THE BASIS OF INDIVIDUALITY IN ORGANISMS. A DEFENSE OF VITALISM[1]

In his presidential address before the Zoological Section of the British Association for the Advancement of Science, Professor D'Arcy W. Thompson ('11) said:

> While we keep an open mind on this question of vitalism, or while we lean, as so many of us now do, or even cling with a great yearning, to the belief that something other than the physical forces animates the dust of which we are made, it is rather the business of the philosopher than of the biologist, or of the biologist only when he has served his humble and severe apprenticeship to philosophy, to deal with the ultimate problem. It is the plain bounden duty of the biologist to pursue his course unprejudiced by vitalistic hypotheses, along the road of observation and experiment, according to the accepted discipline of the natural and physical sciences. . . . It is an elementary scientific duty, it is a rule that Kant himself laid down, that we should explain, just as far as we possibly can, all that is capable of such explanation, in the light of the properties of matter and of the forms of energy with which we are already acquainted.

This quotation will serve as a text for, and the keynote of, the remarks I shall make this morning. For to Professor Thompson's thesis I heartily subscribe. And if in what I say any statement seems irreconcilable with his assertions, such inconsistency is unintentional and, as I believe, apparent rather than real. But that all will follow me as sympathetically as I assume you have listened to the remarks I have quoted is more than I venture to hope.

As I interpret the topic under discussion, two main problems are involved:

1. The scientific problem of vitalism and mechanism.
2. The philosophical problem of idealism and materialism.

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I. THE SCIENTIFIC PROBLEM OF INDIVIDUALITY —VITALISM VS. MECHANISM

The scientific problem of vitalism *vs.* mechanism has recently been formulated by Jennings ('14, p. 17) as follows:

"Is individuality a phenomenon not determined by the perceptual conditions, but requiring to account for it the agency of a non-perceptual agent?" To the discussion of this problem we shall first turn.

The analysis of the concept of individuality—at least human individuality—reveals that individuality presents itself in two aspects, distinguishable in thought if not in reality:

1. The objective or physical aspect of individuality;
2. The subjective or psychical aspect of individuality.

Turning our attention, then, to

1. *The Objective or Physical Aspect of Individuality.*—In this aspect, the organic individual is a persistent, complex, coherent and spatially-distinct whole, consisting of interdependent parts. The organic individual is distinguishable from the inorganic individual by the chemical process of proteid metabolism, growth by the intussusception of new material, and by the process of reproduction. In the higher animals and man integration of the highly differentiated body is effected through the mechanism of a central nervous system and the secretions (hormones) of certain glands. As a physical body the organic individual is subservient to the laws of sequential mechanistic causation, and derives all its energy directly or indirectly from the sun.

2. *The Subjective or Psychical Aspect of Individuality.*—Each organic individual—at least in the case of man—is directly aware of a series of "states" or "moments"

of consciousness, determined directly or indirectly through the agency of the various senses. Within this "wave of consciousness" are presented all of the experiences which together make up the drama of life of the individual. While consciousness may not be defined (except in terms of itself), it may be described.

To other individuals this "inner life" of each individual is non-perceptual, but may —in the case of man—be described through language or other physical expression. To the fact of its non-perceptuality to others is due the "seeming unreality of the inner life."

All the "data" of science are data of conscious experience. The "experiences" of the individual fall into two chief classes:

(*a*) Those experiences which appear as manifestations of the properties of matter and which may be described or interpreted in terms of matter in motion—spatial phenomena.

(*b*) Those experiences such as emotions which do not have spatial attributes—non-spatial phenomena.

But consciousness—the psychical aspect of the individual—is not merely a string of sequential "moments" of consciousness. Its most essential characteristic is its purposeful unity. There is something which unifies, relates and orders the states of consciousness in each individual. This "something"—the "Ego" or "Will"—is able to dislocate in time the order of sequence of past experiences.

Although mind and body—the physical and psychical—are distinguishable in thought, there is no scientific evidence that they are separate in reality.

The laws of sequential causation apply to mental states just as to physical ones.

Mental processes are among the most reliable phenomena in Nature (Glaser, '12).

The problem of vitalism is: How are we to interpret the behavior of this psycho-physical individual?

Two historical answers have been given to the scientific problem of vitalism—(1) the answer of mechanism; (2) the answer of vitalism.

1. *The Mechanistic Interpretation of Individuality.*—Mechanism is the doctrine that all phenomena—living and lifeless—are manifestations of the properties of matter in motion. According to mechanism, sequential physical causation is universal and involves only those forms of energy recognized by physics and chemistry. Such sequences may be either (*a*) mechanical or reversible, like those of machines; or, (*b*) physical or non-reversible, like the radiation of heat. According to mechanism, all vital sequences conform to one or the other of these two types. Individual behavior is —directly or indirectly—the expression of the energy liberated during the chemical process of metabolism. Mechanism recognizes no alien influx or interference of "souls" or "entelechies" in the endless series of physical sequences.

If we let B represent the body (physical individual), and (w) represent the mechanistic view of will (consciousness) as an epiphenomenon, the mechanistic formula of the individual is $B(w)$.

2. *The Vitalistic Interpretation of Individuality.*—According to vitalism the mechanistic formula is inadequate to nature and to life. In the living body—at least in the case of man—sequential causation involves another factor or agency than those recognized by chemists and physicists. This non-physical (non-spatial) "vitalistic" agency modifies the behavior of the living organism so that, from a knowledge of the physical conditions only, "it would be impossible to predict what will happen under any given set of physical conditions." According to vitalism, the will or

other vitalistic agency "so interacts with physical conditions as to give a physical result that is diverse from the result that would be produced under the same antecedent conditions without consciousness" (Jennings).

According to vitalism the formula for the organic individual is either (*a*) the dualistic formula $W + B$ (W representing the will or vitalistic agency, and B the body or physical aspect of individuality); or, (*b*) the idealistic formula $W(b)$ (W representing the will or vitalistic agency, and (*b*) the phenomenal body).

The divergence between the mechanistic and the vitalistic interpretation of individuality is, therefore, very great, constituting in fact "the greatest schism in human thought." "The vitalist sees in individuality—personality or the self—a coordinating center and synthetic activity contrasted with all other agencies in nature—a real creative power. While the mechanist sees only what he sees in any other receptive object, a center where many forces cross, checking, intensifying, neutralizing or transforming one another without loss or addition" (Palmer, '11).

