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DIVERSE DOCTRINES OF EVOLUTION, THEIR RELATION TO THE PRACTICE OF SCIENCE AND OF LIFE[1]

As a fresh unhackneyed subject for an after dinner address I propose to talk on evolution. Some doctrines of evolution are not so hackneyed as others. My own favorite doctrine has been only too much neglected. I now discover with pleased surprise that this very doctrine is coming into fashion. No longer can its exposition be described as a voice or two crying in the wilderness. Philosophical congresses discuss it, eminent zoologists discant upon it; still more significant, it has acquired a name that identifies it. Naturally, therefore, while it is in sight, I seize this opportunity to greet its emergence; to promote its publicity. Therefore, prepare for propaganda. See that your defense complexes are in working order. One needs nowadays to keep them ready for instant use; so you will not complain at my giving them a bit of drill.

The name that the doctrine has acquired is Emergent Evolution. This may be a poor name, but any name is better than being nameless; so one must be thankful. The different ways of conceiving the evolutionary process have diverse bearings upon one's attitude toward the world; upon the temperament and outlook of the student of science; upon the course that science takes. What I wish to do is, not to expound emergent evolution as a doctrine, but to inquire into its bearings on these matters, as compared with those of other ways of looking at evolution; to set forth my own notions of these bearings. You will see that to me this doctrine appears an edifying one. My thesis is that the conscious acceptance of the doctrine of emergent evolution and of its implications would greatly ameliorate biological science as practiced and as preached; would much moderate, mitigate and amend its influence on the human outlook and the practice of living. I speak therefore as a hopeful uplifter.

Evolution is often identified with perfect mechanism; or at least held to be consistent and coincident in its operation with mechanism. According to that doctrine in its perfection, the universe as a whole, or

[1] Address of the retiring chairman of the Zoological Section of the American Association for the Advancement of Science, December 28, 1926.

any limited sample of it, is a set of particles, of one or a few kinds, moving according to certain few invariable laws; the consequent successive groupings of the particles constituting the universe at diverse periods. The process of transformation of the groupings is evolution. From examination of any small sample of the universe, at any time, it is possible to discover the laws of action, of grouping, for all its parts, and for all periods. Consequently, after such an examination of the configuration and motions of the particles at any given moment, the clever observer armed with an adequate computing machine could compute and therefore predict the entire course of evolution; all that will occur or exist at any later period. Evolution is the working of a great machine that never alters its mode of action nor the nature of its product. Science is the examination of what this machine does and produces. Its ideal method is by computation—from a few elementary observations of the constituent particles, their distributions and motions. Science is therefore mainly rationalistic; to but a minimal extent empirical. Nothing essentially new or unexpected can come out of this machine. The thing that hath been is that which shall be, and that which is done is that which shall be done, and there is no new thing under the sun. Such is the soul stirring vision which illumines the path of much of evolutionary science. Even where this vision is not in conscious view, it has induced a subconscious complex which dominates theory and practice. Evolutionary doctrines in large measure adopt the attitudes appropriate to this vision; admit the conclusions based upon it, and regulate their practice accordingly.

The doctrine of emergent evolution rejects this vision as an illusion; explicitly denies the propositions it bodies forth; substitutes for them others that are irreconcilable with them, and with the practical and theoretical conclusions drawn from them. It holds that the conception of the universe as *nothing but* a set of one or a few kinds of particles moving according to a few immutable laws exemplified at any time and anywhere that particles occur, is pitiful in its inadequacy. The notion of computing the entire farther course of evolution from the situation at a given moment, it considers one of those raw and naively incompetent ideas to which at early and unsophisticated periods of culture man is prone. It asserts that the method of science based upon this notion is a false one, not from lack of a sufficiently clever computer with an adequate computing machine; but because at any given time or place the data required for the computations do not exist. It holds that new things, not thus computable, appear as evolution progresses. It holds that with these emerge new methods of action, following new laws; methods not before exemplified; methods that falsify the results of computations based on former methods of action. Concretely, it holds that such new things and new modes of action distinguish the living from the non-living, the sentient from the non-sentient, the reasoning from the non-reasoning, the social from the solitary. It affirms, under correction, that the same is true for the steps from electrons to atoms, from atoms to molecules, from molecules to crystals. It holds that the properties of atoms do indeed depend on those which the electrons have *when they are in the atom;* the properties of molecules on those which the atoms have when *they are in the molecules.* It holds too that the properties of living things depend on those of their physical constituents *when the latter are in living things;* the activities of thinking beings on the action of their physiological constituents when the latter are part of a thinking being; the activities of societies on those of their unit individuals when these individuals form part of the society. But it contends that the constituents of each grade acquire new properties, new modes of action, in becoming part of the "emergent" thing of "higher" grade. It holds that the physics of atoms, of molecules, is not fully known till these are studied in the living as well as in the non-living. It holds that the physiology of bodily constituents separated from the living organism is in essential respects diverse from their physiology *in* the living organism. The constituents of the emergent unit partake of the properties which they showed before becoming parts of that unit; but with additions or modifications. The properties of the emergent unit itself depend on these altered properties of its constituents.

