correct hypothesis, but it does not seem a deduction from any first principle; if so, what is that first principle, and how is the deduction effected? If anything, it is a deduction from polarity; but then polarity in its rigidity, as due to dimensions and as exemplified in crystallisation, is not applicable to the more bulky and special and unstable morphology of a colloid molecule. And again, the coercive force or coercive polarity of a mass over adjacent units, as exemplified in the force of a magnet over iron-filings, is very indistinct in its analogous application to the coercive force of an organ over the materials in the blood. Is the assimilation of material in the nervous system, the muscular tissue, the osseous structures, the skin matter, &c., only an arrangement in certain different shapes or orders of the materials assimilated? No; the assimilation is a process of selective assimilation, and apparently a process of molecule-manufacturing before assimilation which cannot be deduced from the polarity of molecules nor from the coercive polarity of organs, without more definite comprehension of what is meant by polarity. Therefore the deductive interpretation of a possibly correct statement of the facts fails. This is the more certain when Mr. Spencer himself makes the important confession that polarity is "a power of whose nature we know nothing" (p. 179).

Secondly, the question arises, Has equilibration anything to do with repair? Function modifies structure under the law applicable to moving equilibria, that opposing external forces are met by resistive inner arrangements. Therefore the increment of parts, which is the result of this law of equilibration, is due to it, and not to polarity. The thickening of fur, for instance, is due to equilibration. But the thickening of fur is the deposit of suitable molecules of that portion of the organic economy. Therefore the deposit of special molecules in this case is not due to coercive polar force of the mass over the adjacent molecules, but to the establishment of equilibrium between the organism and its environment. What we need to know is, how this general equilibration effects the increased assimilation of materials in the fur? Is it effected by means of the coercive polar force of the existing fur? If so, how is this coercive force regulated by the law of equilibration? What are the relations between the general equilibration of an organism and the coercive polar forces by which the details of fresh arrangements are carried out?

We may remark parenthetically that polarity seems to have nothing to do with waste, but only with repair, and in the latter no reference is made to chemical affinity, with which, perhaps, it is regarded as identical. Yet in regard to waste, are we not bound to suppose a waste or expenditure of polarity? If so, we are bound to range polarity within Professor Stewart's list of energies.

The principal view in which Mr. Spencer regards it is as to its power of restoration of parts to a damaged organism. The process is comprehensible in a crystal where particles of similar shape in a moving liquid condition fall into suitable arrangements with a mass with whose particles it has polar affinity, but is not to be understood when applied to colloids of such bulk as to imply a spherical shape in which the special polarities of its constituents are lost.

Yet Mr. Spencer says, "We must in the case of the organism assume an analogous force." Hence the restoration of a lizard's leg or tail, by the filling out of the original outline. This implies not only a coercive polarity in the mass, but the coercive polarity of the colloid molecules of the lizard's blood. We already know, however, that colloid molecules are destitute of polarity. Nevertheless Mr. Spencer suggests the hypothesis, "That the form of each species of organism is determined by a peculiarity in the constitution of its units—that these have a special structure in which they tend to arrange themselves; just as have the simpler units of inorganic matter." This, it seems to us, is in direct contradiction to the doctrine of the morphologic instability and loss of polarity by the bulky and complex and colloid molecules as taught in the Appendix. Mr. Spencer says (p. 180)—

"We have therefore no alternative but to say, that the living particles composing one of these fragments, have an *innate tendency* to arrange themselves into the shape of the organism to which they belong. We must infer that a plant or animal of any species, is made up of special units, in all of which there dwells the *intrinsic aptitude* to aggregate into the form of that species : just as in the atoms of a salt, there dwells the *intrinsic aptitude* to crystallise in a particular way."

It would be well here to have gone a little more into detail. We can understand how the polarity of a salt will cause the completion of the outline in a mass due to the outline of its constituent particles. It is thereby homogeneous throughout. But even if we granted the same power to organic molecules to aggregate into a mass of a definite form or shape in accordance with their own peculiar specific shapes, yet the only result we could arrive at would be a similar homogeneous mass, the form or shape of which would be the result of the building up of specific shapes. But animal and vegetable masses are not homogeneous, nor aggregated in such a general form as to be the calculable result of the forms of constituent particles. We defy any one to draw the outline of a particle which by building up should produce the resultant outline of a horse. And if we examine the horse, we find a heterogeneous structure and composition which would seem to upset the theory that its construction is due to specific shapes of constituent molecules. In fact, so contrary is this theory to the general facts of vegetable and animal life, that one is tempted to characterise it as absurd.

But this gives Mr. Spencer an opportunity of treating of—

(*e.*) *Polarity in General.*

He takes it as a name for the force by which inorganic units are aggregated into a form peculiar to them.

Let us examine this statement before proceeding farther. Inorganic units may be simple or complex. We may take it that simple units are aggregated into complex units by polarity. It is not clear whether this aggregation commences with similar units or with diversified forms of units, but in any case aggregations proceed under the force of polarity, and whether from different modes of aggregation or from original diverse forms, great diversities of form and aggregation are eventually produced. By and by certain stable and completed forms of aggregate units are produced, and then there goes on a construction into masses due to the forms of these completed molecules. This is effected by means of polar force.

Now with respect to this polar force several questions arise. Firstly, Is it an energy that is interchangeable with the other energies, viz., those chemical separations, those variable rates of molecular motion called heat, light, &c., which we formerly considered? Secondly, Has it anything to do with chemical energy and activity or chemical inertia or indifference? Thirdly, Has it anything to do with equilibration, and if so, are its equilibrations confined to the equilibrations of polar forces, or do polar forces ever come into antagonism with other energies, viz., heat, light, electricity, gravitation, &c.? Fourthly, Is it a corollary from anything, or are its manifestations corollaries from anything, and what are the corollaries from polarity? Generally speaking, what is its scientific position in physics?

Mr. Spencer says (p. 181) that we may apply the word "polarity" to the analogous force displayed by organic units. Yet he says it is "but a name for something of which we are ignorant—a name for a hypothetical property which as much needs explanation as that which it is used to explain. Nevertheless, in default of another word, we must employ this: taking care, however, to restrict its meaning. If we simply substitute the word polarity for the circuitous expression—the power which certain units have of arranging themselves into a special form, we may, without assuming anything more than is proved, use the term organic polarity, or polarity of the organic units, to signify the proximate cause of the ability which organisms display of reproducing lost parts."

With regard to this we have to say, in addition to what has gone before, that we apprehend the main distinction of organic aggregates from inorganic aggregates consists in the power of the one to coerce its constituents, while in the other the constituents determine the form of the aggregate. "The power which certain units have of arranging themselves into a special form" results in that special form, and is the special character of inorganic crystalloids. The power of the aggregate in specialising the forms of the constituent units is an opposite power, and is the characteristic of organic aggregates. The two processes are not analogous, but diametrically opposed.

(*f.*) *Polarity and Physiological Units.*

Always bearing in mind the teachings of Mr. Spencer with regard to the non-polarity and morphological instability of colloid molecules, let us now consider those physiological units, "which possess the property of arranging themselves into the special structures of the organisms to which they belong."

Mr. Spencer teaches us (p. 182) that this property does not reside in the *chemical units* nor in the *morphological units.* By this he does not mean, as one would suppose, that there are chemical units and morphological units existing separately in the blood, but only this, that structure is not due to chemical combinations of oxygen, nitrogen, hydrogen, &c., nor to the particular shapes of some combinations of these. Therefore, he says, we must conceive of some intermediate units, which we may call physiological. The term intermediate would indicate an intermediate position of the same order; that is to say, in the order of constructive aggregation. But elsewhere Mr. Spencer defines physiology as the function or habit of action of the same unit which, otherwise viewed, is a morphological one, having specific structure, shape, and size. We will not, however, minutely reflect upon the loose language of this explanation, but take the positive teaching as it stands, viz., that not to the chemical qualities of certain molecules, nor to the shape of them, is due the polarity which produces that peculiar aggregation of heterogeneous structure and composition which we call an organism. It is due to certain aggregates of these chemical units, exceedingly complex, which have a distinctive character. Some slight differences in the composition of these complex molecules and their consequent display of forces produce these distinctions of character. These distinctions of character again produce the differences of form which the aggregates exhibit.

Does this mean that the physiological unit of a horse, which unit is something more than a chemical unit or a morphological unit, produces the aggregate horse, and that the horse is a consequent of its units, as the crystal is a consequent of its constituents? No; for the crystalline structure is due to the chemical affinities, the simple polarities and shapes of the constituent molecules, whereas these are deemed insufficient in the case of the organic constituents. Physiological units display forces over and above these simple properties.

In the next two chapters on "Adaptation and Individuality" polarity finds no place; but, as remarked under the heading of "Function," it is not easy to see what is the relation of polarity as subordinate to biological equilibration—that is to say, in the anticipatory opposition of inner forces to outer forces. Neither are we enlightened on the subject of the disintegration of organisms, which again seems opposed to, and in certain circumstances overcomes, the polar forces which produce integration.

(*g.*) *Polarity and Genesis.*

Polarity makes its appearance again in the chapter on "Genesis." On page 220 we find that—

"Conclusive proof obliged us to admit, that the component units of organisms, have inherent powers of arranging themselves into the forms of the organisms to which they belong."

Hence sperm-cells and germ-cells have the same powers.

From page 221 it would appear that the physiological units which have produced an organic aggregate have themselves become variously modified in the process, these modifications being effected not by means of incident forces but by means of ancestral forces; and the question arises, Is the organic aggregate still to be regarded as the result of the distinctive character of the physiological units? It would seem not, for in the process the physiological units have themselves become modified. The sperm-cells and the germ-cells differ from the other physiological cells of a completed organism in not having become modified. But if an organism has specific physiological cells, and great masses of these physiological cells of which it is composed have become modified into organs—which are the genuine physiological cells which have produced the organism? It is said that the great bulk of them, without being subject to external influences, as in the growth of the embryo, have departed more or less from the original and general type. Of germ-cells and sperm-cells it is said, "Not that they are peculiarly specialised, but rather that they are unspecialised; such specialisations as some of them exhibit in the shape of locomotive appliances, &c., being interpretable not as intrinsic, but as extrinsic, modifications, that have reference to nothing beyond certain mechanical requirements." Here Mr. Spencer admits that structure is not due to polar forces of physiological units, but that these physiological units become modified by external forces. He does not surely mean that these modifications of physiological units go to the extreme of furnishing them with locomotive appliances, &c. But in all this it seems to us the argument of construction as dependent upon the distinctive characters of physiological units becomes very much attenuated.

After the union of sperm-cells and germ-cells what has polarity to do? Does coercive polarity set in? Mr. Spencer does not follow this up. Two equilibria unite (p. 223) and destroy each other's equilibrium, and set up changes and cell-multiplication, or the manufacture of physiological units fit for assimilation; and it is to be presumed that coercive polar force is the instrument by which this manufacture and assimilation is effected; also by means of the distinctive character of the physiological unit and its polarity these aggregations are worked into a dependent and consequent structure. After this external mechanical forces are supposed to modify these physiological units, and prevent the structure that would logically result from their distinctive character; yet, none the less, the result is a copy of the parent organism, with an exact repetition of all those peculiarities which are set down as the result of modifications of the physiological units by mechanical forces—those external forces, namely, which are in actual relation with the physiological units; for how can those pre-existent ones which modified the physiological units of ancestors act otherwise than through the modified polarities of the sperm-cells and germ-cells? Surely there is much yet to explain in the part played by the polarity of physiological units in the development of the embryo as against modifying forces, which, neither as forces acting in the past on ancestral organisms nor in the anticipated future, are directly in relation with these actual developments consequent upon the properties of the physiological units so as to modify them. The difficulties are enhanced when we come to consider the chapter on "Heredity."

(*h.*) *Polarity and Heredity.*

Page 253.—"The power which organisms display of reproducing lost parts, we saw to be inexplicable except on the assumption that the units of which any organism is built have an innate tendency to arrange themselves into the shape of that organism (§ 65). We inferred that these units must be the possessors of special polarities, resulting from their special structures; and that by the mutual play of their polarities they are compelled to take the form of the species to which they belong. And the instance of the *Begonia phyllomaniaca* left us no escape from the admission that the ability thus to arrange themselves, is latent in the units contained in every undifferentiated cell."

The theory is much the same as that of the building up of crystalloid aggregates. We are to suppose a number of physiological units, very complex, being made up of aggregates of molecules, the result being a special shape, and special polarities which are the laws of their mutual combination. The resulting combination in this case will be a shape and construction due to the shapes and polarities of the constituent units.

The result from the bare statement given would be the formation of a homogeneous colloidal mass without any definite shape. There is no reason to suppose anything more than an irregular lump of material. Besides which we have to point out, that although we are using the term physiological unit, the result, together with that of the analogous crystalloid process, is purely morphological. The whole course of the reasoning would be precisely the same were the term "morphological unit" substituted for the term "physiological unit;" the only utility of the latter is that it is apt to lead better towards the affiliation of organic processes upon inorganic, and in effecting one of those verbal transformations of a logical process by which the theory of evolution is worked out.

