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THE AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

THE CONTROVERSY BETWEEN MATERIALISM AND VITALISM: CAN IT BE ENDED?[1]

IN order that this discussion may be profitable, it must rest on an unequivocal meaning of some sort for the words "materialism" and "vitalism." It will, of course, be impossible to give definitions that will be altogether satisfactory to everybody, perhaps to anybody, even the writer. Every one may, however, be counted on to accept some definition *as a basis of the discussion,* if he thinks the question raised is worth discussing at all.

Since my main desire is in behalf of clear thinking and remunerative work in biology to-day, my effort at defining the terms will specially regard present tendencies and methods in our science rather than lexicographical authority and historical usage; though the historical aspect must not be wholly ignored.

By materialism I shall mean the belief that all biological phenomena may be completely explained by referring them to the material elements of which organisms are composed. The term "mechanism" as used to-day, not in practical zoology, but in philosophical biology is, I think, exactly synonymous with materialism. At any rate, I shall consider such to be the case.

It is less easy to formulate a definition of vitalism. I understand the term to mean the belief that organic phenomena can not be fully explained by referring them to the material elements of which organisms are composed, but that some-

[1] Address of the vice-president and chairman of Section F—Zoology.

thing not really belonging to the natural order, either explicit or implicit, is present in living things. The essence of the conception, whatever be its variety or form of statement, is that something absolutely new and novel came into the world when living beings came, and that this came as a special force, or principle, or factor—anything you have a mind to call it, so long as it is *not* material. A further essential to the conception is that this new thing is elemental, protean, once-for-all. It is not exactly the life itself of the organism. It is rather the informing, underpinning, ultimate motor, of life.

So far as a general discussion like this is concerned, there is no advantage in taking cognizance of a neo- or rejuvenated vitalism, beyond noting that the efforts in conformity with the modern demand for rigorous analysis is to limit, or locate this extra somewhat more definitely in, or among, the material substrata of organisms.

So much for definitions. I said a moment ago that the historical aspect of the subject must not be wholly ignored. All, however, that seems incumbent upon us in this quarter is to remind ourselves that the term materialism has cut a considerable figure in the philosophies of the schools, while the term "vitalism" has not. Further, to most traditional and vocational philosophers materialism as defined is a very naïve, almost childish conception: while its adversary, vitalism, has little or no standing among philosophers. Its essential interests are abundantly cared for by professionals under other captions. The significant thing for us in this treatment of materialism and vitalism by philosophy is the evidence it affords that neither materialism nor vitalism stand up well as philosophical conceptions, under the fire of rigorous logical analysis and a highly developed dialectic. This circumstance can not go unheeded by any careful biologist, for whatever may be his estimate of the worth of metaphysical systems, he can not fail to recognize that every trained metaphysician carries a blade of analysis, and of offense and defense in intellectual encounter, that may well elicit the admiration and be the dismay of any ordinary man of science.

Now this slighting by formal philosophy of conceptions that biology makes much of when it attempts to be philosophic, ought to cause biologists to wonder if perchance their philosophizing is less happy, less trustworthy, than their achievements in science proper. This leads to where I may give my categorical answer to the question taken as the subject of the paper: The controversy between materialism and vitalism would end forthwith could both conceptions be recognized as only mile-stones along the road of progress; could they both be seen to contain truly living substance encapsuled by dead matter which must be left behind as crumpled exuviæ when the next stage of advance is entered upon. The controversy will not cease but will continue with increasing unfruitfulness so long as either side holds the truth it sees as absolute and all-sufficing.

To bring the real inwardness of the case home with force I am going to state it in a way that will at first seem extreme and harsh: *Materialism is a lineal descendant in rational process of the basis of magic of certain ancestors of ours* who, though far cruder than we are, were no less earnest of desire and of effort to understand nature and get on well with her. *Vitalism is similarly descended from the animism of still other ancestors,* probably somewhat more recent and less crude, but no less earnest and sturdy than those with whom magic reigned.

