

THE MEANING OF LIFE

BY PROF. J. K. MAJUMDAR, M. A., PH. D.

A GREAT deal of ambiguity attaches to the question as to the meaning of the term 'life'. The term "life" has usually been confined to biological phenomena; "the initial question of Biology", we are told, "is the nature and characteristics of living matter—the determination of that wherein 'livingness' consists."¹ The term "life" has been taken to be the characteristic quality which is common to plants, animals and man and which distinguishes them from all other things in nature. "Life", Prof. J. A. Thomson warns us, is distinctively a biological concept and there is always a risk in transferring it to other fields.² In its widest sense, "life" may be defined from the biological point of view as the manifestation of action and reaction between organism and environment. Or, as Spencer puts it: "Life is the continuous adjustment of internal relations to external relations." But this definition, Spencer thinks, is abstract and to employ its more concrete equivalent we should do well "to consider the internal relations as 'definite combinations of simultaneous and successive changes'; the external relations as 'co-existences and sequences'; and the connection between them as a correspondence."³ Even so the definition, Spencer adds, is one-sided, inasmuch as it recognizes only the *form* and not the *body* of our conception of life.. "That which gives the substance of our idea of life is," he says, "a certain unspecified principle of activity. The dynamic element in life is its essential element."⁴ And this dynamic element or principle of activity is, he maintains, unknown and unknowable. What we are concerned with in science is alone

¹J. Y. Simpson, "Biology", *Encyclopedia of Religion and Ethics*, Vol. II, p. 622.

²"Life and Death", *Encyclopedia of Religion and Ethics*, Vol. VIII, p. 1.

³*Principles of Biology*, Vol I, p. 100.

⁴*Ibid.*, p. 114.

the phenomena of life which are accessible to our investigations, and this surface knowledge holds good within its own domain. Thus, he argues, "The statement that the continuous adjustment of internal relations to external relations constitutes Life as cognizable by us, is not invalidated by the admission that the reality in which these relations inhere is incognizable."⁵ Hence, for the purposes of science, the above definition will suffice for our purpose, but he insists that even so considered the definition should not include the various abnormal manifestations, which do not properly come under the term "life", though we may safely accept it as covering the normal manifestations.

The "dynamic element", which is thus claimed by Spencer as forming the essence of our conception of life, has perhaps found explicit recognition in the writings of the Vitalists. They contend that mechanical or physico-chemical concepts do not suffice for the treatment of biological facts. Driesch, for example, postulates a non-perceptual "vital agency", or, as he calls it, "entelechy", which is associated with the organisms as distinct from what he regards as non-living things. This "entelechy" directs the physico-chemical processes in certain cases, so that their results are different from what they would have been apart from its intervention. This postulated entelechy is "not a new elemental consequence of some constellation", but it is supposed to be a genuine agent "at work". In Driesch's view the "entelechy" is non-spatial in nature, autonomous and without any seat or localization. It is immaterial and not physical energy. Its function is to suspend and to set free, in a regulatory manner, pre-existing faculties of inorganic inter-action.

Dr. J. C. Bose, the great Indian scientist, is decisive in his rejection of the theory of vitalism. A stimulus produces a certain excitatory change in living substances and the excitation thus produced may express itself in either of the two forms of mechanical or electrical response. In mechanical response the excitation produced expresses itself in a visible change of form as seen in muscle, while in electrical response it expresses itself in certain electrical changes, and not in any visible alteration, as in nerve or retina, and while the mechanical mode of response is limited in its application, the electrical form is universal. Bose further contends that the mechanical and electrical modes of response are practically identical in character, and that not only can the electrical mode of response

⁵*Ibid.*, p. 123.