Again—

"And here the assumption to which we seem driven by the *ensemble* of the evidence, is, that sperm-cells and germ-cells are essentially nothing more than vehicles, in which are contained small groups of the physiological units in a fit state for obeying their proclivity towards the structural arrangement of the species they belong to.

"We must conclude that the likeness of any organism to either parent is conveyed by the special tendencies of the physiological units derived from that parent. In the fertilised germ we have two groups of physiological units, slightly different in their structures. These slightly different units severally multiply at the expense of the nutriment supplied to the unfolding germ—each kind moulding this nutriment into units of its own type. Throughout the process of evolution, the two kinds of units, mainly agreeing in their polarities and in the form which they tend to build themselves into, but having minor differences, work in unison to produce an organism of the species from which they were derived, but work in antagonism to produce copies of their respective parent-organisms. And hence ultimately results, an organism in which traits of the one are mixed with traits of the other."

Again, if the organism be changed in response to environment, as when, for instance, in a chilling climate fur thickens, or from the necessity of escaping capture fish attain the power of adapting their colour to that of their environment, then the physiological units undergo some slight modification, of such a nature that, when rebuilt into new organisms, the new shape or the acquired power is exhibited and established. And thus—

"Bringing the question to its simplest and ultimate form, we may say that as, on the one hand, physiological units will, because of their special polarities, build themselves into an organism of a special structure; so, on the other hand, if the structure of this organ is modified by modified function, it will impress some corresponding modification on the structures and polarities of its units. The units and the aggregate must act and re-act on each other. The forces exercised by each unit on the aggregate, and by the aggregate on each unit, must ever tend towards a balance. If nothing prevents, the units will mould the aggregate into a form in equilibrium with their pre-existing polarities. If, contrariwise, the aggregate is made by incident actions to take a new form, its forces must tend to re-mould the units into harmony with this new form. And to say that the physiological units are in any degree so re-moulded as to bring their polar forces towards equilibrium with the forces of the modified aggregate, is to say that when separated in the shape of reproductive centres, these units will tend to build themselves up into an aggregate modified in the same direction."

Thus when, in obedience to the law of moving equilibria, the animal preceding the moose-deer opposed to the incident external forces the enormous and weighty horns and powerful neck muscles and fore-quarters, the change so effected produced in its physiological units some corresponding modification of structure and polarities, so that when they came to be built up again, they produced the hind-quarters as they were before, and the fore-quarters and horns as newly modified. It seems strange that the effect of building up the modified physiological units of the sperm-cells and germ-cells should be confined to one part of the animal, and should not extend to the whole of it.

In the next chapter, on "Variation," and in the chapter on "Heredity," certain instances are quoted of the hereditary transmission of peculiarities of parts, such as deafness, malformations of limbs, fingers, &c. Are we to suppose that the transmission of peculiarities of parts is due to alterations in the constitution of physiological units from which the whole structure is built? If so, how and in what manner are the sperm-cells and the germ-cells modified by the changed developments of the animal so as to reproduce the peculiarities of parts, such as deafness or malformations?

(*i.*) *Polarity and Variation.*

This chapter deals with the equilibration of organisms in response to incident external forces; with the consequent modification of the physiological units; with the admixture of the slightly different physiological units of two parents; with the fact that every organism is built up not of one class of physiological units but of two or more; with the fact that the germ-cell and sperm-cell each contains not one class of physiological units but two or more, by which, according to the predominance in quantity and particular distribution, will be the form of different parts of the resultant organism.

This view of the subject effects a serious change in the character of our studies. Hitherto it has been a simple matter to suppose (what indeed we found to be quite insufficient practically) that the construction and shape of an organism are consequent upon the construction and polarities of simple and like physiological units. But we have now to suppose that the structure and form of an organism are due to the structure and polarities of four or eight classes of physiological units derived from immediate or remote ancestors. These mixed up together segregate, and thus, by their coercive force on incoming material, form and add to themselves fresh physiological units. But while preserving the original type they will reproduce specialties of shape and function of various ancestors; not, however, that dissymmetry will be produced, in that one leg will be longer than another, or one arm longer than another.

We are not, however, engaged in examining the correctness of the theory, but in ascertaining what part is played by polarity in biological history; and here it would seem that the alteration of shape or function of an organism has the effect of altering the structure and polarities of the constituent units. How this is effected is not set out. It is merely a general inference that it must be so. An alteration of equilibrium in the growth of horns in balance with some external force causes a general readjustment of equilibria throughout the body, and therefore the structure and polarities of the physiological units must be so altered that in succeeding generations the building-up of these units must result in a creature with horns. It is difficult to conceive the nature of such an alteration, nor is its *à priori* justification at all apparent. We do not see how the addition of horns can alter the constitution of the physiological units in the sperm-cell and germ-cell.

However, what we actually find is, that alteration of shape or function in an animal affects the shapes and polarities of physiological units; and these altered shapes and polarities reproduce the alterations in the new organisms. Polarity is said to be the agency by which the change is carried forward. What is the nature of this change of polarity? Is the polarity of a colloid molecule the result of the polarities of its constituent atoms?

It seems to us, however, that when we talk of physiological units—which are colloid molecules—being so modified by the changes of an organism as to reproduce these changed forms as a consequence in their building-up, and are therefore to be regarded rather as morphological units, we are talking quite out of the reach of our knowledge, and are trespassing far beyond the range of legitimate deduction. We have no warrant either from induction or deduction for our attempt, and we are unable to work out our problem. We are brought to a perfect stand-still.

(*k.*) *Polarity as a Factor in Genesis, Heredity, and Variation.*

Genesis, Heredity, and Variation are made to depend largely upon Polarity for their operations. This has already been made manifest. In a new chapter Mr. Spencer gives us an *ensemble* of the operations. The comprehension of the general history of biological change not being our present purpose, there is no need for us to consider the necessity for the overthrowing of an equilibrium, nor for the expenditure and reception of force, nor for growth and its cessation. We are only concerned with the part played by polarity, and as regards that point we only find a repetition of what has gone before. Physiological units have special structures and polarities. They are not exactly alike. Several similar but not exactly identical molecules are mixed together in a fertilised germ. Incoming materials are variously appropriated by each. The constituent physiological units exert a *coercive force*, apparently a polar force, over the raw materials, in conformity with which the materials range themselves.

We certainly do find ourselves in a state of confusion when we read that there are in the organism (which is the result of the special structures and polarities of its physiological units) certain molecular forces antagonistic to the forces exercised over them by the aggregate (p. 275). Is the result of a cause antagonistic to its cause? Whence have come the forces of the aggregate but from the molecular properties? How then can the aggregate turn round with forces antagonistic to its constituent molecules? The whole of the very abstruse reasoning on this page is rendered unintelligible from this enigma.

On p. 278 we find that polarities can be balanced or partially balanced, and that they have a great deal to do with the first stages of the developments incident upon the union of sperm-cells and germ-cells.

And one of the most remarkable things in all this history of integrations and disintegrations is the absence of any reference to the law of co-operation between the three factors in the universe—Matter, Motion, and Force—as set down in the Formula of Evolution. We ourselves have only just recollected it, and Mr. Spencer seems to have forgotten it altogether. The concomitance of the dissipation of motion with these integrations of matter is never mentioned at all, never asserted, never explained. All these complicated processes go on, and that which is supposed to be the key to them all is never advanced either to receive illustration or to throw light upon the intricacies of our study. Indeed, life while it integrates matter also integrates motion instead of dissipating it.

In § 97 Mr. Spencer recapitulates for us the general biological forces. We have, in the first place, units of organic matter which are large, heterogeneous, and unstable in a high degree. Of these are formed other units. What must be their properties? "Already the colloidal atoms are extremely unstable—capable of being variously modified in their characters by very slight incident forces; and already the complexity of their polarities prevents them from readily falling into those positions of polar equilibrium which result in crystallisation. Now the organic atoms composed of these colloidal atoms, must be similarly characterised in far higher degrees."

But, on the other hand, Mr. Spencer supposes that each organ is built up of those highly plastic units peculiar to its species. The question arises, Have these plastic units any defined specific properties sufficiently settled to enable a building-up process to take place? However, he says that these units, when mixed, work towards an equilibrium of their complex polarities. One would think that if this was all they did, some half-dozen of them or fifty of them would soon be able to do it in a very direct manner. But no; they do it by adding raw material to themselves, and by producing an aggregate due to their specific properties; the difficulty of their mechanical modification into bone, muscle, &c., not being explained, and the difficulty of their eccentricities of form not being explained. Then a modified aggregate modifies the constituent physiological units, and so on over again.

Nor is the difficulty explained how in an organism where nearly all the physiological units become specialised into different organs, there are some few which do not become specialised by the organs they occupy:—on the contrary, special organs exist, and are apparently constructed, for the express purpose of secreting them, preserving them, and excreting them as unspecialised. This explanation is partly attempted on p. 288, where we are told it is due to an excess of manufacture of physiological units which cannot be amalgamated with any special organ, and which will arrange themselves into the structure peculiar to the species if freed from controlling forces and placed in fit conditions of nutrition and temperature. We presume a plastic molecule, which we would have supposed perfectly contented to retain any form in which it found itself, would not so arrange itself into a definite form. And again, how can we imagine that the structure in which it is placed protects it, and supplies it with nutriment?

Mr. Spencer winds up the exposition with the usual moral, namely, that all these biological changes are thus seen to be corollaries from those universal principles implied in the Persistence of Force.

(*l.*) *The Double Power of Physiological Units in Construction and Modifiability.*

We have now described with sufficient amplitude Mr. Spencer's teachings respecting the part which Polarity plays in biological changes.

The main question respecting them is—Are colloid molecules so decided in their polarities and shapes that their interrelations sufficiently resemble those of crystalloids to justify an analogous reasoning with regard to their power of effecting similar results in structure: or whether, on the contrary, they are so weak in polarity, so unstable of form, and so susceptible to change, that their mutual interrelations cannot produce structure and organisation? On this point we have two sets of teachings. On the one hand, we are told that general structure results from the structure and polarities of physiological units. On the other hand, we are told that colloid molecules are unstable in shape and indecisive in their polarities.

Thus we find in "Biology," vol. ii. p. 11 :—

"We set out with molecules one degree higher in complexity than those molecules of nitrogenous colloidal substance into which organic matter is resolvable; and we regard these somewhat more complex molecules as having the implied greater instability, greater sensitiveness to surrounding influences, and consequently greater mobility of form." We find them forming an aggregate, "showing vitality only by a higher degree of that readiness to change its form of aggregation, which colloidal matter in general displays; and by its ability to unite the nitrogenous molecules it meets with, into complex molecules like those of which it is composed."

Again, vol. ii. p. 346 :—

"There is good reason for ascribing it to the extreme instability of the organic colloids of which protoplasm consists. These, in common with colloids in general, assume different isomeric forms with great facility, and they display not only isomerism but polymerism. Further, this readiness to undergo molecular rearrangement, habitually shows itself in colloids by the rapid propagation of the rearrangement from part to part.

As Professor Graham has shown, matter in this state 'pectizes' almost instantaneously."

"Biology," vol. i. p. 486 :—

"Step by step as the aggregate molecules so resulting, grow larger and increase in heterogeneity, they become more unstable, more readily transformable by small forces, more capable of assuming various characters. Those composing organic matter transcend all others in size and intricacy of structure; and in them these resulting traits reach their extreme. As implied by its name *protein*, the essential substance of which organisms are built, is remarkable alike for the variety of its metamorphoses, and the facility with which it undergoes them; it changes from one to another of them on the slightest change of conditions."

The question thereupon arises how such units, so devoid of stable shape and form, so susceptible to the least change of conditions, can form the definite units by which structures are built up, and result in shapes due to the definite units of which they are so built up?

If we follow out the latter idea in a structure containing millions of millions of units, it is not so certain that, even if any did contain units of a particular shape, there would be much difference, for the differences of shape are lost in an immense mass. A large building, for instance, may be built as well of solid hexagons as of cubes.

However, to return to the question. Is it possible to get these unstable, and indefinite, and changeable forms so fixed as to have some definite result in structure, yet not so fixed as to be incapable of change? We do not see how it can be done. We are unable logically to follow Mr. Spencer's *à priori* process to this result. If it is of the essence of complex colloid molecules to be unstable, changeable in shape and polarities, we do not see how they can ever reach definite properties. And even though we grant that in a mass this changeableness to external conditions would produce changes in different parts of the mass, we do not see that any typical unit would be produced. The undifferentiated and unspecialised unit in the interior would remain unspecialised still, just as unstable and shapeless as ever. And even if it be granted that differentiation and specialisation took place throughout the mass, then still less is there any typical physiological unit which, separated, would aggregate to itself other molecules to form a similar heterogeneous mass, by a process analogous to that seen in crystalloids.

We must, therefore, leave in the hands of the reader and student the question how we can reconcile the unstable, sensitive, changing character of colloid molecules with the structure and polarities of a physiological unit, aggregating in modes analogous to crystals. We must also leave to his consideration the question how an aggregate composed of bone, muscle, nerve, &c., can have any specific physiological unit. We must further leave him to decide how the physiological unit can be unspecialised, when the germ-cell and sperm-cell are supposed to contain physiological units differentiated as coming from different ancestral sources, and therefore presumably specialised and producing special results. To us it seems that the physiological unit is a fast and loose object, which can be most effectively used in the logic of biological reconstruction, but without being capable either of definite application or definite criticism.

