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Mechanism and Its Alternatives

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The Ideal of Pure Mechanism

Let us first ask ourselves what would be the ideal of a mechanical view of the material realm. I think, in the first place, that it would suppose that there is only one fundamental kind of stuff out of which every material object is made. Next, it would suppose that this stuff has only one intrinsic quality, over and above its purely spatio-temporal and causal characteristics. The property ascribed to it might, e.g., be inertial mass or electric charge. Thirdly, it would suppose that there is only one fundamental kind of change, viz., change in the relative positions of the particles of this stuff. Lastly, it would suppose that there is one fundamental law according to which one particle of this stuff affects the changes of another particle. It would suppose that this law connects particles by pairs, and that the action of any two aggregates of particles as wholes on each other is compounded in a simple and uniform way from the actions which the constituent particles taken by pairs would have on each other. Thus the essence of Pure Mechanism is (a) a single kind of stuff, all of whose parts are exactly alike except for differences of position and motion; (b) a single fundamental kind of change, viz, change of position. Imposed on this there may of course be changes of a higher order, e.g., changes of velocity, of acceleration, and so on; (c) a single elementary causal law, according to which particles influence each other by pairs; and (d) a single and simple principle of composition, according to which the behaviour of any aggregate of particles, or the influence of any one aggregate on any other, follows in a uniform way from the mutual influences of the constituent particles taken by pairs.

A set of gravitating particles, on the classical theory of gravitation, is an almost perfect example of the ideal of Pure Mechanism. The single elementary law is the inverse-square law for any pair of particles. The single and simple principle of composition is the rule that the influence of any set of particles on a single particle is the vector-sum of the influences that each would exert taken by itself. An electronic theory of matter departs to some extent from this ideal. In the first place, it has to assume at present that there are two ultimately different kinds of particle, viz., protons and electrons. Secondly, the laws of electro-magnetics cannot, so far as we know, be reduced to central forces. Thirdly, gravitational phenomena do not at present fall within the scheme; and so it is necessary to ascribe masses as well as charges to the ultimate particles, and to introduce other elementary forces beside those of electro-magnetics.

On a purely mechanical theory all the apparently different kinds of matter would be made of the same stuff. They would differ only in the number, arrangement and movements of their constituent particles. And their apparently different kinds of behaviour would not be ultimately different. For they would all be deducible by a single simple principle of composition from the mutual influences of the particles taken by pairs; and these mutual influences would all obey a single law which is quite independent of the configurations and surroundings in which the particles happen to find themselves. The ideal which we have been describing and illustrating may be called "Pure Mechanism".

When a biologist calls himself a "Mechanist" it may fairly be doubted whether he means to assert anything so rigid as this. Probably all that he wishes to assert is that a living body is composed only of constituents which do or might occur in non-living bodies, and

that its characteristic behaviour is wholly deducible from its structure and components and from the chemical, physical and dynamical laws which these materials would obey if they were isolated or were in non-living combinations. Whether the apparently different kinds of chemical substance are really just so many different configurations of a single kind of particles, and whether the chemical and physical laws are just the compounded results of the action of a number of similar particles obeying a single elementary law and a single principle of composition, he is not compelled as a biologist to decide. I shall later on discuss this milder form of "Mechanism," which is all that is presupposed in the controversies between mechanistic and vitalistic biologists. In the meanwhile I want to consider how far the ideal of Pure Mechanism could possibly be an adequate account of the world as we know it.

Limitations of Pure Mechanism. No one of course pretends that a satisfactory account even of purely physical processes in terms of Pure Mechanism has ever been given; but the question for us is: How far, and in what sense, could such a theory be adequate to all the known facts? On the face of it external objects have plenty of other characteristics beside mass or electric charge, e.g., colour, temperature, etc. And, on the face of it, many changes take place in the external world beside changes of position, velocity, etc. Now of course many different views have been held about the nature and status of such characteristics as colour; but the one thing which no adequate theory of the external world can do is to ignore them altogether. I will state here very roughly the alternative types of theory, and show that none of them is compatible with Pure Mechanism as a complete account of the facts.