This theory of the origin of materialism

and vitalism will probably appear not only harsh but ridiculous at first sight. The idea, it will be said, that many of the very foremost biologists of this hour are kindred, doctrinally, to magicians and occultists, is too absurd to merit consideration. To those who would dispose of the idea in this summary fashion because of a certain sense of injustice or of hurt pride, I would earnestly put the question, Are we truly evolutionists or are we not?

I am convinced that many of us, even biologists, who have never hesitated to accept evolution, do not see and feel its mighty importance when it comes to human traits that are particular and personal. Biologists more perhaps than other class need the regenerating touch of Bergson's "L'Evolution Créatrice." We need to recognize as we never have that evolution means indeed something new coming on every moment; and that since the new grows out of the old it can be neither wholly different from nor wholly alike that from which it came. We need further to see the vital meaning of the extreme probability in the light of myriad facts now constituting our biological knowledge that evolution is truly a universal principle; that is, that there is not a trait, physical or spiritual, of ours, that is wholly finished off and at a standstill. We are every one of us in every atom of our existence and at every instant on the move to some extent, up or down, forward or backward.

Where did all our science—not merely as to its formulation but as to its physical and psychical substratum, come from? Only a few thousand years ago our race not only did not possess a great body of knowledge of the world, but it was not scientific, as we now understand the term, either in mode of observing and thinking or in desire. Did our talent for science come to us as a gift from heaven, or has it grown by slow degrees from hundreds of impulses and influences spread over thousands upon thousands of years and over many lands and seas?

The theoretical answer to the question is on the lips of every one in an audience like this. Our talents came by the way of gradual growth, of evolution. Practically, though, we treat our knowledge much as did our forebears who believed their gifts came direct from heaven. Alongside this question let us ask another: What has become of all the mysticism, the fetishism, the magic, the animism, the divination, and the rest, so characteristic of every race and class of men outside of civilization? Is it reasonable, in the light of what we know about the course and laws of evolution to suppose that those psychical or other qualities that made our ancestors for generation after generation mystics should have left no trace in peoples under civilization excepting in the comparatively few professional mediums, clairvoyants and persons noted for their ignorance and superstition? Could we reasonably expect any modern whatever to be wholly cut off from any trait that was universal and of simply tremendous import in all his early ancestors?

I insist that there is a mighty vein of what makes mystics in the nature of every normal man and woman no matter how elevated a level of culture, of intellectual development he has reached. I insist further that we have not the slightest ground in facts at our command for supposing this element in man's nature can be eradicated and leave him civilized. The truth is that just so far as man feels or has sentiment, imagination, fancy, at all, by just so much is he mystically inclined. It is his intellect, his reason, alone that saves him from being a mystic indeed; and just as sure as any element of pure fancifulness gets into the essentials of a scientific, that is gen-

uinely rational, doctrine, that doctrine departs at once from the way of science and journeys on the way of mysticism and occultism.

This means, brought down to specific application, that search to-day after the "germ of life" in the sense in which this phrase has leaked out of biological laboratories and got into the popular mind is mystical no less certainly than was search after the philosopher's stone. It means that a certain heavily veiled hope being held out in certain biological quarters of the indefinite prolongation of life is the old search after the elixir of life and the fountain of perpetual youth, refined and modernized. It means that those biologists who by intense research on, and still intenser speculation about, a comparatively few "elements" and "substances" in the less well-known sections of the organic realm, seem to expect presently to find a hidden key that will unlock all or nearly all the mysteries of organic nature, are on the same quest with Dr. Faustus: the quest after ultimate knowledge and are doomed to failure and disappointment.