(*m.*) *A Concrete Case of Biological Reconstruction.*

We will now study a concrete case of biological reconstruction in the definite history of a fertilised germ. We will take, for instance, the case of an egg hatched upon an artificial incubator.

Now we are to suppose that one particular spot on the surface of the yolk is a fertilised germ containing ten slightly different physiological units, derived partly from the male and partly from the female progenitor. The theory is that these physiological units have the power of manufacturing by means of their own structure and polarities the raw material of their environment into units of the same constitution and polarities as themselves; and that the aggregation so formed will consequently be homogeneous with the original physiological units: with this proviso, that if there were slight differences in the original units, the mass will be made up of patches of different sorts.

This, it seems to us, would be the end of the process. To proceed further we must refer to Mr. Spencer. We will first quote a passage from "Biology," vol. ii. p. 8 :—

"We found ourselves obliged to recognise in these physiological units, powers of arranging themselves into the forms of the organisms to which they belong, analogous to the powers which the molecules of inorganic substances have of aggregating into specific crystalline forms. We have consequently to regard this polarity of the physiological units, as producing, during the development of any organism, a combination of internal forces that expend themselves in working out a structure in equilibrium with the forces to which ancestral organisms were exposed; but not in equilibrium with the forces to which the existing organism is exposed, if the environment has been changed. Hence the problem in all cases is, to ascertain the resultant of internal organising forces, tending to reproduce the ancestral form, and external modifying forces, tending to cause deviations from that form."

The first remark to make is that we do not see how, during this development (if such it can be called), the forces at work inside the egg ever come into contact with "the forces to which ancestral organisms were exposed." We might suppose, indeed, that the fertilised germ containing the ten physiological units is the result of those forces; but when we have got these, they become "a combination of internal forces," and are not subject to any contact with external forces, storms, &c., of a hundred years ago. The problem has to be worked out from the factors within the limits of the egg-shell, plus a certain amount of communicated molecular motion—the *à priori* result of which would appear to be a jelly-like mass of patches manufactured by the slightly different physiological units out of the substance of the egg.

Elsewhere Mr. Spencer says that this internal development proceeds as stated, subject to the modifying influences of mechanical forces; but in the case of an egg there are no such interfering causes, except the simple and uniform force of the communicated molecular motion called heat.

Let us now take the Appendix to vol. i. Mr. Spencer says (p. 484) :—

"There is no kind of rearrangement among molecules (crystallisation being one) which the modern physicist does not think of and correctly reason upon, in terms of forces and motions like those of sensible masses. Polarity is regarded as a resultant of such forces and motions; and when, as happens in many cases, light changes the molecular structure of a crystal, and alters its polarity, it does this by impressing, in conformity with mechanical laws, new motions on the constituent molecules."

From this it appears that polarity is not a fixed and constant property of the so-called elements. Polarity is only the resultant of the internal forces and motions of the atom, which internal forces and motions may be so altered by communicated motion as to alter its polarity, and thereby its relations to other molecules of the same sort and to molecules of other sorts will be changed. But if this is the case, and if we are therefore unable to tell the manner of these atomic variations of polarity, it seems to us that we have no foundation for chemical science or molecular physics. If polarity is a variable instead of being a fixed and constant cause, and if it is liable to be affected in the manner indicated, it surely loses its position as a ruler of structural change, and the confidence we are asked to repose in it as an explanation of crystallisation and of organic structure is destroyed.

But Mr. Spencer is talking about the influence of communicated mechanical motion upon masses of molecules having polarities—as, for instance, the influence of light upon crystallisation. Now we apprehend that this kind of influence can cause change of structural combination without supposing any change of polarity in the molecules.

Then follows, on p. 486, a long account of the cumulative aggregations of atoms into molecules, and of these into still more complex molecules and systems of molecules, already partially quoted, in order to show the changefulness, sensitiveness, and morphological instability of these aggregates in proportion to their complexity—to show a continually increasing divergence from the well-known formative properties of crystalloids, implying a continually decreasing typical form, and a consequent continually decreasing power of construction into special shapes. So much, indeed, are the polarities of these complex molecules reduced, that they have little bond of union amongst themselves—they seem only capable of being held together by the simpler molecules of sulphur and phosphorus.

The next step in the argument is in the paragraph at the foot of p. 486, where the fact of the existence of "physiological units peculiar to each species of organism" is asserted. But the statement is immediately weakened by the admission that as the organism is made multitudinous in kind, so are these units made multitudinous in kind. Which, then, of these is the "physiological unit peculiar to the species?" Which remains undifferentiated and entitled to the name, and what becomes of it? How comes it that it remains undifferentiated when, like the others, it is in contact with larger organic masses exercising coercive force; and, producing others, is able at the proper time to continue its work of reproduction? And again, how are the necessary arrangements to be made for effecting that combination with the physiological units of another slightly differing individual, in order to disturb its equilibrium, and set up a repetition of changes in that portion of its constituents which is to undergo a like series of differentiations?

To return to our special study, the question arises how, in the egg we have under consideration, these multitudinous differentiations of the typical physiological unit are effected—differentiations, we presume, into bone, muscle, nerve, and other substances?

"Every physicist will endorse the proposition that in each aggregate there tends to establish itself an equilibrium between the forces exercised by all the units upon each and by each upon all."

This is a kind of proposition that can be accepted in its absolute form, but is not capable of much practical illumination nor of much *à priori* effect. If we apply it to our practical problem, we do not get a chicken; we are still in want of a formula that will hatch the egg.

The next passage, on the one hand, is a reassertion of the formative power of colloid molecules due to the equilibrations of their polarities, while on the other hand it seems to take away almost as much from it by a reassertion of their morphological instability.

"As certainly as molecules of alum have a form of equilibrium, the octahedron, into which they fall when the temperature of their solvent allows them to aggregate, so certainly must organic molecules of each kind, no matter how complex, have a form of equilibrium in which, when they aggregate, their complex forces are balanced—a form far less rigid and definite, for the reason that they have far less definite polarities, are far more unstable, and have their tendencies more easily modified by environing conditions.

"Equally certain is it that the special molecules having a special organic structure as their form of equilibrium, must be reacted upon by the total forces of this organic structure; and that if environing actions lead to any change of this organic structure, these special molecules, or physiological units, subject to a changed distribution of the total forces acting upon them, will undergo modification—modification which their extreme plasticity will render easy. By this action and reaction I conceive the physiological units peculiar to each kind of organism, to have been moulded along with the organism itself."

We will see how this applies to our egg. Firstly, the physiological units manufacture similar units out of their environment, and then they range the new units with themselves according to the "form of equilibrium in which . . . their complex forces are balanced," resulting in a special organic structure. We do not know why the term organic is introduced here. If it implies an organism, we have not arrived at that yet as the result of the process of ranging the new molecules into the "form of equilibrium" of the colloid molecules. Suppose, however, that they may possibly range themselves into such a regular form as to be called a structure. Then the individual physiological units will be reacted upon by the total forces of the structure. Still we do not see our way to any definite structure. However, we find that the process is supplemented by the action of external forces, and thus we have a perpetual readjustment of balance, not only between units and the aggregate, but intermediately between the units and the environment. Mr. Spencer sets down the balance to—

"Actions and reactions of the two, in which the units ever tended to establish the typical form produced by actions and reactions in all antecedent generations, while the aggregate, if changed in form by change of surrounding conditions, tended ever to impress on the units a corresponding change of polarity, causing them in the next generation to reproduce the changed form—their new form of equilibrium."

But what about our egg expectant of the farmyard and green fields? We do not see how any very great structural change is effected beyond the patches of similar physiological units accreted around the several original physiological units with which we commenced. The theory of the reaction of the aggregate on the units does not assist us towards the desired differentiation of parts forming altogether a co-ordinated structure. The theory of the action of the environment is reduced to the minimum of communicated warmth, for the contents of the egg are not subjected to mechanical strains, or other external forces.

However, we must bear in mind "that the proclivity of units of each order towards the specific arrangement seen in the organism they form is not to be understood as resulting from their own structures and actions only; but as the product of these, and the environing forces to which they are exposed." They must be "subject to heat of a given degree, that is, to the unceasing impacts of undulations of a certain strength and period; and, within limits, the rapidity with which the physiological units pass from their indefinite arrangement to the definite arrangement they presently assume" (*why?*) "is proportionate to the strengths of the ethereal undulations falling upon them."

This means that the definite form into which physiological units aggregate is due not only to their structures and polarities, but also to molecular and ethereal undulations. Yet, after all, these only assist, not by modifying the shape or construction of the aggregate, but by allowing full and free play to the constituent molecules, and permitting the result the more fully and distinctly to be that consequent upon the structures and polarities of these physiological units. So far our egg remains in the state already described, and makes no progress towards a chicken.

The full statement is given thus:—"In its complete form, then, the conception is that these specific molecules, having the immense complexity above described, and having correspondingly complex polarities which cannot be mutually balanced by any simple form of aggregation, have for the form of aggregation in which all their forces are equilibrated, the structure of the adult organism to which they belong; and that they are compelled to fall into this structure by the co-operation of the environing forces acting on them, and the forces they exercise on one another—the environing forces being the source of the *power* which affects the rearrangement, and the polarities of the molecules determining the *direction* in which that power is turned."

Here the theory is that the physiological units have such a complex structure, and such complex polarities,—although these latter, according to former statements, are in inverse ratio to the former in degree of strength,—that the diverse molecules cannot balance themselves with each other otherwise than by forming a structure, in part resembling the organism from which they were disparted, and more clearly assuming a complete likeness to it (subject to external influences) in the adult form. We can only say that we cannot discern the necessity for such a result. As a matter of fact, we know this to be the actual course of things; but Mr. Spencer's object is to make us understand how it comes about; and to tell us that physiological units can only balance one another's polarities by forming a structure like that of the parent organism, is telling us nothing. We have only a cloud of words. We need to know how the polarities of these physiological units work so as to produce bone, and muscle, and nerve, arranging them into a workable skeleton, a series of muscles, nerves, and brain, organs of sight, hearing, &c., apparatus for breathing, food, assimilation, reproduction, &c., means of locomotion, feathers, &c. To say that this is all explained by the equilibration of the polarities of the original physiological units, together with the assimilated units with ancestral forces, or with present or anticipated forces, does not throw any light upon the process.

We fail then to find a formula which shall hatch an egg. We cannot in any definite manner say why one egg should turn out a black Spanish cock, why another should bring forth a Brahma hen, nor how it is that a third should produce a gosling. The theory of aggregation analogous to that of crystallisation, by which form and structure is produced according to the structure and polarities of units, does not carry us beyond a homogeneous jelly-like mass. To say that they must equilibrate by producing the parental structure, without showing us the dependence of each step of the process, is leaving the matter in such a state of indefiniteness, incompleteness, and obscurity that it cannot be said to be real knowledge, nor to constitute even an intelligible hypothesis.

As mentioned on a previous occasion, we hold that Mr. Spencer's main fault as a philosophic writer is in the misuse of terms. He takes a word of definite meaning and concrete application. He evolutionises it after the manner in which he himself describes evolution, and of which he gives an illustrative instance (p. 348), in showing how by insensible modifications a circle can be transformed into a straight line. We commence with the base of a cone, which gives a circle. An insensible slicing process up one side of the cone gradually gives various undistinguishable conic sections, till we finally arrive at the straight line of the side of the cone. "Here we have five different species of line—circle, ellipse, parabola, hyperbole, and straight line, each having its peculiar properties and its separate equation, and the first and last of which are quite opposite in nature, connected together as members of one series, all productive by a single process of insensible modification." By a similar method Mr. Spencer undertakes to elude the logical faculty. In a similar manner by a series of insensible modifications Mr. Spencer in the course, not of processes, but of sentences, so changes the meaning of words as to make them bear the most diverse applications. We have already seen how the term Force has been universalised. We have seen also how the term Equilibration has been made equivalent to Universal Causation; and we have now a similar instance in the remarkable growth and expansion which has been given to the term Polarity, and to the term physiological unit. All these are words of definite meaning and limited application in the first instance; but by a system of gradual stretching, and by perpetually concentrating the attention upon them, they are forced to wider and wider applications, till at last they are so universalised as to lose all real meaning.

In the case before us, polarity, which we can thoroughly understand as applied to the crystallisation of inorganic substances, is so overloaded with properties and powers, and is so expanded for the purpose of explaining all chemical and physiological arrangements, that it ends in meaning nothing at all. Fresh requirements, fresh properties needed—call them polarities and let them equilibrate. We want growth and accretion—we want modification of molecules—we want fresh aggregates produced out of these modified molecules—call them polarities and let them equilibrate. Anything, everything, is polarity—anything, everything, is equilibration. Make these terms vague and all-embracing, and you can deduce whatever you will. Put into them all that you want to get out of them, and the deduction, though obscure, will be sufficient.