1. There is the naive view that we are in immediate cognitive contact with parts of the surfaces of external objects, and that the colours and temperatures which we perceive quite literally inhere in those surfaces independently of our minds and our bodies. On this view Pure Mechanism breaks down at the first move, for certain parts of the external world would have various properties different from and irreducible to the one fundamental property which Pure Mechanism assumes. This would not mean that what scientists have discovered about the connexion between heat and molecular motion, or light and periodic motion of electrons would be wrong. It might be perfectly true, so far as it went; but it would certainly not be the whole truth about the external world. We should have to begin by distinguishing between "macroscopic" and "microscopic" properties, to use two very convenient terms adopted by Lorentz. Colours, temperatures, etc., would be macroscopic properties, i.e., they would need a certain minimum area or volume (and perhaps, as Dr Whitehead has suggested, a certain minimum duration) to inhere in. Other properties, such as mass or electric charge, might be able to inhere in volumes smaller than these minima and even in volumes and durations of any degree of smallness. Molecular and electronic theories of heat and light would then assert that a certain volume is pervaded by such and such a temperature or such and such a colour if and only if it contains certain arrangements of particles moving in certain ways. What we should have would be laws connecting the macroscopic qualities which inhere in a volume with the number, arrangement, and motion of the microscopic particles which are contained in this volume.

On such a view how much would be left of Pure Mechanism? (i) it would of course not be true of macroscopic properties. (ii) it might still be true of the microscopic particles in their interactions with each other. It might be that there is ultimately only one kind of particle, that it has only one non-spatio-temporal quality, that these particles affect each other by pairs according to a single law, and that their effects are compounded according to a single law. (iii) But, even if this were true of the microscopic particles in their relations with each other, it plainly could not be the whole truth about them. For there will also be laws connecting the presence of such and such a configuration of particles, moving in such and such ways, in a certain region, with the pervasion of this region by such and such a determinate value of a certain macroscopic quality, e.g., a certain shade of red or a temperature of 57°C. These will be just as much laws of the external world as are the laws which connect the motions of one particle with those of another. And it is perfectly clear that the one kind of law cannot possibly be reduced to the other; since colour and temperature are irreducibly different characteristics from figure and motion, however close may be the causal connexion between the occurrence

of the one kind of characteristic and that of the other. Moreover, there will have to be a number of different and irreducible laws connecting microscopic with macroscopic characteristics; for there are many different and irreducible determinable macroscopic characteristics, e.g., colour, temperature, sound, etc. And each will need its own peculiar law.

2. A second conceivable view would be that in perception we are in direct cognitive contact with parts of the surfaces of external objects, and that, so long as we are looking at them or feeling them, they do have the colours or temperatures which they then seem to us to have. But that the inherence of colours and temperatures in external bodies is dependent upon the presence of a suitable bodily organism, or a suitable mind, or of both, in a suitable relation to the external object.

On such a view it is plain that Pure Mechanism cannot be an adequate theory of the external world of matter. For colours and temperatures would belong to external objects on this view, though they would characterise an external object only when very special conditions are fulfilled. And evidently the laws according to which, e.g., a certain shade of colour inheres in a certain external region when a suitable organism or mind is in suitable relations to that region cannot be of the mechanical type.

3. A third conceivable view is that physical objects can seem to have qualities which do not really belong to any physical objects, e.g., that a pillar-box can seem to have a certain shade of red although really no physical object has any colour at all. This type of theory divides into two forms. (a) It might be held that, when a physical object seems to have a certain shade of red, there really is something in the world which has this shade of red, although this something cannot be a physical object or literally a part of one. Some would say that there is a red mental state—a "sensation"—; others that the red colour belongs to something which is neither mental nor physical.* On either of these alternatives it would be conceivable that Pure Mechanism was the whole truth about matter considered in its relations with matter. But it would be certain that it is not the whole truth about matter when this limitation is removed. Granted that bits of matter only seem to be red or to be hot, we still claim to know a good deal about the conditions under which one bit of matter will seem to be red and another to be blue and about the conditions under which one bit of matter will seem to be hot and another to be cold. This knowledge belongs partly to physics and partly to the physiology and anatomy of the brain and nervous system. We know little or nothing about the mental conditions which have to be fulfilled if an external object is to seem red or hot to a percipient; but we can say that this depends on an unknown mental factor x and on certain physical conditions a, b, c, etc., partly within and partly outside the percipient's body, about which we know a good deal. It is plain then that, on the present theory, physical events and objects do not merely interact mechanically with each other; they also play their part, along with a mental factor, in causing such and such an external object to seem to such and such an observer to have a certain quality which really no physical object has. In fact, for the present purpose, the difference between theories (2) and (3) is simply the following. On theory (2) certain events in the external object, in the observer's body, and possibly in his mind, cause a certain quality to inhere in the external object so long as they are going on. On theory (3) they cause the same quality to seem to inhere in the same object, so long as they are going on, though actually it does not inhere in any physical object. Theory (1), for the present purpose, differs from theory (2) only in taking the naive view that the body and mind of the observer are irrelevant to the occurrence of the sensible quality in the external object, though of course it would admit that these factors are relevant to the perception of this quality by the observer. This last point is presumably common to all three theories.