take the place of the mechanical one, but that the former has this advantage that it is applicable where the latter cannot be used. Now, this irritability or responsiveness of the tissue, either in its mechanical or electrical form, was supposed to depend on its physiological activity, seeing that under certain conditions it could be converted from a responsive to an irresponsive state, either temporarily, as by anaesthetics, or permanently, as by poisons. From these facts that a living tissue gives response, while a tissue that has been killed does not, it was concluded that the phenomenon of response is characteristic of a living organism. And, Bose thinks, from a confusion of "dead" things with inanimate matter, it has been supposed that inanimate matter must be irresponsive or incapable of being excited by stimulation. "In irritability", writes Dr. Verworn, "there exists a phenomenon which, as was believed, distinguished all organisms from lifeless bodies, and appeared to mock at a physico-chemical explanation. The unexplained conception of irritability, therefore, . . . became the starting-point of *vitalism* or the doctrine of *vital force*, which in its most complete form asserted a distinct dualism of living and lifeless nature. . . . The vitalists soon laid aside more or less completely mechanical and chemical explanations of vital phenomena, and introduced, as an explanatory principle, an all-controlling, unknown and inscrutable force *hypermécanique*. While chemical and physical forces are responsible for all phenomena in lifeless bodies, in living organisms this special force induces and rules all vital actions.⁶ In opposition to the vitalists' assumption of the super-physical character of response Dr. Bose urges that the necessity for maintaining such a dualism in nature must, on theoretical grounds, fall to the ground if it can be shown that similar effects obtain amongst inorganic substances also, and he claims to have shown that not only the fact of response, but all those modifications in response which occur under various conditions take place alike in metals, plants and animal tissues. As a ground of his contention, Dr. Bose parallelises these phenomena as exhibited in the three classes of substances. He maintains that in a living animal tissue under stimulation the wave of molecular disturbance is accompanied by a wave of electrical disturbance. This characteristic of exhibiting electrical response under stimulation on the part of animal tissues is, he contends, not confined to it alone, but extends to vegetable tissues in a like manner. In these cases Dr. Bose

⁶*General Physiology*, p. 18.

claims to have shown that the same electrical variations as in nerve and muscle are obtained. If we pass to inorganic substances, and use experimental arrangements similar to those used in the case of animal and vegetable tissues, we find the same electrical responses evoked in metals under stimulation.⁷ To establish this contention Dr. Bose tries to show experimentally the similarity, nay the essential identity, between some of the phenomena and their modifications, which are connected with their responsive character, in all cases, animal, vegetable and metal. This is corroborated in the cases of negative variation, relation between stimulus and response, effect of superposition, uniform responses, fatigue, staircase effect, increased response after continuous stimulation, modified response, diphasic variation, effect of temperature, effect of chemical reagents, etc.⁸

As a conclusion drawn from the above considerations, Dr. Bose observes: "Living response in all its diverse manifestations is found to be only a repetition of response seen in the inorganic. There is in it no element of mystery or caprice, such as we must admit to be applied in the assumption of a hypermechanical vital force, acting in contradiction or defiance of those physical laws that govern the world of matter. Nowhere in the entire range of these response-phenomena—inclusive as that is of metals, plants and animals—do we detect any breach of continuity. . . . The study of processes apparently so complex as those of irritability . . . must be faced, and their investigation patiently pursued, without the postulation of special forces whose convenient property is to meet all emergencies in virtue of their vagueness. . . . Amongst the phenomena of response there is no necessity for the assumption of vital force. They are, on the contrary, physico-chemical phenomena, susceptible of a physical inquiry as definite as any other in inorganic regions."⁹

"Irritability" is considered by Bose to be due ultimately to "molecular responsiveness", and excitatory response to be "brought about by the molecular derangement consequent on stimulus, with the subsequent self-recovery."^{8b} and he insists that similar excitatory response is given even by inorganic matter under stimulation. "Irritability or molecular responsiveness, therefore," observes Dr.

⁷For an account of the experiments, see J. C. Rose, *Response in the Living and Non-Living*, Longmans Green & Co.

⁸*Ibid.*

^{8a}*Ibid.*, pp. 189-190.

^{8b}See *Plant Response*, Longmans, Green & Co., p. 741.