But my present purpose does not require me to expound or defend emergent evolution as a doctrine. That has been done of late by others; by Lloyd Morgan, Ritter, Lovejoy, Wheeler, Parker; by many. I need now but to identify the doctrine. There it stands. What I wish to ask is, in rude parlance, "What *of* it?" What differences does it make? Where does it take us if we adopt it and act upon it,—in place of following the vision of mechanical evolution?

It seems to me to make a great difference as to where we go; a great difference to the practice of science; a great difference to the temperament and bearing of the man of science; a great difference to one's outlook upon life and the universe. Let us look into this.

Look first at the relation of the two kinds of doctrine to our own professional work; to the technique of scientific investigation and formulation. For mechanical evolution, the ideal scientific method is mainly rationalistic. We should require but a few

preliminary observations; of the particles; of their configurations and motions. The rest is a matter of computing, of reasoning. Science ought quickly to leave its toe-touch with observation, with experiment, and soar away; your philosopher is your ideal man of science. Continued recourse to experimentation is a mere device of feeble minds. From a sample of the universe we *ought* to be able to reason out the rest. The experimenters are those of us who can't. It is humiliating. Realizing that we are failures, we perforce continue to experiment, and our inferiority complex continues to grow. The experimenter is a groveling creature, engaged in a practice that is a contheme the moment he moves a few inches beyond his experimenter, the more depressed should he be.

This is hard on those of us who find that the only method by which we can progress, in the matters that interest us, is by observation and experiment. I have heard a brilliant experimentalist—a man who has marvellously advanced biological science—say that the moment he moves a few inches beyond his experimental results he goes wrong, as the next experiment shows. He must stick to experiment, or progress stops and error begins. How must such a man beweep his outcast state! How must he wish himself like one more rich in hope and capacity, namely the philosopher! How must he look upon himself and curse his fate, with what he most enjoys contented least! He must, that is, if he accepts the doctrine of mechanical evolution.

Yet in these thoughts almost himself despising, if he but becomes persuaded of the doctrine of emergent evolution—all this changes—his state becomes like to the lark at break of day arising; and now he scorns to change his state with philosophers. The inferiority complex collapses, goes into solution, disappears.

For by the doctrine of emergent evolution, observation and experiment are the primary and the final methods of science, never to be laid aside. They are *the* methods for learning of the universe. On the basis of what they bring forth, reasoning, computation, may indeed act, so long as these stay within the restricted circle that shows nothing new, nothing emergent, as compared with what has already been considered. But always there is the possibility that emergents have come into the circle; always must the conclusions be tested by experiment. Reasoning is good; computation is good; but for *what* are they good? They are good as guides to the next experiment, the next observation. The new things that come in evolution, the new modes of action, can not be discovered by ratiocination; only by observation and experiment. When the reasoned conclusion conflicts with experiment, it is the reasoned conclusion that must give way. Herbert Spencer's tragedy of the deduction killed by an observed fact is as typical and necessary an event in science as is the death of the unfit in the evolution of organisms. The man of science must accept as the final word John Hunter's maxim: Don't think; try! Thinking is an instrument, a very fallible instrument, for helping to decide what to try, but the *last* word must be *try*.