I will now sum up the argument. The plain fact is that the external world, as perceived by us, seems not to have the homogeneity demanded by Pure Mechanism. If it really has the various irreducibly different sensible qualities which it seems to have, Pure Mechanism cannot be true of the whole of the external world and cannot be the whole truth about any part of it. The best that we can do for Pure Mechanism on this theory is to divide up the external world first on a macroscopic and then on a microscopic scale; to suppose that the macroscopic qualities which pervade any region are causally determined by the microscopic events and objects which exist

within it; and to hope that the latter, in their interactions with each other at any rate, fulfil the conditions of Pure Mechanism. This result may remind the reader of the carefully qualified compliment which Mr Gibbon pays to the morality of the Negroes in a foot-note which I forbear from quoting. We must remember, moreover, that there is no a priori reason why microscopic events and objects should answer the demands of Pure Mechanism even in their interactions with each other; that, so far as science can tell us at present, they do not; and that, in any case, the laws connecting them with the occurrence of macroscopic qualities cannot be mechanical in the sense defined.

If, on the other hand, we deny that physical objects have the various sensible qualities which they seem to us to have, we are still left with the fact that some things seem to be red, others to be blue, others to be hot, and so on. And a complete account of the world must include such events as "seeming red to me", "seeming blue to you", etc. We can admit that the ultimate physical objects may all be exactly alike, may all have only one non-spatio-temporal and non-causal property, and may interact with each other in such a way which Pure Mechanism requires. But we must admit that they are also cause-factors in determining the appearance, if not the occurrence, of the various sensible qualities at such and such places and times. And, in these transactions, the laws which they obey cannot be mechanical.

We may put the whole matter in a nutshell by saying that the appearance of a plurality of irreducible sensible qualities forces us, no matter what theory we adopt about their status, to distinguish two different kinds of law. One may be called "intra-physical" and the other "trans-physical". The intra-physical laws may be, though there seems no positive reason to suppose that they are, of the kind required by Pure Mechanism. If so, there is just one ultimate elementary intra-physical law and one ultimate principle of composition for intra-physical transactions. But the trans-physical laws cannot satisfy the demands of Pure Mechanism; and, so far as I can see, there must be at least as many irreducible trans-physical laws as there are irreducible determinable sense-qualities. The nature of the trans-physical laws will of course depend on the view that we take about the status of sensible qualities. It will be somewhat different for each of the three alternative types of theory which I have mentioned, and it will differ according to which form of the third theory we adopt. But it is not necessary for our present purpose to go into further detail on this point….

Teleology, Mechanism, and Design

I have so far discussed Mechanism and its alternatives in a perfectly general way; and have said nothing in detail concerning those peculiar facts about living organisms which make it plausible to distinguish a "Vital Order" with "ultimate characteristics" of its own. Now the peculiarities of living organisms are often summed up in the phrase that organisms are "Teleological Systems". And there is thought to be some special connexion between Teleology and Design, and some special opposition between Teleology and Mechanism. I shall end this chapter by trying to clear up these points.

Teleology is an observable characteristic which certainly belongs to some things in the world. Design is a particular cause which certainly produces teleology in some cases. I want to begin by defining "teleology" in such a way that there shall be no doubt of its existence and that the admission of this fact shall not presuppose the acceptance of any special theory. Suppose that a system is composed of such parts arranged in such ways as might have been expected if it had been constructed by an intelligent being to fulfil a certain purpose which he had in mind. And suppose that, when we investigate the system more carefully under the guidance of this hypothesis, we discover hitherto unnoticed parts or hitherto unnoticed relations between the parts, and that these are still found to accord with the hypothesis. Then I should call this system "teleological ". It will be noticed that there are two clauses in the definition. The first is that our more or less superficial knowledge of the system suggests that it was designed for a special purpose which a rational mind might be likely to entertain. The second is that, if we use this hypothesis as a clue to more minute investigation, we continue to find that the system

is constructed as if the hypothesis were true. I think that probably both factors are necessary. Of any system whatever we might suppose that it was designed to do what we actually find it doing. But in general we should not find that this gave us any clue to investigating its more minute structure or predicting its unobserved behaviour.