(*n.*) *The Affiliation of Polarity upon Evolution in General, and its Relation to Physical Science.*

Our object now is to consider Polarity in its place in the scheme for the unification of knowledge. Since this unification is to be found in the process resulting from the interrelations of primordial factors, it is necessary to inquire what part Polarity plays in that process, and in what manner it is related to those primordial factors.

In the first place we ask, Is it an original factor itself? But in "First Principles," Mr. Spencer, in proposing to express the correlations of the cosmic factors, does not even mention Polarity. He says:—"The three factors are the Persistence of Force, the Indestructibility of Matter, and the Continuity of Motion." The law of their co-operation is expressed in terms of two of them in the Formula of Evolution. We will first ask if Polarity is expressed or implied in the Formula of Evolution. Is it implied, for instance, in Matter or in Motion, in Integration or in Dissipation? We suppose we could not say of Polarity that it is that manifestation of Force called Matter, nor can we say that it is that manifestation of Force called Motion. Neither can we say that it is a process like integration or dissipation. It seems to cause integration if not dissipation, and therefore to be a cause of motion. If it is to be called anything, it must be called a Force, or rather, since there is not one polarity but many,—Forces. But no other kinds or manifestations of Force other than Matter and Motion are included in the Formula of Evolution; and since the Forces of Polarity are amongst the most important factors in cosmical changes, it is evident that that Formula is very deficient in definite intelligibility.

What then are we to say of Polarity as a mode of Force? Mr. Spencer teaches the interchangeableness of modes of Force. Heat, light, electricity, &c.? Is then Polarity interchangeable with them? Can the Polarity of an atom or molecule be changed into the motion of that molecule or atom whereby it loses its Polarity? We do not see that such an interchange can take place, for we do not discern that Polarity can be a rate or mode of motion as the others are. The question arises, Can Motion retain its place at all as one of the primal factors of the cosmos, or is it only a result of the interaction of the primal factors? Must we dethrone the Continuity of Motion from the important position in the unitative formula assigned to it by Mr. Spencer?

Again, what are the relations of Polarity to Matter and the indestructibility of Matter? Matter may be regarded as x, of which we know nothing; and in this case we have nothing to say of the relations of Polarity to it. Or Matter may be regarded as the sum total of the bundles of properties known to us as the chemical elements. In the latter case, what position does Polarity hold? Is it something differential in each kind of atom, something inherent in it and essential to it, which it never loses in any combination, but which rules these combinations in accordance with some laws of which we know nothing? Is it something which cannot be disparted from each atom, and which governs its behaviour to other atoms and molecules. If so, then we have to speak of the Indestructibility of Polarity as one of the fundamental facts of the universe.

If such be the case, then what is the law of the distribution of polarity amongst the chemical elements, and what is the law of their interrelations, by which some have superior affinities for each other, and some have small affinities for each other, in infinite varieties?

The pursuit of this theme would lead us to an investigation of chemical affinities. It would also lead to the consideration of the constitution of molecules, if not of atoms, as well as to a study of the nature of the correlations of the motions of molecules and atoms with shapes and sizes and with special polarities, undertaken with the view of ascertaining how polarity worked, how it was dependent upon shapes and sizes, and how far it was interfered with by molecular motions, all which might help us to understand chemical combinations and changes. What is the cause, or rather what are the conditions, of varieties of Polarity, and how far are they connected with varieties of shape and modes and rates of motion?

Then, again, we should have to consider the relation of special polarities with simple polarity. How far does one affect the actions of the other? How far do they coincide? how far do they counteract each other? And indeed one might go so far as to ask, Could the special polarities all be resolved into the one simple polarity? Further, one would ask of this simple polarity, as of the special polarities, Is not all polarity double, involving repulsion as well as attraction?

We would also have to ask, Does polarity exhaust itself in action? is energy expended in the exercise of Polarity? Surely yes; and yet surely no, for what would atoms and molecules be if they lost their polarity?

In a more concrete investigation we should also have to inquire into the action of that molecular motion called heat, not only in disparting molecules associated together presumably either by simple attraction or by special polarities, but also to some extent in facilitating recombinations of atoms and molecules. How does communicated motion affect the mutual polarities of intermixed masses, and what is the manner of the influence exerted?

This would lead to a consideration of polarity as regards equilibrium. Is equilibrium an equilibration of motions, an equipoise of weights, a balancing of attractions, a balancing of attractions and repulsions, a generating of opposing forces, or what is it? Mr. Spencer throughout the "Biology" largely applies it to the balancing of polarities. It is not very clear what this or its effects can be until we thoroughly understand how far polarity varies, the laws of its variations, whether dependent upon shape and size, whether differentiated in strength, whether variable in mode or strength in the same atom or molecule, modifiable by motion, different from and affected by simple attraction or the attraction of gravitation, how far polarities are negative and positive, &c.; all of which circumstances enter into the consideration of the balance of equilibration of polarities, and must be understood before anything can be deduced from the bare statement that structure results from the equilibration of the structure and polarities of molecules.

The uncertainty as to the terms in which fundamental physical science is to be discussed renders any unificatory endeavour particularly difficult. Apparently there are two primary conceptions as to the nature of the elementary factors. The first is founded upon notions of pure mechanics, and carries out its explanations in terms of the relations of shape and size, together with the motions consequent upon simple attraction. A modification of this theory is that which looks for fundamental explanations in rates or modes of motions or relative velocities. The second theory recognises as ultimate certain special polarities or affinities, although this theory may only hold a mediate position, and may itself be explainable by the first. Between these two theories, which may be termed respectively the mechanical and the physical, Mr. Spencer wavers, basing his explanations sometimes upon one and sometimes upon the other, —a method which is rendered still more confused by the application to the latter of the terms used to describe the general facts of the former. This transferred application of mechanical language to physical processes is a cause of endless confusion. Until scientific men are agreed as to the terms in which fundamental physical science is to be discussed, no unificatory system is possible. If, in addition, we have to find a place in this fundamental science for Feeling as a factor amongst the sequences of the cosmos, the study is still farther, and perhaps hopelessly, complicated. Yet to this conclusion we are almost inevitably forced, for we cannot suppose that Feeling and Consciousness entered upon the history of life uncaused and unrelated to precedent inorganic developments. Consequent upon this consideration is the "double-aspect" theory favoured by Mr. Spencer, which can, however, furnish no explanations.

§ 14. *General Review of the Argument.*

Our study, commencing with the Data of Biology and the Definition of Life, resolved itself into the inquiry, "How is organic evolution caused?" The answer to this question furnished us by Mr. Spencer is couched in terms of Equilibration. He begins by recognising certain aggregates, the origin of which is unexplained; and his omission of any explanation on this point forms a fundamental defect in his historical account of the sequences of the cosmos. These aggregates are moving equilibria, possessed of inner formative forces which not only equilibrate amongst themselves, but act under the restraints of external forces. As moving equilibria they expend energy which they endeavour to replace, and adapt themselves by a process of counterbalance so as to antagonise such forces of the environment as tend to their destruction. This theory of moving equilibria we have already sufficiently discussed.

We have found that these aggregates or organisms are changed through the action of the environment by simple and direct processes, according to the mechanical, chemical, or other relations subsisting between them; and also that such relations involve indirect consequences. These are called Indirect Equilibrations, because although they consist of successive or continuous processes, the action of the original incident force is not immediately, but only mediately and in a deferred manner, manifested in some established change of the organism.

In the detailed account of morphological and physiological evolution, however, we do not find that the explanations are given in terms of abstract laws of force, but in terms of the concrete factors of which a list is furnished us in the three first chapters of the first volume. These chapters recount on the one hand a list of chemical elements forming the basis of organic matter, and describe to us on the other hand the nature of those forces which compose the external factors. In the detailed accounts of development referred to, the term Equilibration is employed simply as a general term alluding to the mutual action of these factors, and not as a term of explanation; nor is the conception of a moving equilibrium of the least use in enabling us to understand any process of organic evolution: it is merely a general name applicable to the grand results which are supposed to be really explicable from the known relationships of concrete factors.

We also noted the defect in the argument from which it would appear that feelings and facts of consciousness, up to their most complex modes of existence, must, under the analogy of the moving equilibrium, be regarded as forces generated by the organism in antagonism to adverse external agencies, and therefore must be actual acting agencies as feelings in the physical relations of the organism with its environment. This *à priori* conclusion we justified by references to inductions from the manifest physical arrangements of some organisms which recognised feelings, as feelings, on the part of other organisms. We thus established the fact that the subjective plays a part in the physical changes and developments of organisms quite independently of any theory as to the merely double aspect of such subjectivity. Nevertheless, we found that in Mr. Spencer's account of physiological development the subjective obtained no place, but that the whole of that development, including even the origin of nerves and the evolution of the nervous system with its consequent actions, was all wrought out in terms of mechanical motion alone.

We found it necessary also to refer in a more marked manner to a fundamental confusion of thought which pervades Mr. Spencer's argument with regard to the factors of evolution, and more particularly of organic evolution. The confusion of thought is between the concrete factors themselves, and general processes regarded as factors—a confusion of the concrete with the abstract. Thus, as just indicated, the factors given to us at the outset of our biological inquiry were the concrete chemical substances oxygen, nitrogen, hydrogen, carbon, and a few others, the properties and relations of which were very carefully considered. We were also furnished with an account of the various external forces which played a part as factors in relation to aggregates composed of the foregoing elements. Our inquiry, therefore, was one as to the interaction of the formative tendencies of the elements (leaving unexplained the biologic tendencies in the expenditure and replacement of energy) with the actions of the external forces. The investigation was purely a concrete one. The result was instability of the originally simple organic aggregate; segregation of like and unlike molecules; the changes due to the laws of mechanical agencies of various kinds; the multiplication of effects, rhythms, evolutions, dissolutions; the whole of which, again, can be summed up in the general term Equilibration, or afterwards specialised as the equilibrations of moving equilibria.

But singularly enough Mr. Spencer occasionally appears to regard some of these terms themselves as factors. It is true that in his *résumé* of "External Factors," given in Chapter IX. of Part III., he recounts the concrete agencies of an astronomic, geologic, and meteorologic character, and also refers to the general organic environment of animals and plants: but in the succeeding chapter on "Internal Factors" the reference made to the concrete chemical factors is but slight.* The stress of the explanation is placed upon the abstract factors; and first let us see what he says as to the instability of the homogeneous, from which it would appear that Mr. Spencer considers the homogeneous must inevitably lapse into something else.

"Our postulate being that organic evolution in general

* Biology, vol. i. p. 420.

commenced with homogeneous organic matter, . . . we have first to remember that the state of homogeneity is an unstable state." How Mr. Spencer can say this, and then proceed to say that it requires external agencies to produce a change in this homogeneous state, we cannot imagine. This, however, not being enough, we are further asked to suppose the case of "a given whole," which, "instead of being absolutely uniform throughout, consists of parts distinguishable from each other,"—a distinction presupposed by Mr. Spencer in the differentiation of the contractile molecules into muscular tissue, and of the irritable molecules into nervous tissue. Nevertheless Mr. Spencer speaks of the gravitation from a state of homogeneity to a state of heterogeneity,* although it will be more conspicuously shown in proportion as the environment is complex. Thus: "Omitting for the present those circumstances which check and qualify its consequences, the instability of the homogeneous must be recognised *an ever-acting cause of organic evolution*, as of all other evolution." †

Next as to the Multiplication of Effects. "When considering the causes of evolution in general, we further saw ('First Principles,' § 116) that the multiplication of effects aids continually to increase that heterogeneity into which homogeneity inevitably lapses. . . . How this multiplication of effects conspires with the instability of the homogeneous to work an increasing multiformity of structure in an organism, was shown at the time; and the foregoing pages contain further incidental illustrations. Under the head 'Adaptation' (§ 69) it was shown that a change in one function must act and react through ever-complicating perturbations on the rest; and that, eventually, all parts of the organism must be modified in their states." ‡

The fact that a whole section of the chapter on "Internal Factors" is devoted to its consideration would almost lead to the presumption that the multiplication of effects is regarded as a factor or cause instead of a result of evolution; although such a position is not actually claimed for it.

* Biology, vol. i. p. 421.
† Ibid., p. 422. ‡ Ibid., p. 424.

The next section is devoted to "Segregation."

"One of the universal principles to which we saw that the redistribution of matter and motion conforms, is that in any aggregate made up of mixed units, incident forces produce segregation, . . . and it was shown that the increasing integration and definiteness . . . results from this ('First Principles,' § 126)."

Here again the redistribution of matter and motion is said to conform to a principle of which the proof is merely an induction from their own actions. Nevertheless it is stated that increasing integration and definiteness result from this principle. Segregation is said to be produced, and we are therefore at a loss to assign its place. Is it the name of the results or of the principle which produced the results?

It is clear, however, that these are but names of some of the general processes resulting from the relations of the actual factors, and it is doing Mr. Spencer an injustice to suppose that he means otherwise, although his language and occasional disproportionateness of treatment warrant the notice we have taken of it. Even Equilibration holds its position but as the name of a process and not as the name of a factor; and although Mr. Spencer's chapter on "The Co-operation of the Factors" is mainly concerned with summarising the relations of the processes, yet it is only as processes resulting from the relations of the true factors—the chemical constituents of the aggregate organism, and the physical forces and varying conditions of the environment.