In other words, *the mighty tendency of the human mind to transcendental and mystical interpretations of the world which manifests itself among primitive peoples as fetishism, animism and magic; among more advanced peoples as idolatry proper; and among nearly all of the most advanced peoples as the supernatural element in religion, persists in our physical science, particularly in our biology, as materialism and vitalism.*

Stating the problem in this broadly generalized way commits us to a very large, difficult and important thesis. Obviously, to deal with more than a small fragment of it here is out of the question. In baldest essentials the truth can be stated thus: Materialism in common with magic consists (*a*) *in assuming the existence of material bodies to explain certain observed phenomena when such bodies do not in reality exist, or at least the existence of which is never proved observationally;* or (*b*) *in assuming that certain observed bodies possess qualities which explain phenomena when in reality no such qualities are possessed by the bodies, or at least are never observed directly.* Vitalism in common with animism consists *in assuming the existence of non-material, essentially extra-corporeal forces or principles to explain phenomena when such forces or principles are never proved to exist.* The sophisticated thinker and the untutored savage are alike in recognizing the mystery inherent in the universe; and they are further alike in their attempted explanations.

Just the fact that the universe is perpetually in the throes of "Creative Evolution" makes this mystery all-pervasive and unending. It is of the very essence of a living world. The wise man takes due account of this element of the incalculable, the unpredictable as a characteristic of the universe, particularly of animate nature; he is not driven thereby to despair of ever knowing anything, but on the other hand is preserved from the obsession of finding a "sufficient cause" for everything under the sun. He recognizes that the whole process is the one great, sufficient and final cause of all its phases, and with that conviction puts an end to all futile search for "complete explanations" and "absolute causes." The proximal causes, the workings of the great process, are, however, of absorbing interest to him. And they are of interest down to the smallest detail; nothing is insignificant, negligible, just because every minutest fragment is an integral and therefore influential part of the whole.

From this point of view, it can be readily

seen how futile is the attempt of materialism to find the "cause" of life in any one set of material elements, and how equally futile is the attempt of vitalism to find the significance of the whole in some intangible "force." Both fail to see that any set of processes taken as a whole and in its organic relation to the rest of the universe is its own final and only adequate explanation. Each attributes to natural objects qualities which no single object or set of objects possesses—qualities which afford a complete "explanation" of another object. Both attempt to explain everything in terms of "something else," and this in essence amounts to a denial of the reality of the organic beings which we actually see and deal with.

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INVESTIGATIONS OF THE CARNEGIE INSTITUTION[1]

WORK in the ten specially organized departments of research in the institution has gone forward during the year with increasing vigor and with increasing productivity. All of these novel establishments may be said to have now passed the preliminary stages of organization, equipment and tentative experience, so that henceforth their efforts and resources may be still more effectively directed and applied. Most of the departments have been strengthened during the year by additions to the staffs of investigators and by accessions to equipment and other facilities, some of which latter have come through the generosity of friends, who have thus shown their appreciation of departmental researches.

But while the existing status of departmental affairs is in general highly satisfactory, it appears essential to again call attention to the fact that with present income and current economic conditions no further expansion of departmental appropriations can be expected. It may be necessary, on the contrary, to curtail research in the departments in order to keep the aggregate expense of the institution within income. It need not follow, however, that this prospective diminution in financial outlay will cause a corresponding diminution of productivity, for work of investigation, like work along other novel lines, is usually most costly in the preliminary stages.

Referring to the current "Year Book" for interesting and instructive details in the reports of the directors of departments, some of the salient features of their activities are summarized in the following paragraphs.

It is a maximum in the pursuit of physical science to proceed from the simpler to the more complex in any attempt to discover the relation among observed facts. In accordance with this maxim, the headquarters of the Department of Botanical Research are located in a desert area where the facts of plant life are exhibited, in general, in their simplest, though often extreme and highly specialized, relations. But even under these favorable conditions plant life presents problems whose solution requires aid from many sciences other than those which are commonly held to make up biology, and especially from chemistry, physics and meteorology. Thus the researches of this department call for much collaboration and for a wide range of observation, experiment and determinate analysis.

During the year the director of the department has continued his investigations on the water-balance of succulent plants, on the conditions of vegetable parasitism, on the variability in plant species induced

[1] From the report of the president.