Now it seems to me perfectly certain that the world contains systems which are teleological, in this sense. The most obvious examples of such systems are machines, like watches, motor-cars, etc. In this case of course we start by knowing that they have in fact been designed by intelligent beings for a certain purpose, such as telling the time or conveying people quickly along roads. Knowing this we can explain, as we say, "what each part is for." Suppose now we were to meet with a certain machine for the first time and to know nothing about the purpose of its constructor. As we have met with plenty of other machines (though none exactly like this); as we know that all of these have been made by some human being for some purpose; and as we know of no machines which have arisen in any other way; we may legitimately infer that this one also was constructed by a human being for some purpose. By studying the action of the machine we may then be able to guess what the purpose probably was. We can then predict how it will probably be constructed in detail, and how it will probably work under various circumstances. And, if our predictions are found to be true, it is likely that we have hit on the true purpose of the machine. I will call the kind of teleology which is shown by watches, motor-cars, and other artificial machines, "external teleology". By this I mean that the purpose for which such systems were constructed, and by which their minute structure can be anticipated, is not wholly or mainly to keep themselves going or to produce other machines like themselves. Their main function is to do something, such as telling the time, which is of interest not to themselves but to their makers or other men.

Now it seems to me equally clear that living organisms are teleological systems in the sense defined. The most superficial knowledge of organisms does make it look as if they were very complex systems designed to preserve themselves in face of varying and threatening external conditions and to reproduce their kind. And, on the whole, the more fully we investigate a living organism in detail the more fully does what we discover fit in with this hypothesis. One might mention, e.g., the various small and apparently unimportant glands in the human body whose secretions are found to exercise a profound influence over its growth and well-being. Or again we might mention the production in the blood of antitoxins when the body is attacked by organisms likely to injure it. I will call this kind of teleology "internal teleology". Whatever be the right explanation of it, it is plainly a fact.

We have now to consider the relation between Teleology and Design. (i) The definition of "teleology" involves a hypothetical reference to design. The system is teleological provided it acts as if it were designed for a purpose. But it does not involve anything more than this. It remains a question of fact whether the system was actually the result of a design in someone's mind. (ii) So far as we know, the teleology of non-living machines is always due to design. They behave in the characteristic way in which they do behave simply because their parts are constructed and fitted together in certain special ways, and we have no reason to suppose that this special arrangement could arise spontaneously without the intervention of a mind which deliberately chose it. (iii) The real paradox about organisms is that they are teleological systems which seem nevertheless to arise without design. It is this last fact which we must now discuss.

Many organisms have minds connected with them. But we know that if they were designed at all, the mind which designed them was certainly not the mind which animates them, unless this be extraordinarily different from what it appears to be both to itself and to others. The highest type of mind which we are acquainted with is that which animates a human body. If we designed our own organisms we are quite unaware of the fact. And the enterprise seems altogether beyond our powers. The most skilled physiologist does not know how to make a living body; but, if we say that his mind designed his own organism, we must suppose that it performed as an embryo a feat which it is totally incapable of performing in its developed state. We must say then that, if organisms are designed by minds, either (a) the designing mind is altogether different from and enormously wiser and more skilful than the animating mind; or