The great argument drawn from the laws of the moving equilibrium is more a statement of results than a key to explanations. In the summaries of biological development given in Chapter I. it is very prominent. In the detailed explanations of Chapter II. it is not given as an explanation of the means for securing fresh energy in order to replace the expended energies of the moving equilibrium; nor of the means for effecting those adaptations by way of antagonism to external destructive forces which it is supposed to necessitate; nor of the means by which a species, considered as a moving equilibrium, effects its continuance by reproduction of individuals, which by analogy with the case of an individual moving equilibrium should be considered an assimilation rather than a reproduction. Altogether, Mr. Spencer's grand principle of biologic description is not a means of explanation at all, but only a nomenclature of results.

The general tendency of the whole argument is merely to give an *à priori* justification for the doctrine of gradual and natural development, in support of the similar inductions which result from our concrete studies. Mr. Spencer endeavours to show that such a view is not only reasonable but also necessary. In this we hold that he has fully succeeded; and if he had so limited his claims, we should have had no occasion to subject his works to so close a criticism. But there can be no doubt that Mr. Spencer not only distinctly claims for that philosophy at which he aims the full explanation of every existence, but also endeavours to furnish us with a coherent system of sequences from the primordial nebula to the present time. In this attempt we consider he has failed, although in that bold endeavour he has been successful in throwing light upon many great processes of the cosmos, enlarging and giving definiteness to many of our ill-formed conceptions, and pointing the way to further triumphs of thought in the future.

An important consideration refers to the value and meaning of those "mechanical interpretations" which Mr. Spencer claims to have given * to the evolution of organisms generally, and to the causes of organic change taught by Mr. Darwin in "natural selection," &c., specially. What Mr. Spencer means by "mechanical" is not very apparent. Clearly he cannot claim to have made these "interpretations" within the limits of the terms in their strict applications as we find them in a work on mechanics. Undoubtedly Mr. Spencer must refer to those first principles of abstract dynamics which he derives from the Persistence of Force. These abstract principles, however, being derived by induction from a study of their sequences, the converse result is inevitable. One part of the reasoning is but

* Biology, vol. i. pp. 445, 457, 466, and generally the chapters on "Indirect Equilibration" and "The Co-operation of the Factors."

complementary to the other. The inductive law becomes the deductive principle. The process of deduction simply retraces the steps of the inductive process. The Formula of Evolution is as much the result of an induction as the means of a deduction. Indeed these abstract laws are of little use in deductive explanations, as we have seen in our previous studies. All solid and useful deductions have to be made from original concretes. The only use of abstract laws is to show the uniformity of process, which enlarges our view of the unity of nature, and facilitates the reasonings from concretes to concretes by expressing their truths in general terms. Abstract terms are of no use but as generals, and derive all their value from what they contain of the concrete. *A priori* reasoning is only useful as a means of applying *à posteriori* experience.

Therefore to find the unity of sequence which would unify knowledge and attain the goal of philosophy as quoted from Mr. Spencer at the outset of this work, we must be able to deduce the origin of organisms and all their developments from the concrete internal and external factors before referred to. The identification of the general characteristics of these processes with those of inorganic changes is not an explanation of sequences at all. Notwithstanding Mr. Spencer's elaborate work, we still find that the origin of organisms and of their special characteristics cannot be deduced from their concrete antecedents, whether we regard them as biologic moving equilibria, or as manifesting feeling and consciousness, or as having the power of reproduction, which last aspect we shall now proceed to consider.

§ 15. *The à priori Explanation of Genesis and Reproduction.*

Hitherto we have taken the fact of genesis and reproduction as unquestioned, and have considered each species of organism very much as though it were one continuous existence. If a species could be studied in this way—as being itself a continuous moving equilibrium acting in the same manner as an individual organism, adapting itself by readjustment of its inner forces so as to antagonise detrimental external forces, and so as to secure assimilation of those external forces which are favourable to the continuance of its existence—the study of biology would be very much simplified. But we hold that the cases are not parallel. The suggested analogy between the life of an individual and the continuance of a species does not hold good. Although it is possible to find sufficient points in common to enable us to formulate certain modes and processes applicable to both, yet a deeper investigation shows an essential distinction between the methods of continuance. The life of the individual is protracted by the assimilation of energies from the environment in replacement of the energies expended. The species is continued not in this manner, but by the actual multiplication of individuals; and no analogy can be made out between these two processes. Again, it would be difficult to show that any individual, or even any group constituting part of a species, had the same relation to the whole which any separate organ bears in relation to the whole of an organism. In the latter case there is a distinct interdependence of structure and function, in many instances of such a nature that upon its sudden stoppage or severance the whole organism perishes. The analogy between the constitution of an organism and the constitution of a state was early recognised, as shown in Æsop's fables and St. Paul's Epistles; but we do not think that Mr. Spencer's analogy carries the matter one step in advance. The writers referred to used the analogy for rhetorical purposes. We have to regard its import scientifically and logically, and we do not find that the conception of a species as a moving equilibrium accords with the conception of an individual organism as a moving equilibrium, so that the existence and modes of continuance of both can be explained and expressed in common language as deductions from the ideal abstract conception of a moving equilibrium.

Before entering farther upon this inquiry, let us first consider the question whether, upon the supposition of the continuous existence of an individual organism, the same diversity of morphological and physiological development could have taken place as under the system of successions of individuals.

"It is manifest *à priori*, that since changes in the physical state of the environment, as also those mechanical actions and those variations of available food which occur in it, are liable to stop the processes going on in the organism; and since the adaptive changes in the organism have the effects of directly or indirectly counter-balancing these changes in the environment; it follows that the life of the organism will be short or long, low or high, according to the extent to which changes in the environment are met by corresponding changes in the organism. Allowing a margin for perturbations, the life will continue only while the correspondence continues; the completeness of the life will be proportionate to the completeness of the correspondence; and the life will be perfect only when the correspondence is perfect." *

From this it would appear that there is no *à priori* necessity for death; and when we consider the characteristics of the ideal abstract moving equilibrium from which the working principles of the concrete organism are deduced, it is clear that a moving equilibrium which possessed the power not only of adapting its inner forces so as to counter-balance inimical external forces, but also of doing this continuously from its other faculty of replacing the energies thus expended by assimilating external energy,—might continue in existence for ever in some modified form.

Although, however, there is no *à priori* necessity for death, still we can see the great probability of its occurrence in the accumulation of failures of adjustment on the part of the moving equilibrium, and in the possibilities of the failures of supply of the replacing energy. Failing the means of reproduction, moving equilibria would therefore become extinct, or might be originated *de novo* in the same manner as existent or preceding organisms; but the life history of each would be determined absolutely by its own relations to its own environment. The suggestion we here wish to make is, that such developments could never attain to the complexity and variety we see exhibited in the actual world. We find, accordingly, that reproduction and heredity play a very important part in Mr.

* Biology, vol. i. p. 82.

Spencer's scheme of biological reconstruction. Without their assistance we believe Mr. Spencer could not theoretically have accomplished any of his explanations. The inquiry, therefore, as to the *à priori* explanation of genesis, reproduction, and heredity assumes great importance.

Such an inquiry must, according to the terms of our hypothesis, be worked out with reference to the requirements and constitution of our ideal abstract moving equilibrium. From the conception of the nature of this moving equilibrium and its relations to external forces, it is required that we should deduce the reproduction of other moving equilibria which are copies of itself.

We must attempt this problem either independently or by the means furnished us by Mr. Spencer. We are afraid, however, that, as an independent logical endeavour, we are unable to make a single deductive step in the direction desired. The concrete instances in the physical world from which we derived our conception of a moving equilibrium were the solar system and the spinning-top; and to these were superadded the conception of the supply and expenditure of energy derived from the steam-engine, although the latter is a mental act which we are not really able to achieve, and merely allow for the sake of the argument which Mr. Spencer advances. We wish to pursue the subject beyond the initial steps, but to those steps we nevertheless offer the strongest objections. Given such a conception, we can, it is true, deduce protracted if not eternal existence, so long as there are external forces to be assimilated and used up in the maintenance of the moving equilibrium, and so long as the external inimical forces which have to be antagonised are not of such a nature as absolutely to destroy the moving equilibrium itself. But we cannot see the least reason to suppose that, under any circumstances whatever, this moving equilibrium would propagate itself—would ever out of the superabundance of supply receive more energy than it expended; and even if it did, that it would do more than augment in bulk. We cannot imagine that it would ever tend to organise these supplies into separate and independent copies of itself.

Let us therefore see what Mr. Spencer has to say upon the subject. It is evident that the *à priori* explanation must be found either in abstract considerations such as those just discussed, or in the relations and properties of the concrete chemical elements, and their complex combinations out of which organisms have originated, and are supposed to have been developed in conjunction with their environment. To carry out our examination of Mr. Spencer's views, we shall have to study principally Chapters VII. to X. in Part II. of the "Biology."

Chapter VII. is devoted to an account of the "Inductions of Genesis" leading up to the statement—

"The above induction is an approximate answer to the question—*When* does gamogenesis recur? but not to the question which was propounded—*Why* does gamogenesis *recur?*—Why cannot multiplication be carried on in all cases, as it is in many cases, by agamogenesis? As already said, biologic science is not yet advanced enough to reply. Meanwhile, the evidence above brought together suggests a certain hypothetical answer, which it may be well to set down.

"Seeing, as we do, on the one hand, that gamogenesis recurs only in individuals that are approaching towards a state of organic equilibrium; and seeing, on the other hand, as we do, that the sperm-cells and germ-cells, thrown off by such individuals, are cells in which developmental changes have ended in quiescence, but in which, after their union, there arises a process of active cell-formation; we may suspect that the approach towards a state of general equilibrium in such gamogenetic individuals, is accompanied by an approach towards molecular equilibrium in them. And the need for this union of sperm-cell and germ-cell, is the need for overthrowing this equilibrium, and re-establishing active molecular change in the detached germ—a result which is probably effected by mixing the slightly different physiological units of slightly different individuals." *

Mr. Spencer, however, professes to consider the question more fully in Chapter X., after having considered the subjects

* Biology, vol. i. p. 233.

of heredity and variation. In the meantime, is it not singular that the question as put by Mr. Spencer is not, "Why does genesis take place?" but "Why does gamogenesis recur?" Surely what we desire to have explained in the first place is the necessity for genesis at all. Taking this for granted, as Mr. Spencer does, it may be comparatively easy to find answers to subordinate questions; but the mind of the reader will remain unsatisfied as long as no answer is found to the great preliminary question. This question Mr. Spencer passes over in absolute silence. And on examining the course of thought pursued in suggesting an answer to the special question proposed, we find the whole burden of the *à priori* explanation rests upon a supposed but unproved "need" or necessity for the continuance of the species. This requires the re-establishment of active molecular change in the detached germ, and explains "the need for overthrowing this equilibrium," and the "need for the union of the sperm-cell and the germ-cell," which are supposed to be in a state of "molecular equilibrium" (whatever that may be), consequent upon the approach of the organism to a state of general equilibrium. This, again, implies the "need" for those organs which ensure the union of the two cells; and if "feeling" is a factor in the organism, called forth by the action of the forces in the environment as a means of defeating them, if not in individual survival, then in vicarious survival, we perceive the "need" for those feelings which bring the organisms together in effectuating such an union of sperm-cells and germ-cells. But this throws the whole onus of the argument upon the "need" for the continuance of species—a "need" which ought to be explicable from the constitution of the ideal abstract moving equilibrium, but which we have seen is not thus deducible. Obviously upon the hypothesis genesis should be explicable as a rearrangement by an organism of its own forces, for its own individual maintenance against some destructive force of the environment.

The important part which this "need" for the continuance of the species has actually played in the development of organisms, if Mr. Darwin's theories are true, cannot but be acknowledged as wonderful, both for its extent and the immense variety of its influences. It is as though Nature had said, "I have need of the continuance of species," and all the adjectives in the vocabulary rushed to offer their aid jointly and severally;—softness that should contain the seed and protect it uninjured, hardness that should defy the outrage of the elements, solidity that should present a firm resistance to the shocks of earth, lightness that should waft the seed on zephyr wings through the air, profusion that should defy destruction, whatever individuals might perish in the chances and changes of the great life conflict. Then the flowers and their sexual loves afford a wonderful contemplation in connection with their servants the insects. How wonderful the structural developments in relation to their winged messengers of love! how beautiful, how sweet their varied attractions! how rich the banquet provided for the welcome guests! how sharp the defences against the intrusion of the smooth-coated plunderer, who would despoil without rendering the erotic service! Then again the birds, with their wings and their plumage and their antics, all to win the love and admiration of their mates; the soft nest, the hard coating provided for the eggs, and the instinct of the parents for the care of the young. But in the insect world is displayed the most wonderful adaptation for the preservation of the race. The ant tribe seems almost to exist for the continuance of its species alone. The whole life-interest of the community seems concentrated on preservation. Bee communities also partake of the same characteristic. By force or persuasion, all animated nature is urged on involuntarily to the union of the sperm and the germ. Even in the human race, where the volitional is partially predominant, sexual feeling is one of the strongest passions; and in spite of all prudential considerations, in spite of the responsibilities of a family, and the risks or certainties of harassing and lifelong poverty and care, youths and maidens are forced on to the propagation of the race. It is true that in man there are often many high and noble motives engaged in the fact of a marriage; but sexual love is the fundamental basis. For this master-passion men and women will sacrifice much. It is the parent of noble endeavour, of wonderful industrial energy, of beautiful self-sacrifice and self-rule, and alas! also of sacrifices of all that is good and noble—the destruction, as by a fire-blast, of character and position, of domestic happiness and of self-respect. Thus even man is made the sport of this need for the preservation of the species, and all animated nature seeks its continuance.