Bose, "must be regarded not as characteristic of organic substances alone, but as the universal property of matter. In the case of what is commonly known as the living, we have merely higher complexities, with greater instabilities, of molecular structure. External stimulus is here liable to induce greater derangement, and the irreversible molecular change known as death takes place the more easily, the more highly organized the complexes may be. . . . In studying the responsive phenomena of living organisms, therefore, we must fix our attention on their molecular aspect, and try to follow out the physico-chemical changes which are consequent on the molecular derangement induced by stimulus."⁹

So far as physical science goes, I think Bose has perhaps sufficient justification in resisting the vitalists' conception of life, which seems to be one-sided and insufficient.¹⁰ The vitalists' notion of an "entelechy" as solely thwarting or holding in abeyance the so-called mechanical processes of the organism, as if the mechanical processes were simply blind and entirely at the mercy of the entelechy, seems to be contrary to ascertained fact, and from the point of view of science it can hardly be sustained. In an essay on "Life and Vital Energy" which forms the introduction to Rudolph Wagner's *Handwörterbuch der Physiologie*, Lotze long ago contended for what is called the mechanical view to a place in the science of physiology. In criticising the theory of vitalism as a scientific principle or doc-

⁹*Ibid.*, p. 741.

¹⁰Recent scientific researches in biology and physiology confirm in essence the contention that a physico-chemical explanation of vital facts holds good so far as science is concerned; e. g., Dr. J. S. Haldane holds that a "mechanistic theory of life" is correct so far as it goes, and that the two great physical laws of the conservation of matter and of energy can be justifiably extended to all living organisms, including human beings. Or, in other words, scientifically regarded, however complex the changes involved in organic activity may be, they are, at any rate, changes in a material system. Hence, in a sense, biology may be regarded as the physics and chemistry of organisms, i. e., vital or organic changes are physico-chemical changes. Thus among the biologists and physiologists the prevailing opinion is growing in favour of the mechanistic theory as supplying a clear working hypothesis without the postulation of a vital force. (See *Mechanism, Life and Personality*, Lec. I.) In the same strain Prof. R. F. A. Hoernlé, Dr. J. Johnstone, L. J. Henderson, etc., hold that so far as science is concerned the mechanistic theory of life obtains equally in both the domains of the so-called "organic" and "inorganic". In Dr. Johnstone's view, as science is concerned only with the description of "givenness", and a "givenness" is but one, though we arbitrarily divide it into two domains of the organic and inorganic, there can only be one way of describing it and that way is the mechanistic one. (See *Philosophy and Biology*, Intro.) Similarly, Prof. Hoernlé maintains that if we abstract from a scientific description of the phenomena of life its teleological character, then what are called "organism" and "machine" both alike can be analysed and their changes described in physico-chemical terms. (*Studies in Contemporary Metaphysics*, Chap. VI.)

trine, Lotze's main contention is that however peculiar, what the vitalists call, the principle of Life may be in itself, it can never be free from interaction with that same matter which is known to us to be subject to physical laws of its own, and that the conclusion which the facts suggest is that the phenomena of Life arise out of a special *combination* of material elements, no one of which has any claim to be called exclusively or pre-eminently the principle of life. But in Lotze's view the mechanical view, though true, can in no sense be regarded as final.¹¹ I shall, however, try to show that the theory of vitalism has perhaps some value from the point of view of philosophy. No doubt, the definition of life offered by Spencer as the "adjustment of internal relations to external relations" is only a *formal one*, i. e., it describes only the occurrences that take place between the organism and the environment, but that which Spencer called the *material* aspect of the conception of life and which he perhaps rightly thought to form the essential feature of the conception, lies in the principle of activity of which these occurrences are manifestations. It is with the occurrences that science may be said to be concerned, and philosophy with the active principle, and Dr. Bose is considering the matter from the scientific point of view. His view of life as consisting in "response to stimulus" may be said to correspond in certain respects to the formal definition of life given by Spencer. According to Dr. Bose, as we have seen, the responsive action, or, as he calls it, "irritability", is "ultimately due to molecular responsiveness and excitatory response is brought about by the molecular derangement consequent on stimulus with the subsequent self recovery." Or, in Spencer's words, it may perhaps be said that the internal relations are adjusted to external relations in an act of response. But so far only is there agreement. The intimate connection, nay the essential identity, between physical and physiological phenomena of response which Bose has attempted to prove, and in which he finds the strongest ground for attributing life to the so-called "inorganic", would find no support from Spencer and the physiologists who adhere to the division of nature into "organic" and inorganic."