(b) that the animating mind, as known to itself by introspection and to others by communication, is the merest fragment of the total animating mind, and that the part of it which does not appear to itself or to others is of superhuman wisdom and ingenuity. Of course it might be held that the designing mind, or the designing part of the animating mind, though extraordinarily clever at its own particular job, takes no interest in anything else; or that it works in a wholly different way from the minds which are known to us. But this will not help us. If the conception of design is to provide any explanation of the peculiarities of organisms we must mean by "design" something of the same nature as the only designs that we know anything about, viz., our own. Otherwise we are merely playing with words. Now we have designs only when we imagine a possible state of affairs, apply our knowledge of the properties and laws of matter to discover how it might be brought about, and then use our technical skill to shape the material and to arrange it in those ways which we have seen to be necessary for our purpose. If the minds which design organisms act in this way they must have a superhuman knowledge of the laws and properties of matter, superhuman mathematical ability to work out the consequences of various possible combinations, and superhuman technical skill; and all analogy makes it most unlikely that a mind which took no interest in anything but the one job of manufacturing organisms would have these powers. If, on the other hand, the minds which design organisms act in some quite different and to us unknown way, then we have no right to call them "minds" or to call their mode of operation "design". We are merely assuming a wholly mysterious cause for the teleology of organisms, and tricking ourselves into the belief that it is an explanation by using the familiar words "mind" and "design". I conclude then that, if organisms be the result of design in any intelligible sense, their designers may fairly be called "gods"; and either we are gods in disguise or there are superhuman beings who make organisms.

These considerations remove one positive argument in favour of the theory of entelechies. I am sure that many people who look with a friendly eye on entelechies do so because of the teleological nature of organisms. They think of entelechies as little minds which design organisms and direct and control their growth and reactions. But they modestly regard entelechies as very inferior minds or as the inferior parts of the minds which animate organisms. Now, if I am right, this modesty is wholly out of place. If the hypothesis of an entelechy is to explain anything, we must suppose that an entelechy is a very superior mind or the very superior part of the mind which animates an organism. The theory insinuates itself into our confidence by pretending that the entelechy is so lowly a mind as scarcely to deserve the name; but it can explain the facts only if it supposes the entelechy to be so exalted a mind as to deserve the name of a "god".

I pass now to the relations between Teleology and Design, on the one hand, and Biological Mechanism, on the other. It is evident that, up to a point, there is no opposition between teleology and mechanism. Nothing can be more thoroughly teleological than a watch or a motor-car; yet these are machines, and their characteristic behaviour is wholly deducible from the special arrangement of their parts and from the general laws which these parts would equally obey in isolation or in other and non-teleological complexes. We may say then that, so long as we take a material system as a going concern and do not raise questions about its origin, there is no reason whatever why its characteristic behaviour should not be at once teleological and capable of complete mechanistic explanation. Now the mechanistic biologist regards organisms as very complex machines; and indeed if we were not very familiar with artificial self-acting and self-regulating machinery it would never have entered our heads to suggest a mechanistic theory of vital behaviour. So long as he confines his attention to a developed organism there is nothing preposterous in this theory. It is only when we consider the origin of teleological systems that a legitimate doubt arises whether teleology and mechanistic explanation are ultimately consistent with each other.

(i) Every system which is certainly known to be at once teleological and mechanistic is an artificial machine; and, if we follow its history far enough backwards, we always come to one or more organisms, which are teleological but not certainly mechanistic systems. It is true that many machines are themselves made by machines; but sooner or later in this chain we come to human bodies which made these machines and were not themselves made by machinery. Thus,

apart altogether from any question of minds and their designs, there is something dangerously like a vicious circle in professing to explain the teleology of organisms by analogy with artificial machines. For, the moment we begin to consider the origin of organisms in general or of any particular organism, we have to admit that all artificial machines were ultimately made by organisms whilst no organism is ever made by an artificial machine.

To this objection I think that the following answer might be made. It might be said: "Admittedly we must distinguish two kinds of machines, viz., natural and artificial. We can quite well admit the general principle that all machines are made by other machines. Natural machines (i.e., organisms) are always made by other natural machines; artificial machines may be made proximately by other artificial machines, but in the long run in the history of any artificial machine we come to a natural machine. We admit then that natural machines are causally prior to artificial machines; but this involves no logical circle. We first derive the general notion of machinery and of a mechanistic explanation of teleological behaviour from the specially simple and obvious case of artificial machines, at a time when we do not suspect that our bodies are themselves natural machines. Eventually we apply the notion thus derived to our bodies, and find that it fits them perfectly. There is no inconsistency between the facts
a. that the recognition of artificial machines is psychologically prior to the recognition of natural machines, and
b. that the existence of natural machines is causally prior to the existence of artificial machines".
I think that this is a valid answer to the particular logical objection raised above. But it does not exhaust the difficulties of Biological Mechanism; and this brings us to our next point.