But whence this "need?" Surely to say that the necessity for the continuance of the species produced the means and the desire, and the adaptations for effecting it, is to confound the end with the cause. It is to reverse the order of an evolution which derives all its force and all the direction of its developments from an initial activity. If the need for the continuance of the species caused the means for its continuance, then structure and function have a teleological purpose; design is implied, and a designer. The means are provided for an end; the end is foreseen; and according to the necessities of each case the means are provided. This is enough to shake our faith in non-teleological theories to the very foundation. Evolution has no explanation to offer for genesis; it can show no need for it in the primal constitution of things; it can deduce it from none of its factors.

We do not indeed ask if there is any need for the propagation of the elementary substances, for they remain a constant quantity. But we might ask, Is there not just as great a need for the continuance of any of the chemical compounds as for the continuance of an organism? We might ask, Is there not a need for the propagation of the solar system, which is a moving equilibrium? We might ask, Is there not just as much a need, and a need founded only upon precisely the same deductive necessity, for the continuance of the compound called water, or air, or salt—compounds which are not quantitatively permanent, but which are subject to dissolution. If we can deduce the need of their continuance, we can deduce the need for their propagation; and if we cannot deduce from "First Principles" the need for the continuance of chemical compounds or species of organisms, we cannot deduce from it any of the structural and functional arrangements of organisms for effecting that object.

We see, then, that, as a purely deductive reasoning process, this chapter affords no explanations. The premisses from which we are to deduce our explanations are nowhere given; and any that we guess at as probable premisses turn out to be inadequate.

We have searched the chapter on the "Differentiation of the Outer Tissues" and that on the "Differentiation of the Inner Tissues" for a deductive warrant for genesis and reproduction, but all in vain. The chapter on "Physiological Development" also fails to throw any light upon this subject. Only when we come to the chapter on "Direct Equilibration" is the matter referred to at all. Direct equilibration is the balancing of a new incident force by a new structural arrangement, which has already been explained. Mr. Spencer says in this chapter that although many functional adaptations are explicable in this way, there are many that *are not so explicable*, as there is no external incident force to be set over against them as their cause—and amongst these he mentions *genesis* or reproduction. There is no incident force tending to produce a counter-force of function, similar to the case of the production of nerves by incident motions, of eyes by incident light, &c.

Therefore this, along with other cases, is left over for explanation in the succeeding chapter, which treats of "Indirect Equilibration." What, then, is indirect equilibration? It turns out not to be equilibration at all. It is not equilibration in the ordinary mechanical sense of working towards a state of quiescence, nor is it equilibration in the arbitrary meaning accorded to it by Mr. Spencer, of one force directly or indirectly producing a counter-force or opposite motion in a moving equilibrium; and the instances given show that it is not an equilibration of any kind. A case adduced is this: Suppose the seed of a tree (which seed has light hairs or down) is blown by the wind upon a soil having in it material by which this down in subsequently-produced seeds is made to grow longer; the seeds will thereafter be scattered over a wider area, and the tree will increase and multiply over a greater extent, than it would have done before. This, we take it, is merely an interfering cause producing a certain new effect; but what there is of equilibration about it we fail to see, unless all effects are equilibrations of all causes. However, be it what it may, the fact remains that none of the important cases specially reserved to be dealt with under this heading are even referred to. All we know is that Mr. Spencer says genesis cannot be accounted for by direct equilibration, and that he does not attempt to account for it even by indirect equilibration.

If we proceed now to examine the suggested *à priori* explanation of heredity given on p. 253, we find, firstly, that no such explanation is to be expected in the present state of Biology. The suggested analogies between the process of crystallisation and organic structure we considered in a previous section. Variation, treated of in Chapter IX., depends upon the explanation of genesis and heredity. Thus we are brought round at last to resume the study of the *à priori* explanations of genesis postponed by Mr. Spencer from Chapter VII. to Chapter X. The argument quoted by us from the former is reproduced for consideration in the latter. How is it dealt with?

We are surprised to find that the question considered is not the *à priori* explanation of genesis, but the question, "*Why* does gamogenesis recur?" The answer is an explanation of the necessity for gamogenesis. This necessity is found in the end, and not, strange to say, in the primary conditions. Mr. Spencer's statement is to the effect that those moving equilibria called organisms, in the course of their individual growth and development, arrive at a time when they attain a certain definite balance of parts and of external relations. The attainment of this state causes the physiological units of which they are composed also to exhibit an approach to equilibrium; although it is not clear whether Mr. Spencer refers to all the physiological units of the organism, or only to those which are freely floating in the interior fluids, or to those, again, which are specially secreted in the organs of reproduction. It is on approaching this state of general equilibrium that the organism gives off those physiological units which are to form the nucleus of fresh organisms. These being almost in a state of equilibrium,—a state which is effected very shortly after parting from the parent organism—are not fitted of themselves, Mr. Spencer argues, to fulfil the office of reproduction; though the reason why is not apparent. But since the union with a slightly different physiological unit from a slightly different organism would be calculated *à priori* to initiate constructive changes, these combined activities under favourable conditions would cause such growth and development as to result in a new organism, combining in varied forms the properties of both parent organisms. Mr. Spencer shows indeed the reasonableness of this supposition; but he shows it too well; for he implies an adaptation of means to the accomplishment of an end. The process is essentially teleological. The need for the continuance of species being taken for granted, then, since the simple casting off of physiological units is insufficient to accomplish it, means for the union of two cells are requisite: therefore they are produced. But this is not *à priori* reasoning. The deductive process requires that we should be able to discern why those moving equilibria called organisms should cast off certain portions of themselves made out of the assimilated forces, not in the way of manufacture by each special organ of units suitable for its own repair, nor yet in the way of floating units in the general circulation of such nature as to produce results due to their own properties and polarities, but in a special manner and by special organs. This first act, however, is not explained. There is no reason *à priori* in the nature of moving equilibria, nor in their relations to the environment, to justify any such process. Now granting such a process, is there any *à priori* necessity in the admitted incapacity of the physiological unit to reproduce its parent (which by the analogy of crystallisation it ought to do)—is there any logical necessity for supposing that organisms, having regard to this failure, should produce adaptive arrangements for accomplishing an union of two such slightly different units? It is not even deducible *à priori* that the union of two slightly different physiological units of separate organisms would result in another perfect organism. We must conclude that Mr. Spencer's *à priori* explanation of genesis and reproduction is a complete failure.

We do not know that it is requisite to examine Mr. Spencer's reasoning in detail. He commences by endeavouring to establish as an universal doctrine the theory that the aggregate exercises a coercive force over its units.* This is shown by references to changes in the molecular arrangement of iron and unannealed glass, and by the process of crystallisation. Organisms are said to display the same characteristics. But this we dispute; for while the characteristic of the inorganic changes referred to lies in the fact that the whole coerces the parts into uniformity of arrangement, the characteristic of organisms is the incoercibility of the parts, the retention of individuality by the separate organs.

Mr. Spencer argues that in the early stages of the evolution of an organism the molecular forces possess "an immense excess" over "those antagonist forces which the aggregate exercises on the molecules." We do not consider this intelligible, but "while this excess continues, it is expended in growth, development, and function,—expenditure for any of these purposes being proof that part of the force embodied in molecular tensions" (*query*) "remains unbalanced. Eventually, however, this excess diminishes." But can Mr. Spencer show that the units of a moving equilibrium, the only characteristics of which are due to their position as members of a mutually balanced system of forces, possess any power when separated from that system of reconstructing from the forces of the environment a copy of the system of which they formed a part? And then can he show that the molecular activities of this member, together with those which it succeeds in coercing, will jointly possess such a reconstructive power, until a complete system of balance is attained, after which this system of balance coerces its originators? And can he further show that under these circumstances the balance of forces requires that some should be expended in reproduction? We do not think that he can establish this theory by any process of abstract reasoning, not even if we begin by granting the theory that a species is itself a moving equilibrium. The whole of the reasoning on pages 274 and 275 is merely an attempt to translate the facts of Biology relating to reproduction into terms of the relations of forces, without any endeavour at all to show the deductive connection; and yet this is supposed to be an *à priori* explanation!

* Biology, vol. i. p. 274.

But it is evident that the mere translation of all biological processes into terms of force, the mere representation of them in other language, albeit the language is of the most abstract and universal applicability, does not amount to an explanation of the order of sequences by which we would be able to understand how such and such a particular phenomenon occurred.

Section 96 exhibits in a very remarkable manner the faulty conclusions to which a consistent *à priori* thinker is inevitably led.

"And so we reach the remarkable conclusion, that the life of a species, like the life of an individual, is maintained by the unequal and ever-varying actions of incident forces on its different parts. An individual homogeneous throughout, and having its substance everywhere continuously subject to like actions,* could undergo none of those changes which life consists of; and similarly, an absolutely uniform species, having all its members exposed to identical influences, would be deprived of that initiator of change which maintains its existence as a species.† Just as, in each organism, incident forces constantly produce divergences from the mean state in various directions, which are constantly balanced by opposite divergences indirectly produced by other incident forces; and just as the combination of rhythmical functions thus maintained, constitutes the life of the organism; so, in a species, . . . it is similarly by the rhythmical production and compensation of these contrary deviations, that the species continues to live." The point to be here considered is this—Does a species live except as by the existence of the individuals composing it? Mr. Spencer seems to regard it as having an individual and corporate existence capable of being spoken of in analogous terms. And since a homogeneous organism under homogeneous circumstances would not be an organism, he argues that an absolutely uniform species under identical influences would not maintain its existence as a

* This is an impossible supposition according to Mr. Spencer's teaching in the chapter on the "Instability of the Homogeneous" in "First Principles."

† Surely this is a new theory, that the initiators of change maintain the existence of species. Mr. Darwin's theory is that they cause the origin and change of species.

species because it would not manifest those adaptations which constitute life. Does he mean that the species would die out because it had become perfectly adapted to its homogeneous circumstances? "The moving equilibrium in a species, like the moving equilibrium in an individual, would rapidly end in complete equilibration or death, were not its continually dissipated forces continually resupplied from without." What is the "without" of a species considered as a whole, and how does it as a species dissipate its forces, and get resupplied from without? The argument requires that changed incident forces should be the forces supplied; but surely changed conditions are not necessary for the continuance of a species.

À priori reasoning begins in words and ends in words; and this Chapter X. exemplifies throughout in a remarkable manner the futility of all such efforts for the investigation of truth.

In the chapter on the "Laws of Multiplication" in vol. ii. we find a half-suppressed, half-expressed recognition of the need for the continuance of species.

P. 391.—"If organisms have been evolved, their respective powers of multiplication must have been determined by natural causes."

P. 393, § 317.—"The individuals of every species being thus dependent on certain environing actions; and severally having their moving equilibria sooner or later overthrown by one or other of these environing actions; we have next to consider in what ways the environing actions are so met as to prevent extinction of the species."

Here is disclosed the whole tenor of Mr. Spencer's theory. The necessity for multiplication of the species does not arise from inherent necessities of the constituents of the cosmos, and is not one of the inevitable sequences from their existence, but it arises from the final aim and intention of preserving the species from extinction. This is the great end for the accomplishment of which adequate means have to be provided.

Having this necessity in view, Nature seeks the preservation of all special modes of life in various ways (pp. 394 and 395).

Firstly, in the preservation of the individual.

Secondly, in the reproduction of the species.

The favourable and adverse influences affecting both processes are recounted, and Mr. Spencer continues :—

"§ 318. Such are the factors with which we are here concerned. I have presented them in abstract shapes, for the purpose of showing how they are expressible in general terms of force—how they stand related to the ultimate laws of redistribution of Matter and Motion."

The unification sought, then, is to be found in ultimate universal propositions.

"For the purposes of the argument now to follow, we may, however, conveniently deal with these factors under a more familiar guise. Ignoring their other aspects, we may class the actions which affect each race of organisms as forming two conflicting sets. On the one hand, by what we call natural death, by enemies, by lack of food, by atmospheric change, &c., the race is constantly being destroyed. On the other hand, partly by the endurance, the strength, the swiftness, and the sagacity of its members, and partly by their fertility, it is constantly being maintained. These conflicting sets of actions may be generalised as *the forces* destructive of race and *the forces* preservative of race."

Surely this is a bad piece of generalisation which specifies natural death, lack of food, &c., as forces, and classifies together fertility, strength, sagacity, &c., as forces. The word "force" seems to lend itself to any emergency, and appears able to cover up in its mysterious folds all awkward transitions in Mr. Spencer's arguments.