This, however, is but one side of the story. The other side con-

¹¹Lotze's contention is now upheld by Dr. J. S. Haldane, Prof. R. F. A. Hoernlé, Dr. J. Johnstone, L. J. Henderson, etc., who, though advocating a universal maintenance of the mechanistic theory of life so far as scientific description is concerned, do not regard it as, in any way, the final, nay it is, according to them, wholly insufficient and erroneous as a final explanation of the phenomena of life.

sists in trying to discern what lies behind these processes or manifestations, for, as Kant said, "life means the capacity to act or change according to an internal principle." This side of our conception of life may be said in Spencer's words to form the *material* aspect or the "body" of such a conception. The internal principle is perhaps what Spencer meant by the "dynamic element" or the "principle of activity", or in the vitalists' phraseology "entelechy", of which the processes of life may be said to be manifestations. The true justification for any such conception as this must be furnished, if at all, by philosophy. But for a fuller or more complete understanding of what we mean by life we must take into consideration both the sides and try to understand the one in the light of the other. The contention of Bose that the law of conservation of energy holds good in the action and reaction between the organism and the environment, as it obtains elsewhere, and that it introduces no mystical power such as would in any part thwart or place in abeyance the action of forces already operative, thus evinces itself in its true light. Prof. J. A. Thomson writes: "In the domain of the inorganic there is little individuality, no apparent freedom of action, no endeavour, no purposiveness, no learning in the school of time. But its uniformity has been a probably indispensable fulcrum for the lever of will."¹² The mechanical law of the conservation of energy has been maintained to hold good only in the realm of what is called inorganic nature. Dr. Bose, on the other hand, has tried to show that this law holds good in both the domains of the so-called "organic" and "inorganic". It should be observed that Bose's explanation is, in no sense, materialistic. Quite the contrary. The drift of his thought is towards spiritualism and he all along tries to dispose of the conception of "dead matter". How then are we to understand Bose's position? I think in this way. It has been customary to describe the workings or actions of the so-called "inorganic" things in nature as simply blind and mechanical and as taking place solely in accordance with mechanical laws. But this may be said to be rather an assumption than a statement of fact. The admission that "insignia of life have not yet been discerned either wholly or in their proper perspective" perhaps corroborates this view. The action and reaction which takes place alike between the organism and its environment and a so-called "thing" and its environment, or as Bose calls it its responsive action, consists in

¹²*System of Animate Nature*, p. 75.

molecular rearrangement, i. e. every particle plays a part in the responsive action, and while Bose insists that there is no necessity of introducing a vital principle to explain this fact, the statement should be taken with reserve. As a scientist Bose may be said to be concerned only with the phenomenal side of the problem of life, and from this point of view, what he urges may be true. Yet Prof. Ward is perhaps right in holding that "the real agents, whose appearances alone constitute the physiologists' phenomena, must be regarded as monads."¹³ In other words, the rearrangement of the molecules, in which the responsive phenomenon is said to consist, is not something blind, but is a phenomenal manifestation of real agents at work. The vitalists, while pointing to the all important principle of activity or the "entelechy" even in the sphere of the so-called "living matter", leave unexplained what are called the mechanical processes of the organism, which play, as we have seen, an important and essential part in what is called the phenomena of life. In this respect it may be said that neither the mechanistic theory nor vitalism is a sufficient explanation of the phenomena of life, and while they are but one-sided accounts and in opposition with each other, pan-psychism or monadism claims to be able to replace both.

¹³*Realm of Ends*, p. 462.