(ii) It is true, but it is not the whole truth, to say that the history of every system which is positively known to be both teleological and mechanistic (i.e., of every artificial machine) we come at length to an organism. We also come to the mind which animates this organism; to a design in this mind; and to the deliberate arrangement of matter in view of an end. And this seems to be essential for the production of a teleological system out of non-teleological materials. On a mechanistic theory the teleological behaviour of a system must be due wholly to the initial configuration of its parts; and, if matter has only the properties which physicists and chemists ascribe to it, it has no tendency by itself to fall into those extraordinarily special arrangements which alone can give rise to teleological behaviour. Now, if the analogy of organisms to artificial machines is to be used at all, it must be used fairly; we must not ignore one essential part of the facts about the origin of artificial machines. Let us then apply the whole analogy to organisms. It is certain that, when one organism produces another by ordinary processes of generation, the mind of the first does not design and construct the second, as it would if it were producing an artificial machine like a watch or a type-writer. This in itself need cause no trouble to the Mechanist. When one artificial machine produces another the mind of the first does not design the second, for artificial machines have no minds. The Biological Mechanist will therefore simply say that the generation of one organism by another is analogous to the production of one artificial machine by another. But, as we have seen, the latter series eventually brings us back to a mind with designs. Hence, if the Biological Mechanist is to apply his analogy fairly, there arc only two courses open to him. The first is to say that there always have been organisms, and that organisms have never arisen from inorganic matter. On this alternative he has a series of natural machines going back to infinity. In that case of course every artificial machine will also have an infinite ancestry of other machines, since the production of an artificial machine eventually brings one back to a natural machine. Such a theory would be self-consistent; though it would still leave the awkward difference that design enters into the history of every artificial machine and of no natural machine. It is of course an alternative that most mechanists would be very loath to take; for one of the advantages claimed for Biological Mechanism over Substantial Vitalism is that the former does and the latter does not render the development of living from non-living matter conceivable.

The other possible alternative is to admit that organisms arose in the remote past out of non-living matter. This means, on the mechanistic view, that natural machines arose from matter which was not arranged in the form of a machine. And this can be consistently held only if the

Biological Mechanist will postulate at that point the intervention of a mind which deliberately designed and arranged non-living matter in the form of a natural machine. For, as we have seen, the only systems which we positively know to be machines have all arisen in this way; and, if matter has no properties except those which chemists and physicists assign to it, there is not the least reason to suppose that it can spontaneously fall into the extremely special configuration which is needed if the resulting system is to behave teleologically. Thus the proper complement to a completely mechanistic theory about organisms is some form of the doctrine of Deism; a result which accords very well with that simple piety which is so characteristic of Biological Mechanists.

But, even if we are willing to go thus far with the Biological Mechanist, we cannot allow him to leave the matter there. Every system which is positively known to be a machine has been ultimately made, not by a pure spirit, but by a mind which animates an organism which it did not design or construct. This mind formed a design; in consequence of this the organism which it animates has moved in various ways; and it is thus and thus only that the design has been realised in foreign matter. Once more, if we are to use the analogy of machines at all, we must use it fairly and not ignore these parts of it which, so far as we can see, are essential but which are not convenient. The Biological Mechanist, having been brought willingly or unwillingly to Deism, must now take a further step and ascribe to God an organism which God's mind animates. And by all analogy we must suppose that God did not design or construct his own organism; since, so far as our experience goes no mind designs or constructs the organism which it animates. Thus, in the end, we shall be brought to one organism at least, viz, God's, which presumably has not arisen out of non-living matter either spontaneously or by design. This seems to be the final result of seriously and fairly applying the analogy between organisms and machines, when we cease to confine our attention to the organism as a going concern and try to account also for the origin of organisms, as Biological Mechanism would wish to do.