The successful experimenter then may lift up his head; he is practicing the highest activity of man; the essential method of science. And so emergent evolution leads to my own favorite doctrine of the radically experimental nature of science. It is as a doctrine of radical experimentalism that I have before discanted upon it. Radical experimentalism leads to emergent evolutionism, as emergent evolutionism leads to radical experimentalism; they are indeed obverse views of one doctrine. To this joyful meeting and coalescence I must in a few moments allow myself to come back.

But what a difference, too, acceptance of the doctrine of emergent evolution will make in our conception of the relation between the living and the non-living! What a difference it will make in the practice of investigating the properties and activities of organisms. No longer will it be held that the only sound method of learning about the organic is to study the inorganic. No longer will the conviction prevail that the best interpreter of the living is he who confines himself to the study of what is not living. That notion has been the curse of biological science; condemning it to move in pretentious superficialities. Emergent evolution demands a study of the inorganic as well as of the organic; but no more. It demands a study of the inorganic for the sake of the organic. Since the activities of constituent parts in the living are modifications of their simpler actions in the organic and since many of the simpler actions too persist in organisms, a knowledge of the inorganic must continue to be the foundation on which to build an understanding of the organic. But the constituent parts act differently within the organic, for they have come into new relations; the laws of action of atoms and molecules are not fully known till they are examined in organisms. The experimental method is as valid and as indispensable in the living as it is in the non-living. Any result which it yields in the living is as sound and may be as ultimate, as anything it discovers in the non-living. The doctrine of emergent evolution makes the biologist loyal to experimentation and observation in his own field of work, whatever is found in other fields. Courage and defiance sprout in his soul in place of timorous subservience to the inorganic. No longer can the biologist be bullied into suppressing observed results because they are not discovered nor expected from work on the non-living parts of nature. No longer will he feel a sense of

criminality in speaking of relations that are obvious in the living, for the reason that they are not seen in the non-living. Biology becomes a science in its own right—not through rejection of the experimental method but through undeviating allegiance to it. The doctrine of emergent evolution is the Declaration of Independence for biological science.

And *within* the realm of biological science a parallel result must follow. Different organisms, different societies of organisms, are diverse emergents, showing diverse systems of relations and consequent diverse methods of action. No longer must it be held that what is true for one organism is necessarily true for another. No longer will the investigator expect by a single crucial experiment to settle a question for the whole organic world. Knowledge of the biology of the oyster is practically not a solid basis for judgment of that of the social insects; this practical fact will be recognized as theoretically significant; as a fact typical of biological science; not something to be minimized and explained away. Organic evolution will be seen as emergent evolution in its most conspicuous and manifold display. In that day resplendent with promise when this is recognized, the practice of facile generalization which honeycombs with error biological science will lose its seductive charm. To generalize will be recognized as the most laborious task in biology, instead of the lightest and simplest. To discover what organisms have in common becomes an object for wide-extended comparative investigation; not a matter for assumptions. Divergent results of experimentation in different organisms are not to be rejected on *a priori* grounds; diversities are as significant as uniformities. This state of affairs, on the one hand a corollary of emergent evolution, is revealed on the other hand by the advance of experimental biology; things living behave themselves as if emergent evolution were a true doctrine.

And all this applies to man as to other organisms; to his conduct, to his social organization, to his prospects and possibilities. Man, like other organisms, is an emergent. His actions may follow the same principles as those of other organisms, or he may act on different principles. This is not a matter for assumptions; it is all a question of fact, to be discovered by experiment; by experience and in no other way. What man has in common with other organisms is to be discovered by investigation and careful comparison, not taken for granted. Wherein he differs from other organisms; wherein he is unique—this stands on the same footing; it is purely a question of observable fact. Data drawn from the study of man are as ultimately valid (provided drawn by equally sound methods) as are those from Amoebae, the frog or the rat; and this whether they are like or diverse from what is found in other organisms. If a student of humanity asserts that man shows certain characteristics, his assertion is not negatived by the fact that no such characteristics are to be found in other organisms. There is no *a priori* ground for sneering at the notion that man in some respects acts on principles diverse from other animals. *A priori* principles of this sort don't go, if emergent evolution is a correct doctrine; such questions are purely matters for investigation. It is true that the investigation of man is difficult; but unhappily that does not make it the less necessary.