Which of these two interpretations are we to accept? Are the two views wholly irreconcilable? Is the problem of individuality, after all, an insoluble one?

Opinions differ. The literature is voluminous, for this is the problem of the ages. Wholly unprejudiced discussion is rare. Among scientific men the cause of vitalism has suffered because of its association historically with theological dualism, while on the other hand many vitalists have opposed mechanism upon the mistaken belief that mechanism is identical with—or demands the postulate of—philosophical materialism.

Among the divergent views expressed, a few may be mentioned which are indicative of the trend of present opinion concerning the problem of individuality—the problem of vitalism and mechanism.

Professor L. J. Henderson finds that the discussion of the vitalistic problem has led to the following dilemma:

Assertion 1.—Common sense—as represented by those who make a study of the movements of physical bodies—leads to the conclusion that all physical events are subject to the laws of physical causation.

Assertion 2.—Common sense—as represented by those who make a study of the behavior of men in history—leads to the conclusion that some physical events are not subject to the laws of physical causation alone, but that will or caprice has affected the course of historical events.

Now since both assertions appear to be equally valid in common sense experience, and as both opinions can not be true at the same time, and as there seems to be no immediate prospect of their reconciliation, Professor Henderson turns away his attention to more promising lines of investigation.

William MacDougall ('11) discovers the same dilemma. On the ground, however, that the issues involved are too important to admit of neutrality, he casts in his lot with the vitalists. His book on "Body and Mind" is a strong defense of the vitalistic thesis. Other recent valuable contributions to the formulation and elucidation of the vitalistic problem have been made by Ward ('03), Driesch ('14), Bütschli ('01), Palmer ('11), Bergson ('11), Jennings ('14), Lovejoy ('09), Spaulding ('09), Sumner ('10), Woodruff ('11), Ritter ('11), Glaser ('12), R. McDougall ('13), R. S. Lillie ('14), A. J. Balfour ('79), Stout ('05), Lloyd Morgan ('05), Paulsen ('95), Höffding ('05), Haldane ('08), Ladd ('09), Bosanquet ('12), Strong ('03), Conklin ('15), Loeb ('11), James ('07).

Jennings ('14, p. 20), taking up the problem as a scientific problem by the method of radically experimental analysis, reaches the following conclusion:

> The phenomena of life require nowhere the differential action of a non-physical agent. Their occurrence is bound up throughout with that of physical and material phenomena. Diversities in them are determined by antecedent physical and material diversities. They show, therefore, the same type of relations to each other, to physical conditions, and to matter, as do the phenomena called physical. But they include phenomena not found in the non-living, and therefore to be known only through study of the living. Such is conscious individuality, the highest manifestation from the interwoven tissue that makes up the experienced universe.

That is to say, Jennings comes to the conclusion that the problem of vitalism has no experimental meaning. With this opinion presumably the majority of biologists will agree.

Is this, then, the final answer of science (physical science) to the problem of the ages? Is the case of Vitalism vs. Mechanism closed and the verdict rendered in behalf of the defendant? Will the vitalist accept the verdict? We may anticipate that he will not, if we are to judge on the basis of past experience. In the past when verdicts have been rendered against him—as in the Vital Spirits Case, the Urea Case, the Vital Force Case, etc., he has always shifted his ground, and although defeated in every trial, he has always been able to secure a rehearing of his case in the same court—the court of physical science. Will he do so now? I am of the opinion that he will.

But on what grounds can he make an appeal? He can scarcely convince a scientific jury that his case has not been heard in all fairness and impartiality upon the basis of the premises made. He may not fairly claim that the experimental and analytical logical methods have been inadequate or inconclusive. So far as I can see, his only chance of securing a rehearing at the court of science or in the higher court of philosophy (as suggested by Professor Thompson, '11) would be to demonstrate that the fundamental postulates upon which his case has been previously tried have been in error, and that the conclusions reached have been based on false premises. On this ground there would seem to be sufficient justification for taking his case to the higher court of philosophy, which has jurisdiction over matters relating to fundamental postulates.

If, then, the vitalist can show that his case has been prejudiced by the philosophical assumptions made in previous trials, if it must be admitted that it makes a difference to the case of the vitalist whether it be based upon materialistic, or dualistic or idealistic postulates, and if it can be shown that the basis upon which the case has been tried has not been the only possible basis upon which it might be tried and that, in fact, it has been tried upon a wholly false basis, then the vitalist is justified in demanding a rehearing in the higher court of philosophy, which has jurisdiction over such cases. Such considerations are, I infer, the reasons for the selection of this morning's topic. And if the outcome of the discussion be the decision that the case of vitalism has been prejudiced in the past by the false premises made by the attorneys who have handled the case in the court of science, then in all fairness the vitalist should be granted the rehearing he now demands.

It has been frequently assumed in the discussion of vitalism by scientific writers that the formula of mechanism is adequate to experience. This, for example, appears to be the assumption which underlies the argument of Jennings ('14). Shall this assumption pass unchallenged? Certainly

not by the vitalist. He has challenged it again and again, holding that it is not justified in experience. This is the argument of the vitalist in brief: He asserts:

The case of vitalism is not one to be tried in the court of physical science, for it does not come within the jurisdiction of that court, since the mechanistic formula is inadequate to life. For

Physical science treats of only a part of human experience—viz., that part of human experience having spatial attributes, or which may be interpreted in terms of matter in motion.

But human experience includes phenomena without spatial attributes—phenomena which may not be interpreted in terms of matter in motion. This is recognized by the division of the sciences into the physical sciences, which deal with those phenomena having spatial attributes (or which are the manifestations of the attributes of matter in motion); and the mental sciences—psychology and philosophy and ethics—which deal more especially with non-spatial experience. But individuality (human personality) includes both classes of phenomena. The court of physical science, therefore, in trying the case of individuality is dealing with one which does not strictly come within its jurisdiction. Hence, vitalism—the case of personality—now appeals to the higher court of philosophy which tries cases relating to the fundamental postulates of both mental and physical sciences.