Tentative Decision between the Three Theories of Organisms

When we consider the teleological characteristics of organisms the three possible theories of Substantial Vitalism, Emergent Vitalism, and Biological Mechanism cease to be on a level. In the first place, there seems to be nothing to be said for Substantial Vitalism, and a great deal to be said against it. We may therefore provisionally reject it, and confine our attention to Emergent Vitalism and Biological Mechanism. It seems to me that, so long as we merely consider the behaviour of the organism as a going concern, there is no strong argument for deciding between the two types of theory. For it is quite certain that a material system, once it is in being, can be teleological and at the same time mechanistic in its behaviour. Hence, even if we did not see our way to explain certain teleological characteristics of developed organisms mechanistically, the Biological Mechanist could always answer that this is merely because we do not yet know enough about the minute structure of the machine or about the more obscure physico-chemical properties of non-living matter. And this is what he is continually occupied in saying. But, when we come to consider the origin of organisms as well as their behaviour, the case is altered. We find that Biological Mechanism about the developed organism cannot consistently be held without an elaborate Deistic theory about the origin of organisms. This is because Biological Mechanism is admittedly a theory of the organism based on its analogy to self-acting and self-regulating machines. These, so far as we can see, neither do arise nor could have arisen without design and deliberate interference by someone with matter. And, in applying our analogy, we have no right whatever to ignore this side of it. I do not of course assert that this is a conclusive objection to Biological Mechanism. Deism has always seemed to me a much more sensible theory than most of its more pretentious successors. But I do wish to make it quite clear that Biological Mechanism is committed logically to a great deal more than is commonly supposed. It Emergent Vitalism could dispense with the need for all this Deistic supplementation it would pro tanto score over Biological Mechanism. But can it?

It might well be thought that in this matter Emergent Vitalism is no better off than Biological

Mechanism. On both theories the peculiar behaviour of an organism is completely determined by its structure and its components and by nothing else. The only difference is that on the Emergent View the peculiar behaviour of such systems must be "seen to be believed", whilst on the Mechanistic View it could in theory have been foretold from the structure and the behaviour of the components in isolation or in non-living wholes. If you make it an objection to the Mechanistic Theory that the characteristic behaviour of the organism depends on the arrangement of its parts, and that this arrangement could only have happened by design, does not the objection apply equally strongly to the Emergent Theory? This argument is plausible, but I do not think that it is sound. The Biological Mechanist points to the analogy between organisms and artificial machines, and asks us to believe on this ground that organisms are machines. To this we answered that matter has no natural tendency to arrange itself in the form of machines (i.e., of teleological systems whose characteristic behaviour is mechanistically explicable); and that therefore, if organisms be of the nature of machines, there is no reason to suppose that they could have arisen spontaneously and without design. But it is perfectly consistent for a man to hold that matter has no tendency to fall spontaneously into the form of machines and that it has a natural tendency to fall into the form of organisms; provided he holds, as the Emergent Vitalist does, that organisms are not machines but are systems whose characteristic behaviour is emergent and not mechanistically explicable. Thus the real difference is that a possibility is open to the Emergent Vitalist, who recognises two fundamentally different kinds of teleological system, and that this possibility is closed to the Biological Mechanist, who recognises only one kind.

Of course this possibility, which is open to the Emergent Vitalist and not to the Biological Mechanist, is very vague and needs to be worked out in much greater detail. This would be the task of the empirical scientist rather than the critical philosopher. I will content myself with saying that the Emergent Vitalist should not rest with nothing better than the vague statement that matter has a natural tendency to fall into that kind of structure which has vital behaviour as its emergent characteristic. If Emergence be true at all there are probably many Orders below the Vital Order. What must be assumed is not a special tendency of matter to fall into the kind of arrangement which has vital characteristics, but a general tendency for complexes of one order to combine with each other under suitable conditions to form complexes of the next order. At each stage in this process we shall get things with new and irreducibly characteristic properties and new intra-ordinal laws, whilst there will probably remain certain complexes of all the lower orders. The universe would thus grow continually more varied, so long as the special conditions necessary for this combination of complexes of lower order to give complexes of higher order continued; and at every new stage new possibilities of further development would begin. It would be the business of the believer in Emergence to determine the precise condition under which the passage from one order to the next can take place; to state definitely what are the irreducibly characteristic features of each order; and to deduce those characteristic features which can be deduced.

It seems to me then that on the whole Emergent Vitalism is distinctly to be preferred to Biological Mechanism. It does not necessitate a complicated Deistic supplement, as Biological Mechanism does; and this seems to me to be an advantage. At the same time it is perfectly consistent with the view that there is a God who created and controls the material world; so that, if there should be any good reason to believe in such a Being, the Emergent Vitalist could meet the situation with a quiet mind.

C.D. Broad. *Mind and It's Place in Nature*. Chapter 2. London: Routledge and Kegan Paul, 1925.