The argument so far stands thus :—We have to see how the laws of multiplication stand related to the ultimate laws which affect the redistribution of Matter and Motion; and the factors with which we have to deal are the favourable forces and the adverse forces affecting the continuance of the individual existence and the continuance of the species. This leads us to Chapter II., the "À Priori Principle."

Sections 319, 320, and 321 show how Forces always tend through rhythmical movements towards an equilibrium—a moving equilibrium—and thus species are continuous moving equilibria.

"While, therefore, on the one hand, we see that the continued existence of a species necessarily implies some action by which the destructive and preservative forces are self-adjusted; we see, on the other hand, that such an action is an inevitable consequence of the universal process of equilibration."

So far it is not made out that there need be in the nature of things any continuance of an individual or of a species. Nor do we see why the individual, when once formed, should not exist for as many thousand years as the external conditions are favourable. But if there is an external force of cats acting adversely to the internal force of mice, it is clear that the mouse force will be limited; and if it were not for the favourable forces of nimble legs, scraps of food, reproduction, &c., mouse force would come to an end. All these competitive organisms, however, are subject to such mutual adjustment and rhythmical predominances of forces as prove preservative of all of them in some kind of re-adjustment.

P. 394.—"We have next to consider in what ways the environing actions are so met as to prevent extinction of the species." This is evidently a teleological thought. Again, "There are both active and passive adaptations by which organisms are enabled to survive adverse influences." Once more, "The first class consists of self-protective arrangements. The second process by which *extinction is prevented*—the formation of new individuals to replace the individuals destroyed—is carried on as described in the chapter on 'Genesis.'"

A little farther on the matter is complicated by a change of idea, when it is observed (p. 401), "The forces preservative of race are two—ability in each member of the race to preserve itself, and ability to produce other members; power to maintain individual life, and power to generate the species." Passing over the strange application of the term forces, we are brought back to the preservation of the race in the theory that, given the need for such preservation, these *must* vary inversely. Mr. Spencer certainly limits his remarks to races which continuously survive; but there is a suggestion in the background that unless extinguished by utterly overthrowing forces, races ought in the nature of things continuously to survive.

For example, Mr. Spencer says on p. 410—

"Thus, then, the condition which each race must fulfil if it is to survive, is a condition which, in the nature of things, it ever tends to fulfil. In the last chapter we saw that a species cannot be maintained unless the power to preserve individual life and the power to propagate other individuals vary inversely. And here we have seen that, irrespective of an end to be subserved, these powers cannot do other than vary inversely. On the one hand . . . it is requisite that they should have great ability to form new individuals, and *vice versâ*. On the other hand that they should have great power of self-maintenance."

It is needless to say that there is nothing in a mechanical theory, or in the laws of force, or in the Formula of Evolution, or even in the laws of equilibration — however Mr. Spencer would prefer his theory of the universe to be named—which has any regard for the survival of any of its productions. Aggregates are formed in the working out of its constituents: and if we could make out that organisms are among the aggregates so formed, we can see no reason why these should be preserved any more than a piece of salt rock or crystal. Nature is indifferent to her productions, and has no *need* for any organism to continue. If organisms do continue and if organisms propagate, it is not for the purpose of continuing a race or species. These are merely incidents in the cosmical history: and if we cannot understand why organisms should continue to exist and to reproduce themselves, then we have not the key to the history of the cosmos. If Mr. Spencer is unable to explain it, he cannot claim to have succeeded in the unification of knowledge.

The abstract statement of Mr. Spencer's theory is briefly as follows:—

Moving equilibria continue to move and to preserve their equilibrium.

If moving equilibria part with motion, they must receive motion or come to a stop.

If moving equilibria are likely to stop from lack of motion received, they will try to get a supply of it. (Adaptations for assimilation.)

If moving equilibria are interfered with by an external force likely to destroy them, they will generate an opposite force, for the purpose of self-preservation. (Adaptations for self-protection.)

If moving equilibria are likely to come to an end from the expended motion being in excess or otherwise, they will throw off a portion of themselves which shall unite with a portion of a similar moving equilibrium in order that the same kind of moving equilibrium shall continue to exist.

We cannot but consider it a matter of regret that Mr. Spencer has not composed a separate book on ideal or *à priori* mechanics. A work like his, the main principles of which are founded on mechanics, would be far more easily understood and would receive far readier acceptation from the general public if it were accompanied by a special treatise showing the nature and laws of all those mechanical conjunctures which occur in a scattered form throughout his *à priori* expositions.

§ 16. *Natural Selection—Its à priori Interpretation.*

We have had occasion in various places to call attention to some passages in Mr. Spencer's exposition of biological development where teleological implications appear. Teleology may possibly find a place in Biology when organisms arrive at such a stage of development as consciously to adapt means to ends, in the intelligent appreciation of certain suitabilities, and in what we may regard as semi-volitional activities, such as some of the actions relating to the attainment of food or the escape from enemies. But it is evident that in a system of deductive interpretation, where all explanations are sought as the resultants of the properties and relations of original factors, teleology or anticipatory adaptation for the purpose of securing definite objects, such as the continued existence of an organism or of a race, are quite outside the range of the hypothesis. It therefore appears singular that in so many passages Mr. Spencer should admit by implication the adaptation of means to secure these ends. We consider that even if Mr. Spencer repudiates teleology, and uses this manner of statement merely by way of convenience, it is a very faulty method of presenting his argument when the real question at issue is this very one as between teleology on the one hand, and deduction or unforeseeing development on the other hand. It is only right under these circumstances to call attention to a passage in which Mr. Spencer justifies his procedure in this respect, and in which he claims for natural selection all that Paley claims for design.

"While the explanation of the teleologist is untrue, it is often an obverse to the truth; for though on the hypothesis of Evolution, it is clear that things are not arranged thus or thus for the securing of special ends, it is also clear, that arrangements which *do* secure these special ends, tend continually to establish themselves,—are established by their fulfilment of these ends. Besides ensuring a structural fitness between each kind of organism and its circumstances, the working of 'natural selection' also ensures a fitness between the mode and rate of multiplication of each kind of organism and its circumstances. We may, therefore, without any teleological implication, consider the fitness of homogenesis and heterogenesis to the needs of the different classes of organisms which exhibit them." *

It is clear from this that when the student finds any passages in Mr. Spencer's works which imply the adaptation of means to ends in a teleological sense, he must render them into terms of those deductive interpretations which are recognised as "natural selection." This theory, as an inductively established truth, is now very generally and correctly understood from the writings of Mr. Darwin and the more popular expounders of his text. By it is meant the survival amongst species of those individuals which are best fitted to the environing inorganic and organic conditions. Thus if fleetness is an essential to escape from enemies, those animals will survive which possess in a superior degree the structure and powers enabling them to surpass their fellows in speed; and these, since they survive, will propagate and reproduce their own superior qualities. On the other hand, those individuals of the attacking species will survive who, by their wariness or comparative

* Biology, vol. i. p. 234.

speed, relatively to their companions, are able to overtake or otherwise secure the slowest or unwariest of their prey. These again will propagate their superior qualities, while their clumsier companions perish.

At the same time that the increased use of parts thus leads to their further and still further development, changed conditions of habitat and environment sometimes cause disuse and consequent reversal of the process. Thus, established structures gradually dwindle away and finally disappear.

That which takes place amongst the individuals of a species takes place also amongst species regarded as wholes; so that entire species may become extinct from the superior fitness of other species to the environing conditions.

In these ever-fluctuating processes, with accompanying disappearances of intervening links, the distinctions between species have grown more and more marked, until at last schematic classifications, although difficult, become justifiable.

This process of "natural selection" may be regarded as a thoroughly established truth, and one which has received the recognition not only of experts, but also of all thoughtful men who have given their attention to the subject. It is now, in fact, a commonly taught truth of popular science.

Our business concerns only the deductive interpretation of the doctrine; and our first question refers to the necessary requirements of a deductive interpretation. Three methods of procedure are open to us. Either we may justify "natural selection" by abstract reasoning from the relations of ideal moving equilibria, which may be regarded as a mechanical problem on the one hand of the relations of bodies in motion, or on the other hand of the relations of energies or "forces" in aggregation, related to other energies or "forces;" each such aggregate of energies expending and receiving energy, and counterbalancing external inimical forces by means of antagonistic adaptations of its own "forces." Or, secondly, we may deduce "natural selection," through various intermediate stages of development, from the properties of the chemical elements, as set forth by Mr. Spencer in the first chapter of his work, in interrelation with the physical factors of the environment, as described in the chapters immediately following. Or, thirdly, taking organisms and their reproduction for granted, and perhaps taking the origin of variations for granted, we may deduce the probability of "natural selection," or the continuous adaptation of organisms to their environment, implied in the survival and propagation of the fittest, with the consequent variations of species.

We fear, with regard to the first of these problems, that we shall find ourselves unable to take a single step beyond the initial statement. Regarding the moving equilibrium in its purely mechanical aspect, as instanced by the solar system, there is no reason whatever to suppose either adaptation of the biological sort, or assimilation, or reproduction, all of which are requisite on the hypothesis under consideration. If, again, we consider a moving equilibrium as composed of separate energies or forces, that is to say, organs with their concomitant functions which constitute a balance, jointly and severally antagonising distinct forces of the environment, the energy expended therein being ever replaced by the assimilation of favourable forces from the environment,—if, we say, it is possible to suppose such an aggregate on purely physical grounds, even then reproduction and heredity, which are not deducible from our premisses, have to be taken for granted; and the chain of abstract reasoning is not continuous.

Should we once more endeavour to fill in this abstract model with the known properties of the concrete elements which are our physical factors,—namely, oxygen, hydrogen, nitrogen, carbon, &c., in relation to environment,—the same difficulties attend us as before. We shall not even then be able to deduce genesis and reproduction. If we see our way to organisms at all, it is merely in the direct equilibrations by which different parts of a mass of organic matter are differentiated. We can take no deductive steps towards the accumulation and expenditure of energy, much less towards any effort for self-preservation. Here, again, we fail *à priori* to account for reproduction; and failing this, our theory of natural selection is not derivable in a ratiocinative way from our given factors.

As a matter of fact, Mr. Spencer in his *à priori* interpretation of natural selection does not proceed so far back as these abstract hypotheses. All he attempts to do is to show the probability that organisms which have the power of adaptation to circumstances, and which also have the power of reproducing copies of themselves, will continually develop in directions favourable to their continuance. The process is shown to be facilitated and the results heightened by the aid of gamogenesis. In this endeavour it cannot but be admitted that Mr. Spencer has succeeded. It is not a difficult thing, after a theory has been established inductively, to show that it is reasonable *à priori*. Given the earlier stages of biology, it is easy to prove that the subsequent stages are reasonable probabilities : and this is all that Mr. Spencer has done.

The great defect of the explanation lies in the fact that it still leaves unexplained the question of origins. Failing an explanation of the expenditure of energy for self-preservation or sustenance; failing an explanation of reproduction, of gamogenesis, of heredity, of the part played by feeling, of variation; all the subsequent developmental work accomplished by "natural selection,"—and it is vast indeed,—remains still unexplained. Granted these, we acknowledge the grandness of the explanation; but the fact that these fundamentals remain unexplained cuts off the latter explanation from the primordial physical hypothesis; and until this great hiatus is bridged over we cannot admit that the deductive process is complete.

It would be desirable to have cleared up, before this question is further discussed, what are the limits of the application of "natural selection." Is it a term, for instance, applicable to molecules of every sort? Are we to say that all the molecules and aggregates of molecules now existing in the world have their present state and form by virtue of "natural selection" or the survival of the fittest? Do we say of the granite mountains which have survived their more friable companions that their present existence is due to natural selection? Do we regard the solar system as an instance of the survival of the fittest? Do we imagine that any inorganic molecule exhibits the traits which we characterise by those terms?

Or, on the other hand, are these theories or descriptions wholly inapplicable to inorganic aggregates and essentially characteristic of organisms or organic matter? If so, then there is a breach of continuity between inorganic development and organic. Another deductive failure exhibits itself. We come again upon the gulf which—approach the inorganic by what terms and theories we may—continually manifests itself and severs the two classes of phenomena, though not widely yet too deeply to fathom.

If it is to be fathomed, it must be by the careful and close study of the behaviour of the most minute organisms. Actual observation and experiment upon these, and upon highly complex inorganic molecules, can alone inform us of the law by which one is transformed into the other, should such indeed be the case at all. No amount of ingenuity of thought can ever be expected to solve the problem. If the evolutionary philosopher takes refuge from his difficulties in the mere terms and phrases applicable to the more developed branches of his science when he meets with problems in those precedent inquiries which are more obscure, he is liable to be called upon to demonstrate their applicability. Can "natural selection" penetrate below organisms so as to explain the origin of organisms?

Again, the term "spontaneous variation" needs more scientific precision. To what depth of investigation is it legitimate to employ it, and what meaning will it carry with it in its application to inorganic processes? Can it be used in connecting the development of the inorganic with the evolution of the organic?