But is the vitalist justified in his assertion that physical science—mechanism—is inadequate to experience? Here there is decided difference of opinion. Dr. Jennings supports the "mechanistic dogma" of the universal applicability of mechanistic interpretation. For he says ('14, pp. 6–5) that mechanism is a "purely descriptive account of what is found to hold in experience." "There is no ground, theoretical or practical, for limiting scientific treatment to diversities of any particular kind (as diversities of motion)," that, in other words, the field of physical science includes the entire field of human experience. "Mechanism," therefore, is adequate to nature and to individuality. Consequently, if this position be taken, there would appear to be no reason for continuing the case of vitalism further.

I am unable to discover that any considerable number of psychologists accept Dr. Jennings's assumption. On the contrary, the great majority seem to agree with Professor Ladd when he says ('09, p. 884):

> Thinking and the cognitive judgment can never be explained—and, indeed, the facts can not even be stated—in terms of either neururgics or the mechanism of presentations.

In other words, there is doubt that psychologists would accept the assumption of Jennings of the adequacy of mechanism to experience. For the same reason, his further assumption—underlying his whole argument—that "every diversity in conscious states is accompanied by a diversity in physical conditions" may be challenged as far transcending our present knowledge. The vitalist may call attention to the fact that Dr. Jennings assumes as the basis of his argument the very point under discussion—the question in litigation—viz., the adequacy of the mechanistic formula.

But I am of the opinion that the vitalist has the best of reasons for appealing his case to a higher court on the ground that the basic philosophical assumptions upon which his case has been argued have prejudiced the case against him and have been philosophically unsound. For all who have discussed the case of vitalism in relation to individuality (personality) have made implicitly or explicitly philosophical assumptions. Indeed, the problem of the psycho-physical individual can not be dis-

cussed otherwise. W. MacDougall ('11) argues the case for vitalism on the basis of philosophical dualism. The dualistic assumption appears to underlie the "common sense" argument advanced by Professor Henderson. James Ward ('03) advocates the case of vitalism on the basis of a critical idealism (spiritualism).

That Jennings ('14, p. 18) accepts the postulate of materialism is clear from his assertion that "when the set of phenomena we call matter reaches a certain complexity, it gives rise to this particular manifestation that we call personality." In other words, unconscious matter in the course of evolution produced consciousness. Before this stage of material evolution consciousness did not exist—there was no consciousness. Matter exists before mind, but later gives rise to consciousness as a quality of an underlying substance. The real thing then is matter which indeed once existed independently of any consciousness at all. Whether there were any consciousness or not, matter would still persist. The real organic individual is the physical individual, and all its qualities—psychical and other—are manifestations of this basic material body. This tacit assumption was presumably behind the declination of Jennings ('14) to accept the two classes of conscious experience mentioned above.

Is the materialistic assumption nonvalid? Does its postulation by Jennings prejudice the case of vitalism? Is the case of vitalism "ruled out of court" and completely subverted if the materialistic postulate is admitted? Unquestionably it is. For materialism (philosophical, not scientific) is the one philosophy with which vitalism is wholly irreconcilable. To assume it, therefore, is to deny vitalism (neo-vitalism). The case doesn't have to be tried at all. But the whole contest which has been waged by vitalism has been against materialism. In opposing mechanism the vitalist has been "barking up the wrong tree." His mistake has been due to the inexcusable identification of mechanism with philosophical materialism. Vitalism has no real issue with mechanism—not at least with mechanism as a scientific method of interpretation of spatialized phenomena. But with philosophical materialism as a postulate of science the vitalist may for the best of reasons take issue. Therefore, as Paul appealed to Cæsar and to the higher court of Rome, the vitalist may with justice ask for a continuation of his case in the higher court of philosophy.

What then is the philosophical standing of the materialistic postulate? What really is basic to individuality (human personality)? Of what are we more certain—of an external world independent of consciousness and consisting of atoms or electrons in motion, or of a world of ideas, of purposes and of emotions? We therefore are compelled to consider the philosophical problem of reality and the case of vitalism becomes in the higher court of philosophy the Case of Idealism (or Dualism) *vs.* Materialism. To this, the second point of the topic under discussion, we may now turn our attention.

II. THE PHILOSOPHICAL PROBLEM OF INDIVIDUALITY—IDEALISM (OR DUALISM) VS. MATERIALISM

The problem which is now before us is the central problem of philosophy—the problem of reality. Is the materialist correct in holding that the organic individual (human personality) is in reality an aggregate of atoms or electrons which might exist independently of consciousness? Is, therefore, the formula for the individual $B(w)$?

Is the dualistic philosopher correct in asserting that the individual consists of two realities—body and mind—which are not only distinguishable in thought, but also separate in reality, although united tem-

porarily in human individuality? Is, therefore, the formula for the individual $B + W$?

Or is the idealist correct in maintaining that the individual is in reality spiritual—a Will or "Ego" with physical manifestations? Is the body of the organism an ideal (though none the less real) body—a mechanism through the agency of which the will or Ego operates? Is, therefore, the formula of individuality $W(b)$?

Upon the answer given to these questions by the philosopher will depend the future standing of vitalism in science.

The considerations which have led most philosophers and many men eminent in science to repudiate the materialistic assumption and to conclude that in ultimate analysis and in reality our world and the individual is spiritual are in brief as follows:

In the first place, the data of science are phenomena in consciousness. For anything to be outside of consciousness, therefore, is to be unknown, and hence outside of the field of science which deals with the known. To postulate an external world of atoms and electrons independent of—or outside of—consciousness is to postulate an unknowable world—a metaphysical world. It is a wholly erroneous notion that this conclusion of philosophy involves the denial of an external world—the "permanent possibility of sensation." There is indeed—to the idealist not less than to the realist—an external world which is the cause of our ideas. But this external world of ours must be a world of ideas—that is, if it is like our ideas as we believe it is. But if the objects in this external world are like our ideas, then they must be ideas. Therefore, "either the real external world is a world of ideas—an outer world of mind which each of us may in a measure comprehend through experience, or—so far as it is external and real—it is wholly unknowable" (Royce, '92). "It was Berkeley," says Lloyd Morgan ('05), "who knocked the bottom out of materialism as a philosophy so that no amount of tinkering can make it again hold water." Materialism, therefore, as a philosophy, has long been in disrepute among philosophers. It is, therefore, almost incomprehensible why an outworn and discarded philosophy should be made the basis of a scientific discussion of the problem of individuality. Are we to assume that "one assumption is just as good as another" and that it is impossible to distinguish between true and false assumptions? Does it not matter to us whether our basic assumptions are philosophically sound or not? Are the conclusions reached by modern philosophy of no concern to the biologist in the discussion of the problem of individuality?

The acceptance of the materialistic postulate by scientific men notwithstanding its philosophical disrepute appears to be due in part to the confusion of philosophical with scientific materialism, and in part to the strong prejudice against philosophical views owing to the excesses of philosophers during the romantic period. The combination of this prejudice with that against philosophy as the "handmaid" of religion makes it to-day almost impossible for philosophical arguments to receive a fair hearing in the court of physical science. How in the history of human thought the mechanistic interpretation of the phenomena of the external world became gradually transformed into a philosophy of life may best be understood by a brief statement of its genesis in the thought of the individual.

The untrained person considers the world to be just about what his senses tell him it is. Later, however, he learns to distinguish between an internal reality and an "external" reality and he finally comes to ask, "How much can I know of external reality?" He soon learns that all he can know

of the "external" world must be acquired through the senses, *i. e.*, through the physiological-psychological process. This process involves three steps: (1) The stimulus (the object in the external world); (2) The nerve disturbance (caused by the stimulus); (3) The sensation or sense impression (the result of the nerve disturbance). Through the discoveries of the chemist and the physicist he learns that all of the phenomena of the external world may be reduced to or expressed in terms of atoms or electrons in motion, rapidly in gases, less so in liquids and still less so in solids; that all chemical change involves a rearrangement of atoms, and finally that all forms of energy depend on the rapid movement of atoms. Moreover, the physiologist assures him that these assertions hold true for the living as well as for the lifeless. Thus the physical (external) universe appears to be a universe of atoms or electrons in motion.

Up to this point in his thinking our hypothetical friend has been standing on perfectly sound ice. With his conclusion there is not the slightest reason to disagree. This —the mechanistic interpretation of the physical universe—is the accepted interpretation of our generation. Its validity as a scientific hypothesis stands unchallenged. There is no reason whatever to believe that in principle it will ever be overthrown. The mechanist gets on very thin and very treacherous ice (where the philosopher is unable to follow him) when he infers that when electrons come together in certain propositions and under certain conditions consciousness would be the result. Thus he might reach the conclusion of the materialist that whether there were any consciousness at all, the dance of atoms and the material universe would go on just the same. The universe, then, he concludes, is in reality a universe of atoms and electrons independent of consciousness. Some such process of reasoning as this appears to be the usual method of the transformation of the mechanistic thinker into a materialistic philosopher. The considerations which appear to invalidate his conclusion have already been stated above.

The disproof of materialism (as a philosophy—not as a working scientific hypothesis) is at the same time the argument adduced in support of philosophical idealism (spiritualism), the status of which is so unquestioned that it has become the dominant philosophy of the twentieth century. Many scientific investigators impressed by its logical soundness have adopted it as the basis of their thought and of their interpretation of nature and of life.

That the world of science is withal a world of ideas has been appreciated by scientific thinkers scarcely less than by philosophers. "Our one certainty is the existence of the mental world," writes Huxley. "Ego is the only reality and everything else is only Ego's idea," says Charles Sedgwick Minot. "The sole reality that we are able to discover in the world is mind," says Verworn. "Our world is after all a world of individual consciousness and ideas," says Crampton. "The field of science is essentially the contents of the mind," says Karl Pearson. "The world of knowledge is of such stuff as ideas are made of," writes Josiah Royce.

Thus the basis of modern critical idealism is so sound that its position has come to be regarded as impregnable, and the arguments now used against it are not directed at its foundations, but at certain supposed logical consequences of its acceptance. Many of the arguments raised against critical idealism are based on misunderstanding. One of these is the erroneous inference that idealism is subversive of a mechanistic interpretation of the physical universe. To hear some of the arguments used against it

one would think that neither philosophy nor theology had advanced during the development of human thought. Idealism is not a doctrine of those who "wish to lay the intellect to rest on a pillow of obscure ideas," nor is it an attempt to undermine mechanistic hypotheses. Many of the objections are made by those who confuse modern critical idealism with solipsism or subjective idealism. The limits of this paper do not admit the presentation of these objections and their rebuttal. I search in vain, however, for a real, valid, scientific objection to the postulate of modern critical idealism. That it is the dominant philosophy of our generation has already been asserted.

I shall not attempt to discuss the dualistic postulate, since it has little standing among philosophers and none at all among men of science—except upon such illogical grounds as even scientific men are capable. The dualistic hypothesis, therefore, doesn't interest us. But if one were compelled to choose between the postulate of dualism and that of materialism the adoption of the former would appear to be far more rational.

It is well recognized that epiphenomenalism is but thinly disguised materialism and the arguments against the latter apply equally against the former. Of epiphenomenalism Minot ('02, p. 3) says:

> An epiphenomenon is something superimposed upon the actual phenomena having no causal relation to the further development of the process. There is no idea at all underneath the epiphenomenon hypothesis of consciousness. The hypothesis is simply an empty phrase, a subterfuge—which amounts to this—we can explain consciousness very easily by merely assuming that it does not require to be explained at all.

Says W. McDougall ('11, p. 150):

> Epiphenomenalism, though it may perhaps be consistent with the law of the conservation of energy, offends against a law that has a much stronger claim to universality, namely the law of causation itself; for it assumes that a physical process, say a molecular movement of the brain, causes a sensation, but does so without the cause passing over in any degree into the effect, without the cause spending itself in any degree in the production of the effect, namely, the sensation.

Consequently, in our discussion of the problem of individuality, we are compelled, I believe, to make our choice between philosophical materialism and idealism (spiritualism), that is to say, between mind and matter (independent of mind) as the basis of individuality. Our choice is to be made between a postulate which is philosophically disreputable and one which has been accepted by the great philosophers of recent times from Berkeley and Kant to Emerson, Royce and James; between the assumption of a wholly unknowable and metaphysical world and the indisputable assumption that our one surest reality is consciousness; between the Haeckelian riddle and the assumption that our world has moral and spiritual meaning; between a world in which the words and gestures of every individual "would have been just what they have been, the same empires would have risen and fallen, the same masterpieces of music and poetry would have been produced, the same indications of friendship and affection would have been given in the absence of consciousness" (C. Lloyd Morgan, '05), and the "common sense" view of the historian that human motives and purposes have affected the course of human events; between a fatalistic world of illusion, on the one hand, and a world in which choices are real and ideals count; between an assumption which renders untenable the great human ideas of God, freedom and immortality and one which gives these unquestionable validity.