To say that those forms which survived must have answered to the conditions of survival (while those forms which perished did not answer to the conditions), and to say that those forms propagated which answered to the conditions of propagation (while those which did not propagate did not answer to the conditions), is not reasoning at all either by the deductive or the inductive method, and does not carry the mind forward to any new proposition. It is merely an identical proposition with its complementary negative. It is merely looking at the beginning and at the end of a process, and saying that somehow or other—even although the nature of the dependence is not discernible—every intermediate step in the whole range of sequences is the result of the interaction of preceding factors. And even if some of the conditions of survivorship and propagation are discernible, then to make any partial predication as to the conditions is not tantamount to a complete deductive interpretation. Thus the theory of natural selection or survival of the fittest is valid and useful in the Darwinian account, but of no value in the Spencerian attempt to affiliate biology upon inorganic evolution.

It is claimed for natural selection that it not only accounts for the variation of species but also for the origin of species; but it must be noted that the origin referred to is not the origin of the simplest biologic forms, but the origin of one species out of another; and the claim thus made does not differ in its significance from the power of accounting for variation of species. When we are told that natural selection accounts for the origin of species, all that is meant is such an extension of its application as to give it a power of accounting for all the most complex forms of life, granted some original simple form. But it is certainly not able to explain the origin of those simple forms, nor even the origin of many variations. Granting these, however, and granting heredity, it is of immense value in explaining the subsequent development.

It is noteworthy that natural selection can make no progress without the accident of origins and the accidents of spontaneous variation. Some accident of origin must have occurred amongst inorganic molecules by which such an arrangement was effected as to set up a habit of motion or function necessitating waste and instituting repair. Some of these aggregates acquired somehow the power of reproduction. Some by other happy accidents acquired other accretions of function, more particularly relating to nutrition. The more fortunate acquired motions to secure food supply. Others, still more lucky, acquired organs of locomotion. All these happy variations were preserved by "natural selection;" but not one of them is explicable thereby. Natural selection cannot account for a single form, a single function, or a single feeling; it can only explain their growth and competitive preservation after they are once originated.

Thus, however much the mind may be filled, and whatever satisfaction it may derive from the investigation of the vast and interesting field of inquiry opened out by the theory of "natural selection," still this branch of explanation is not equivalent to the continuity of explanation which we seek. It is not the bulk of explanations which constitutes the unification of knowledge, but the linear continuity of sequences. Each individual portion of these successive and dependent explanations is of enormous importance, and is to be valued accordingly; but until it is properly placed in due order of succession, and the mode of its dependence fully ascertained, the logical faculty which aims at the unification of all knowledge by its power of deducing all phenomena from original factors is not satisfied.

§ 17. *The Theory of Accidental Origins.*

A review of the Evolution hypothesis would be incomplete without an examination of what may be termed the "Happy Accident" theory. This theory is inadequately treated both by Mr. Spencer and by Mr. Darwin. Upon the latter it was not incumbent to go further back than was necessary for the limited scientific purpose he had in view, namely, the study of the variation of species and of the so-called origination of species by natural selection. Mr. Darwin need do no more than accept the scientific fact of accidental variation, and upon the favourable influence of such chance variation on the survival of certain individuals he might build up his views of their development into a species by one or other of the various modes of natural selection of which he gives an account. But it was not requisite to explain these accidental variations, nor to consider biology as a series of deductions from preceding factors; he was at liberty to accept certain acknowledged facts of nature and to reason therefrom. With Mr. Spencer it is otherwise. It is incumbent upon him, seeking as he does to give an explanation of universal sequence, to explain fully the part played in biologic evolution by accidental variations, lest, under cover of such an indefinite notion, we should fancy we understand more than we really do of the connections of sequences. However, before we proceed with our criticisms let us have the bearings of the question fully laid out before us.

This is best done by quitting our author, and taking for consideration two charming little books written by Mr. Grant Allen. We refer to his "Evolutionist at Large" and his "Vignettes from Nature," works obviously intended and well adapted to popularise the theory of development by natural selection. In a very interesting manner he familiarises the mind with the changes effected by the use and disuse of parts; with the developments effected in a species by the survival and consequent propagation of those individuals best fitted to the conditions of their environment; with the divergent effects of different influences acting upon a common stock; with the developmental influence of sexual preferences; with the important results of protective colourings, shapes, textures, tastes, and odours; with the part played by means of attractions offered to the senses of various animals; and with the other methods of biologic evolution. All these are presented to us in a familiar manner as lessons to be learned by any of us in the study of common objects by the wayside.

Given in this form, it is scarcely to be expected that the author should take into account philosophical difficulties. Nor, like Mr. Darwin, is he committed to any universalistic deductive theory, and therefore he is quite free to work out the methods of natural selection without being obliged to account for origins. Our criticism, therefore, does not apply to the accomplishment of his task, but only to the general position of Evolutionists, and we merely make use of his works as illustrative of this position.

One of the principal characteristics of the works in question is the amount of teleological language and the amount of teleological implication. This, however, has to be wholly ignored if the work is to be regarded scientifically. The author would justify himself no doubt in the same manner as Mr. Spencer in the passage referred to in the preceding section. We constantly read of the means adopted by plants "in order to" accomplish some end essential to their own preservation or propagation; of some "device" or "plan," either of function, of construction, or of colouring, for ensuring their own existence or the fertilisation or preservation of their seeds. The same anticipatory or foreseeing prearrangements are constantly predicated of the functions, structures, and colourings of animals. Although the author indicates that this teleological language is only figurative, yet we hold that its very extensive employment is highly detrimental to the scientific value of his work, and highly inconsistent with the special object he has in view, which is natural development as opposed to teleology. So marked is this characteristic, that in some passages the author would seem to imply intelligent adaptation on the part of plants to the eventualities of the future in their own race. But the abundant use of such metaphors tends to obscure rather than to illustrate the author's object.

This object is mainly to explain biologic evolution by natural methods. To these methods we have already referred. All we are concerned with at present is, firstly, to notice that they are limited in their application to races of creatures which possess the power of propagation, and therefore that an unexplained power of genesis is antecedent to the operation of "natural selection." In the next place, we have to observe that "natural selection" does not originate variation, but only selects such variations as are advantageous to the preservation of the race. Natural selection thus requires a basis of accidental origins upon which to work. Of these accidental origins or variations, some, being useless to the race, perish in their inception by a natural law, and others, being serviceable, are preserved by natural selection, and are developed by use and continued by heredity. Of these accidental origins our author says—

"The lucky accident, the casual combination of circumstances, which produced the first elongation of the receptacle in the strawberry has never happened to befall its more modest kinsfolk. For on such occasional freaks of nature the whole evolution of new varieties entirely depends. A gardener may raise a thousand seedlings, and only one or none among them may present a single new and important feature. So a species may wait for a thousand years, or for ever, before its circumstances may happen to produce the first step towards some desirable improvement." *

Again—"An accidental variety of leaf or flower, like the monstrosities which we cultivate in our gardens, means, as a rule, very little indeed, because it is not correlated with any need or habit of the plant. It affords no material upon which natural selection can work."

And we find continued reference made throughout the work to the "original accidental possession" of some property, to individuals which by chance "happen to show any tendency," which "take" (at first by accident) to some habit, or which "happen to have developed" some function or rudimentary structure.

It is upon these bases that natural selection works. They are pre-essential to it, and, therefore, in any deductive system have to be accounted for before the process of natural selection is introduced. Natural selection itself does not account for them, but only for their consequences. Let us therefore consider the nature and extent of the happy accidents which gave rise to and assisted in biologic evolution. Their extent must have been coequal with every special arrangement of structure and function by which the preservation of the individual has been secured either in the procurement of food or in protection from enemies, as well as with those by which the propagation of the species has been effected.

What then is "an accident?" Of course, our study, being a scientific one, does not admit of the use of the term in any occult sense, but only within legitimate scientific meanings. For instance, the generalised relations of bodies known as the laws of mechanics hold good of all bodies in their mechanical relations; but any special mechanical relation of which we do not know the preceding conditions is regarded as accidental. This mode of statement does not place particular events beyond the laws of mechanics, but only expresses our ignorance of the particular line of sequences which led up to the particular concrete instance of which we make the predication that it is accidental. The same remarks apply to chemical combinations. We understand the general relations of the chemical elements, and we

* The Evolutionist at Large, p. 24.

understand our own special chemical experiments; but of many chemical events we say they are accidental because of our ignorance of some of the particular sequences which led up to their occurrence. We would call the solar system an accident, or the arrangement of the seas and continents of the planet on which we reside—if we are not too pessimistic—a happy or lucky accident. These arrangements are understood as due to certain great laws of physics and chemistry; and if we call them accidental, all we mean is that we cannot trace their special antecedents. Nevertheless, our general knowledge of physics and chemistry is just as true and just as valid for all the concrete cases within our cognisance as if the whole individual history of all atoms was known to us.

Now let us consider some cases to which the term "accidental" is applied, but which do not fall within the scope of the above explanation, and in which the employment of the term tends to false reasoning. Suppose we say of some inorganic molecules or systems of molecules that they accidentally acquired the habit of motion or of self-sustenance. If by that we meant no more than that some particular atoms known to possess certain properties in relation with other atoms accidentally got together and so were enabled to display those properties in actual relation, then the meaning is scientific; but if it is meant that they displayed properties not known to be included in our primary knowledge of them, then the "accidental" outcome implies a something wanting in our knowledge of those primary properties, or else it implies that something new has accidentally come into existence. The former conclusion does not militate against inductive science, but it does militate against the validity of a deduction based upon a hypothesis as to the properties of these primary factors; and the latter conclusion is subversive of any logical scheme whatsoever.

Again, suppose we say that some of these systems of molecules accidentally acquired the habit of multiplication by propagation, and that the habit of heredity was accidentally introduced. It is clear that if these circumstances occurred there could be no new principle or property accidentally introduced into the cosmos, but that only some event unexplainable from its immediate concrete antecedents had taken place. If such phenomena, however, are to be regarded as "accidental" in any other sense, it simply means the introduction of new factors, of which we have no knowledge. Events have occurred which are not explainable by our general deductive theory, implying an ignorance of theory as well as of immediately preceding concrete relations.

This mode of applying the term "accidental" is therefore found not to be equivalent to the mode of applying it to particular physical and chemical combinations whose general laws we understand, but whose particular concrete conjunctions we are unable to explain. Our ignorance in the latter case is merely of immediate special antecedents and not of general law or theory; whereas in the cases referred to our ignorance is of general law and theory as well as of immediate antecedents. It is some general law or factor of which we are ignorant rather than some particular series of sequences, the general law of which is known. In one case the scientific system is not interfered with by the "accidentals;" in the other case the theory with its deductive explanations is found to be altogether valueless. In the one case the accidentals fall within the line of sequences; in the other case events occur which cannot be recognised as falling within the deductive system.

If we say of some aggregate of molecules that it accidentally acquired the means of locomotion, we introduce under cover of the word "accidentally" new properties not deducible from the known properties of any combination of the chemical elements. The expression of our ignorance, again, is not merely that of the particular order of sequence of known factors, but is indicative of the impossibility of connecting in thought the new phenomena with any of the known properties of the preceding factors. It indicates a deductive failure.

Lastly, should we say that some aggregate of molecules accidentally developed a sense of feeling, our term "accidentally" masks the entrance of a very important and powerful factor in organic development, and indicates our ignorance of its relation to preceding factors.

Thus by means of the continuous accretion of accidental combinations and by means of the accidental entrance of new factors, natural selection is afforded most extensive bases, both in extent and diversity of nature, to work upon in biological development. Evolutionists exhibit very clearly the interaction of organisms with environment and of organisms with organisms, showing how natural selection has worked amongst all these accidentally produced combinations and accidentally produced factors; but it must not be supposed that by thus extensively dwelling upon the wonderful history of natural selection we have exhausted the explanation of biological history or even found a basis of explanation. We have only been afforded a means for understanding an intermediate portion of it. What is required in addition is to show that the accidental variations are within the limits of the properties of the primary factors from which it is proposed to reconstruct biology. If the "accidental" is shown to be within the limits of the original properties it is legitimate and logical, but as actually used it appears to us to mask the introduction of factors not properly included in the premisses.

§ 18. *Summary.*

Thus we have seen that whether we set out to deduce biological evolution from the relations of the concrete internal and external factors as described at the outset of vol. i., or from the nature of mechanical moving equilibria as given in reply to the question, "How is organic evolution caused?" we have equally failed in that deductive endeavour. Therefore the evolution of biology is not affiliated upon evolution in general.

With regard to Mr. Spencer's system of philosophy taken as a whole, we come to the conclusion that, admirable as is the boldness, magnificent as is the sweep, extraordinary as is the connectiveness of his reasonings, he nevertheless fails in his vast attempt. At the same time we must admire the grandeur of the outline he has sketched, acknowledge the greater breadth of view he has given to human speculation, and appreciate the abounding wealth of suggestion displayed throughout the work, which not only enriches human knowledge, but is sure to give rise to further earnest, bold, and penetrating research into the mysteries of nature.

At the same time, we feel that, although deduction may give unity and consolidation to science, it must be mainly to experience and induction that we are to look for the solid increment of knowledge: and if ever we arrive at a final unification, which is doubtful, it must be by the patient labour of the human race through ages yet unborn.

THE END.

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