That modern philosophy has repudiated the materialistic postulate is not surprising in the light of the considerations presented above. Its adoption by biologists as the

basis of their interpretation of personality and of life is incomprehensible unless it be assumed that biologists are strongly prejudiced against the idealistic philosophy through misunderstanding. But, since the materialistic postulate is not only philosophically unsound and wholly unnecessary for any ends which the mechanist has in view, and since it is metaphysical, unscientific and irrational—wholly inconsistent with the lives of those who make it, as Conklin ('15) has said—biologists must reject it and accept the idealistic assumption as modern philosophy has done. We need to bring back our scientific postulates to the touchstone of fact. Our biological premises have been too narrow. We live in a larger scheme of things than mechanism has been able to discover. There is more in life than is dreamed of in the materialistic philosophy.

> The world of space and time, of physical cause and effect, matter and finite mind is but a very subordinate part of reality (Royce).

The way out of the blind alley into which materialism has led us is, as D. G. Brinton has said, "not by the assumption of an entity apart from attributes; but by the indisputable truth that the laws of mechanics and motion themselves are in final analysis nothing else but laws of thought of the reasoning mind, and derive their first and only warrant from the higher reality of that mind."

In the light of such considerations and in view of the fact that the materialistic postulate has usually been the basis of the biological discussion of the problem of individuality, and in view of the fact that upon the materialistic assumption the vitalistic interpretation of life is wholly excluded and therefore has no experimental meaning, the vitalist seems not unreasonable in his demand for a rehearing of his case upon an idealistic basis. For, upon this basis, the possibility of a vitalistic interpretation is not excluded as it actually is upon the materialistic basis. Upon the idealistic premise the possibility is open that not all of individuality (personality) is spatially expressed, that is to say, mechanized. In other words, upon this assumption the contention of the vitalist may be valid—viz., that from a knowledge of the physical conditions alone "it would be impossible to predict what will happen under any given set of physical conditions." The case of the vitalist depends wholly upon the overthrow of philosophical materialism. The problem of vitalism has thus become a philosophical one.

Many of the arguments used by vitalists do not appeal to the writer as intrinsically sound. I fully agree with R. S. Lillie ('14) and O. Glaser ('12) that the argument of the insufficiency of mechanism to "explain" everything has been much overworked. And yet there are a few considerations of this sort which seem to me to have some weight. Of these I will mention only two. The first is the difficulty of explaining the synthetic activity of the conscious mind on the basis of brain structure. One of the greatest weaknesses of mechanism in the field of physiological psychology is the lack of appreciation of the synthetic and correlating activity of human consciousness (will).

The other difficulty relates to the phylogenesis of the rational human individual. Is it possible for us to believe that a chaos has become a cosmos without the effective cooperation of a directive intelligence or will? Is it possible to believe on rational grounds that a material universe devoid of mind has produced a mind capable of judging mechanism? Says J. J. Putnam:

> If this were true it would seem possible for a man to lift himself by his boot-straps. But if it be impossible for mechanism (unguided by in-

telligence) to produce the mind of a person capable of judging mechanism, it is clear that mechanism has not been the only principle at work in the evolutionary process.

If Dr. Putnam's contention is sound, it becomes possible to understand the point of view of the modern theologian when he says:

Never yet has something come out of nothing. Never yet has order arisen out of confusion or light out of darkness as a result of anything other than personality. Force, law, life and achievement carry the mind irresistibly to the supreme will, to the supreme life, to the personality of God. A universe teeming with mind, fired within and stamped without with intelligence is the attestation of the living God. God is the meaning of the universe (Gordon, '10).

The acceptance of the idealistic postulate and of the point of view of the neo-vitalist make it possible to understand Dr. Gordon when he says further:

Behind all human achievement we see the creative spirit at work. Back of all achievement in literature we see the personality of Homer and Æschylus, Dante, Goethe and Shakespeare. Behind the achievements of the race in art we see the personality of Praxiteles, Raphael and Michael Angelo. For the entire high achievement of the race there is no explanation but the creative spirit of human personality. In our contemplation of nature and in our attempt to comprehend it we need to carry with us the sense of creation. The universe is the supreme achievement. Behind this achievement is the infinite soul and as our human world is a living and expanding achievement, we must conclude that within it is the creative spirit of God.

That scientific men occasionally catch a glimpse of the theological viewpoint seems borne out by the following quotations:

There is a wider teleology which is not touched by the doctrine of evolution, but is actually based upon the fundamental proposition of evolution (Huxley).

We are beginning to see the ascent of the Ideal of evolution. Thus biological science must indeed become the handmaid of religion (Thomson and Geddes).

Supposing that in youth we had been impregnated with the notion of the poet Goethe, instead of the notion of the poet Young, looking at matter not as brute matter, but as the living garment of God, is it not probable that our repugnance to the idea of the primeval union between spirit and matter might be considerably abated? (Tyndall).

I see everywhere the inevitable expression of the Infinite in the world (Louis Pasteur).

In whatever direction we pursue our researches, whether in time or space, we discover everywhere the clear proofs of a Creative Intelligence (Sir Charles Lyell).

We are unmistakably shown through nature that she depends upon one ever-acting Creator and Ruler (Lord Kelvin).

I can not imagine the possibility of any one with ordinary intelligence entertaining the least doubt of the existence of a God (William Crookes).

Matter and energy have an original property, assuredly not by chance, which organizes the universe in space and time. . . . If life has originated by an evolutionary process from dead matter, that is surely the crowning and most wonderful instance of teleology in the universe (L. J. Henderson).

If then for the reasons advanced we are to accept the idealistic postulate as the basis of our discussion of individuality, what will be the effect upon the mechanistic interpretation? How wide is the sphere of the mechanist? Just as wide as he used to think before he converted a method of investigation into a complete philosophy and interpretation of life. Most of our lives are mechanistic as we have always believed them to be. A large part of that which is not mechanistic is deterministic. For we are bound by heredity, hormones and habit.

Such limitation—such determinism—is the essential condition, as Palmer ('11) has well said, of that little measure of vitalistic freedom which we actually enjoy. The laws of determinism rule our lives more than the vitalist has been willing to believe. But we are free to choose between two alternative lines of necessity and to that extent at least our fates are in our own hands.

The study of animal behavior justifies the inference that consciousness is effective in them as in man. But to a far greater degree are their lives mechanized. Those of plants appear to be wholly so, whatever they may once have been.

I have made this plea for a rehearing of the case of the vitalist, knowing full well that his is not a popular cause among my scientific colleagues. The reasons why I have done so have been presented. No one realizes more than I the liability of error involved, for I am far from familiar fields of investigation. If I am in error, past experience has taught me that the error will soon be discovered and pointed out by those with whom I differ, and the truth which we all seek will be advanced.

But by no means should men of science play the part of the theologians of the fifties. The spirit of science is not dogmatic. And yet extremes meet and sometimes the spirit of the twentieth-century scientist matches that of the theological dogmatist of the nineteenth. For when Minot ('02) maintained the thesis that consciousness must have been a factor in evolution his paper aroused such bitter opposition that one scientific colleague, who by his prejudices was wholly incapable of appreciating the fundamental strength of Minot's position, had his copy of SCIENCE bound mutilated by leaving out the number containing Dr. Minot's address. He did this on the ground that as a friend of Dr. Minot's he did not wish to perpetuate a paper which would undermine Dr. Minot's reputation as a scientific man.

The objectionable thesis of Minot's was as follows:

> It seems to me inconceivable that the evolution of animals should have taken place as it actually has taken place unless consciousness is a real factor and dominant. Accordingly I hold that it actually affects the vital processes. There is, in my judgment, no possibility of avoiding the conclusion that consciousness stands in immediate causal relations with physiological processes. To say this is to abide by the facts, as at present known to us, and with the facts our conceptions must be made to accord.

In justice to the zoologist who did what he could to obliterate all traces of Dr. Minot's paper, it is only fair to say that science has every reason on the basis of experience to regard such "vitalistic" views as "dangerous" from the standpoint of mechanism, because of the constant temptation to pass in explanation over into the psychological field—in other words, to revert to primitive modes of explanation. Therefore, to the person under discussion Dr. Minot may have seemed indeed a traitor to science.

But this is, I am sure, a most exceptional case, and quite anachronous. The spirit of the scientist is not the intolerant spirit of the partisan. Every biologist may be expected to treat the cause of the vitalist as if it were his own cause and grant him the rehearing in the court of philosophy which he now demands. In the discussion of this problem as believers in the scientific method it is our duty to set forth "that calm, fair-minded, tolerant spirit" which has characterized the thought of scientific men in the past. This—the scientific—spirit means, as President Vincent has said:

> an attitude of open-mindedness towards all truth; a determination to get all the essential facts before forming a judgment; a willingness to abandon a position when it is no longer intellectually tenable; a tolerance of the opinions of others which are to be accounted for rather than derided or denounced. This spirit is free from acrimony, blind partizanship and prejudice—the spirit which seeks the truth which makes men free.

If, then, the question of vitalism is to be discussed at all in our classrooms—I know of none where this interminable problem is not mentioned—and, if because of conscience's sake we are unable to accept the postulate of idealism, we may nevertheless

give the question fair, impartial and scientific treatment. Such treatment, I am compelled to believe, can not be given without full consideration of the basic principles upon which the discussion has been based. Adequate treatment it can not receive upon the materialistic assumption only. For, as has been shown above, the adoption of this postulate begs the whole question under discussion and precludes the possibility of a vitalistic interpretation of individuality. Therefore, if we must adopt this postulate for ourselves, we ought at least to present the problem as viewed from the standpoint of idealism which clearly admits of the possibility of the vitalistic interpretation, and give our reasons for the rejection of the idealistic assumption. Moreover, failure to set forth the implications which grow out of the acceptance of materialism or idealism would appear to mean the omission of considerations of great importance bearing on the question. But above all let us rid our minds of the wholly erroneous notion that the cause of mechanism demands the postulate of philosophical materialism; and, in case we are vitalists, let us free ourselves for the equally fallacious belief that the mechanistic interpretation of the physical aspect of individuality is irreconcilable with the vitalistic interpretation of *life as a whole*. Like the Darwinian and Lamarckian hypotheses the mechanistic and vitalistic hypotheses are complementary and not irreconcilable interpretations of individuality.

The general purport of this paper, therefore, is well expressed in the words of Professor H. W. Rand ('12, p. 850):

> Science will never solve its problems—at most, it will never do more than think it has solved them—unless it constantly realizes its own limitations and unless it frequently assures itself of the security of its foundations. Now, perhaps more than at any other time, the natural scientist stands in need of help which may well come from the philosopher. Is it not timely to raise the question as to the validity of the assumptions upon which science rests and the integrity of the methods by which we attempt to progress?

Says Rogers ('09):

> It is no unusual thing for human reason to complete its speculative edifice in such haste that it forgets to look to the stability of the foundation.

SUMMARY

A. *The Scientific Problem of Individuality Vitalism vs. Mechanism.*—As formulated by Jennings ('14, p. 17) the problem reads:

> Is individuality a phenomenon not determined by the perceptual conditions, but requiring to account for it the agency of a non-perceptual agent?

There are two historical answers:

1. *The Thesis of Vitalism.*—That "individuality is a phenomenon not determined by the perceptual conditions only."

2. *The Thesis of Mechanism.*—That "individuality is a phenomenon determined by the perceptual conditions only."

1. The *Argument of Vitalism* is based on the assumption that either:

(*a*) The organic individual is in reality monistic, spiritual, a "Will" of "Ego" having material (bodily) manifestations, integrated and individualized not only by a central nervous system and by hormones, but (in the case of human individuality) by a "Will," also. "Will" is the unique characteristic of the individual (personality);

The formula for the individual is: $W(b)$; or, as some vitalists assume,

(*b*) The individual is in reality dualistic, a united will and body.

The dualistic formula for the individual is: $W + B$. The vitalist concludes that individuality (personality) is a phenomenon not determined by the perceptual conditions alone, but requiring to account for it the agency of a non-perceptual agent.

2. The *Argument of Mechanism* is based upon the assumption that:

The organic individual is in reality monistic and material—a body with epiphenomenal mental manifestations. Unity is effected by means of a central nervous system and hormones uninfluenced by a "Will."

The formula for the individual is $B(w)$. The mechanist concludes that individuality (personality) is a phenomenon determined by the perceptual conditions alone. Now, since obviously the conclusion of vitalist and mechanist is not logically deduced, but simply restates the fundamental assumption made, and since the conclusion, therefore, is true only if the assumption is true, and, since the truth of the assumption is a philosophical problem.

The Case of Vitalism *vs.* Mechanism must now be carried to the higher court of philosophy, which has jurisdiction over such cases.

We are therefore compelled to take up—

B. *The Philosophical Problem of Individuality—Idealism* (*Spiritualism*) *vs. Materialism.*—What in reality is the basis of individuality in organisms? Is the individual a material body of various properties, and nothing more? Is the basic principle of life spiritual, or material, in reality?

1. The basic assumption of mechanism (materialism) is, that—The individual (human personality) is in reality monistic and material, a body with epiphenomenal mental manifestations, and that individuality is expressed by the formula $B(w)$. Now, since this assumption is found upon analysis by philosophers to be unscientific (unknowable), useless (to the mechanist as well as to others), unnecessary (on logical grounds) and metaphysical, and since it states or interprets the known (*i. e.*, experience) in terms of the unknown and knowable (real substance, independent of consciousness), this materialistic assumption is rejected by modern philosophers.

Consequently, if the opinion of experts is to be respected, and if, therefore, we must regard the materialistic assumption as false, then we are compelled to reject the conclusion of the mechanists that an interpretation of individuality (personality) in mechanistic terms alone is adequate to experience. For false premises mean false conclusions.

The acceptance of the idealistic (spiritualistic) assumption by modern philosophers compels us to accept it.

It seems necessary, therefore, to conclude that the vitalist is correct in asserting that not all of personality is spatially expressed. In other words,

Individuality (personality) is a phenomenon not determined by the perceptual conditions only, but requiring to account for it the agency of a non-perceptual agent.

This agent is the "Ego" or "Will." The formula of individuality therefore, is: $W(b)$, and the vitalistic theory "ist noch nicht aus dem Welt geschafft."

And, unless by caprice or prejudice we refuse to trust the opinion of experts and adopt a discredited philosophy as the foundation of our thought, vitalism will continue to be our interpretation of individuality in organisms, although *not, of course, in the mechanistic aspects of individuality.*

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LITERATURE CITED

Balfour, A. J. 1879. A Defense of Philosophic Doubt.

Balfour, A. J. 1895. The Foundations of Belief. Longmans.

Balfour, A. J. 1914. Theism and Humanism. Doran.

Bergson, H. 1911. Creative Evolution. Holt.

Bosanquet, B. 1912. The Principle of Individuality and Value.

Brooks, W. K. 1899. The Foundations of Zoology. Macmillan.

Buetschli, O. 1901. Mechanismus und Vitalismus. Leipzig.

Conklin, E. G. 1915. Heredity and Environment. Princeton Univ. Press.

Crampton, H. E. 1911. The Doctrine of Evolution. Columbia Univ. Press.

DeLaguna, T. 1910. Dogmatism and Evolution. Macmillan.
Dendy, A. 1915. Progressive Evolution. *Am. Nat.*, 49.
Driesch, H. 1908. Science and Philosophy of the Organism. A. & C. Black.
Driesch, H. 1914. The Problem of Individuality. Macmillan.
Edinger, L. 1908. Comparative Anatomy and Comparative Psychology. *Jour. Comp. Neurol.*, 18.
Glaser, O. 1912. Is a Scientific Explanation of Life Possible? *Pop. Sci. Mo.*, 81.
Glaser, O. 1912. Reflections on Autonomy of Biology. *Am. Nat.*, 46.
Gordon, G. A. 1910. The Appeal to Cæsar. *Congregationalist*, 95.
Griggs, E. H. 1908. The New Humanism. Huebsch.
Haeckel, E. 1905. The Riddle of the Universe. Harpers.
Haldane, J. S. 1908. Presidential Address: "Reports." Brit. Asso. Adv. Sci.
Henderson, L. J. 1913. The Fitness of the Environment. Macmillan.
Herrick, C. J. 1915. Introspection as a Biological Method? *Jour. Phil., Psych. and Sci. Method*, 12.
Herrick, C. J. 1915. Introduction to Neurology. Saunders.
Hoeffding, H. 1905. The Problems of Philosophy. Macmillan.
Holt, etc. 1914. The New Realism. Macmillan.
Huxley, J. S. 1912. The Individual. Putnam.
Huxley, T. H. 1893. Method and Results. Appleton.
James, W. 1907. The Energies of Men. Science, 25.
Jennings, H. S. 1906. Behavior of Lower Organisms. Macmillan.
Jennings, H. S. 1913. Doctrines held as Vitalism. *Am. Nat.*, 47.
Jennings, H. S., 1914. Life and Matter. Johns Hop. Univ. Circ. 270.
Judd, C. H. 1910. Evolution and Consciousness. *Psych. Rev.*, 17.
Ladd, G. T. 1909. Review of Marshall's "Consciousness." Science, 30.
Ladd, G. T. 1913. The Study of Man. Science, 37.
Lang, W. H. 1915. Plant Morphology. Science, 42.
Lillie, R. S. 1913. Henderson's "Fitness of the Environment." Science, 38.
Lillie, R. S. 1914. The Philosophy of Biology. Science, 40.
Lillie, R. S. 1915. What is Purposive Behavior? *Jour. Phil., Psych. and Sci. Meth.*, 12.
Lodge, O. 1905. Life and Matter. Putnam.
Loeb, J. 1900. Comparative Physiology of Brain. Putnam.
Loeb, J. 1911. The Mechanistic Conception of Life. Chicago Univ. Press.
Lovejoy, A. O. 1909. Review of Driesch's Science and Philosophy, etc. Science, 30.
Macdougall, R. 1913. Neovitalism, etc. Science, 37.
McDougall, W. 1911. Body and Mind. Methuen.
Marshall, H. R. 1909. Consciousness. Macmillan.
Mast, S. O. 1913. Review of Loeb's "Mechanistic Conception, etc." *Biol. Centralbl.*, 33.
Mast, S. O. 1914. Review of Henderson's "The Fitness, etc." *Biol. Centralbl.*, 34.
McCabe, J. 1910. The Evolution of Mind. Macmillan.
Minot, C. S. 1902. The Problem of Consciousness. Science, 16.
Moore, G. E. 1903. The Refutation of Idealism. *Mind*, 12.
Morgan, C. L. 1905. The Interpretation of Nature. Macmillan.
Morgan, C. L. 1903. Introduction to Comparative Psychology. Scribners.
Morgan, T. H. 1910. Chance or Purpose, etc., Science, 31.
Palmer, G. H. 1911. The Problem of Freedom. Houghton, Mifflin.
Parker, G. H. 1914. Biology and Social Problems. Houghton, Mifflin.
Paulsen, F. 1895. Introduction to Philosophy. Holt.
Pearson, K. 1892. The Grammar of Science. A. & C. Black.
Perry, R. B. 1905. The Approach to Philosophy. Scribners.
Putnam, J. J. 1915. Human Motives. Little, Brown.
Rand, H. W. 1912. The Problem of Organization. Science, 36.
Ritter, W. E. 1909. Life from the Biological Standpoint. *Pop. Sci. Mo.*
Ritter, W. E. 1911. The Controversy between Materialism, etc. Science, 33.
Rogers, A. K. 1909. A Student's History of Philosophy. Macmillan.
Royce, J. 1892. The Spirit of Modern Philosophy. Houghton, Mifflin.
Royce, J. 1899. The World and the Individual. Macmillan.
Schaefer, E. A. 1912. The Nature, Origin and Maintenance, etc. Science, 36.
Schiller, F. C. S. 1907. Studies in Humanism. Macmillan.
Shaler, N. S. 1901. The Individual. Appleton.
Sherrington, C. S. 1906. The Integrative Action, etc. Constable.
Spaulding, E. G. 1909. Review of Driesch's "The Science, etc." *Phil. Rev.*, 18.
Stout, G. F. 1905. Things and Sensations. Oxford.
Strong, C. A. 1903. Why the Mind has a Body. Macmillan.
Sumner, F. B. 1910. Review of Driesch's "The Science, etc." *Jour. Phil., Psych. and Sci. Meth.*, 7.
Thompson, D'A. W. 1911. Magnalia Naturæ. Science, 34.
Thomson, J. A. 1913. Professor Henri Bergson's Biology. *Proc. Roy. Phys. Soc. Edin.*, 19.
Thomson and Geddes. 1911. Evolution. Holt.
Ward, J. 1903. Naturalism and Agnosticism. Macmillan.
Warren, H. C. 1914. The Mental and the Physical. *Psych. Rev.*, 21.
Watson, J. 1907. The Philosophical Basis of Religion. Maclehose.

Wenley, R. M. 1910. Modern Thought and the Crisis, etc. Macmillan.
Woodbridge, F. J. E. 1906. The Problem of Consciousness in "Studies in Honor of C. E. Garman."
Woodruff, C. E. 1911. Modern Vitalism. *New York Med. Jour.*, Aug. 19, 26.

GUSTAV SCHWALBE

THE death is announced of Professor Doctor Gustav Schwalbe, one of the most distinguished anatomists of Germany, who, established in recent years his leadership in the subject of human anatomy through his broad and profound knowledge of comparative anatomy. His analysis of the human remains of the Lower Paleolithic, beginning with the type Neanderthal skull, resulted in the recognition of *Homo neanderthalensis* as a distinct species of the human race. This has been followed by many other penetrating studies from which an entirely new system of cranial measurements has been deduced, namely, an internal system which takes account of the proportions of the brain in place of the external system of Brocca and the older anatomists based on the superficies of the skull. Following the lamented death of Eberhard Fraas, the paleontologist, the loss of Schwalbe will be severely felt in the University of Strassburg. All those who enjoyed the pleasure of the acquaintance of this distinguished anatomist and who recall his genial and modest personality will deeply lament his death.

HENRY FAIRFIELD OSBORN

THE RURAL ROADSIDES IN NEW YORK STATE

BY investigations just completed by the New York State College of Forestry at Syracuse, it has been found that nine tenths of the roadsides in the rural districts of New York state are entirely void of shade trees. When this is considered along with the fact that last year New York state paid out of the state treasury about $30,000,000 for the construction and maintenance of roadbeds, it shows that the state is not yet awake to the great need and the great possibilities in rural roadside improvement.

The preliminary survey which has just been made by H. R. Francis in charge of the landscape extension work of the College of Forestry, covered nearly 3,000 miles of the main lines of highways passing through such important points as Rochester, Buffalo, Jamestown, Olean, Hornell, Corning, Ithaca, Cortland, Elmira, Binghamton, Oneonta, Kingston, Hudson, Albany, Schenectady, Glens Falls, Lake Placid, Malone, Potsdam, Watertown, Utica, Rome and Syracuse.

During the survey studies were made of such important features in rural roadside improvement and beautification as good and bad varieties of trees found along the highways, views and vistas obtained from the highways, the effects of the shade trees on crops in adjacent fields, the possibilities of the covering of barren embankments and the planting of some desirable sort of vegetation where overhead wires are in large numbers. One of the principal features studied was the condition of the roadbed as affected by the presence or absence of shade trees.

A detailed study of the main state highway east and west between Albany and Buffalo will be made immediately by the State College of Forestry. The observations which have already been made in all sections of the state together with the information obtained by the detailed study will be used as a basis for an educational publication to be issued by the college and distributed very widely to organizations in the state, such as the automobile clubs, women's clubs, commercial associations, granges, farm bureaus and the State Forestry Association and other individuals interested in this development.

This is the first comprehensive study to be made of the landscape treatment of the rural roadsides in the state and the college predicts a wider appreciation of the possibilities and the necessity for the planting and preservation of forest trees along the rural roadsides. Few people in the state will be able to visit the wonderful national parks of the west, but an increasing number of people will own automobiles and use the highways of the state. Many if not all of these highways may easily become state park ways of beautiful trees and