Emergent evolution thus relieves the general biologist of that intolerable burden of responsibility that has been forced upon him, the responsibility of speaking oracularly on the problems of human life, on the constitution and conduct of human society; relieves him of the duty of explaining to man what is wrong with him and what he must do to correct the evil situations that he gets into. The biologist who speaks authoritatively on such matters must be a specialist in the biology of the Hominidae, just as the authority on hookworms and liver flukes must be a specialist in helminthology. That is, he must be a student and experimenter, an actor, in the social life of man; he must be an economist, a politician, a historian, as well as a physiologist. For such an authority, if emergent evolution is a correct doctrine, the proper study of mankind is man—man taken of course in his setting as an organism and as part of the world; but yet an extensive and intensive study of man as a distinct emergent; a creature in his own right. Such a biologist will identify the biology, the behavior of man with that of other organisms only critically, after detailed comparative study and demonstration of the respects in which they are identical; and he will give full weight to any evidence that they are diverse. If it is indeed in social organization that we find emergent evolution most manifestly at work; if it *is* here that that which is new in principle most frequently and conspicuously appears, then we shall be cautious in accepting the advice of even the king of the termites on our own social problems; we shall use discretion and take his advice at most as suggestions toward experimentation. For any organism or society separated from others by steps in emergent evolution, the only possible method for progress is by trial and error. In such progress by trial and error will indeed be found free play for the utmost sharpness of vision as to what it is best to try, and for all possible astuteness of judgment as to what has turned out error; but in the end *a trial* it must be, with no antecedent certainty as to results.

And if we are not to set arbitrary bounds for

emergence, then we may be led to admit with Ritter[2] that a particular human individual may be an emergent; a thing set off from all others, in some respects unique; a creature that is a law unto itself; not to be compressed into any general formula. From the acceptance of this, large consequences will be found to flow.

All this will make a revolutionary change in the outlook on certain troublesome human problems that touch directly the man of science; will help him to reconcile being a man of science with being human. A conflict seems to rage between the principles of scientific method and the principles by which human beings act. Science—mechanical science—asserts that all action is determined by the conditions preceding it, in such a way that all action could be predicted from a knowledge of those conditions. There is then no chance of *our* altering what was predictable before we came into existence; all our efforts are quite in vain; we are helpless. Mechanical science thus leads to fatalism; to the extinction of all stimulus to effort, of all man's attempts to guide the course of events. Worse, mechanical science asserts, not only that all action is determined before it occurs, but that it is determined by the physical conditions, by the material situation; that is, it teaches materialism, with all its gross consequences. Whatever happens is determined by the motions of the constituent particles with their immutable laws; it is only on these that computations can be based. Ideas, ideals, purposes, beliefs—all that is mental—are left without function in the scheme of things. They ought not to exist. And if they do, they might as well not. Their existence is unaccountable. Some have therefore adopted toward them Christian Science attitudes, have succeeded in prevailing on themselves to deny that they do exist. This appears like an instance of the strange power of an idea, but for mechanism it is not.

It can not be denied that men speaking in the name of biological science have proclaimed the basic doctrines from which those conclusions have been drawn; from which they are perhaps justly drawn. The immutability of the laws of nature, the theoretical predictability of the future from the past, the denial that anything essentially new can occur—these are almost commonplaces of the schools. The explicability of all that occurs in the living through a knowledge of the laws of the non-living is a dogma in wide circles of biology. The incompetence of the mental to affect physical happenings has become a widely held doctrine, urged by biologists, philosophers and psychologists. The objective examination of behavior, we are told, leaves no role for the psychic; as one physiologist expressed it "the sensations, memory, thoughts,—disappeared like fluttering forms of vapor; —nowhere remained the smallest spot for the psyche." Neal felt that he was opposing generally accepted scientific doctrine when he had the hardihood to maintain that consciousness makes a difference to what happens. So nearly a commonplace has become the doctrine of the inefficacy of the mental that one finds a writer in a philosophical magazine raising timorously and apologetically, with the fear of the biologist in his soul, the questions whether it *may not* after all be true that "purpose makes a difference," and that "intelligence is practical and a source of power." So low has the perfect doctrine of mechanism brought us!

Holding farther than the future could be computed from the past, that the laws of nature are immutable, mechanical science necessarily turns one's eyes exclusively back into the past for judging of the future. Nothing will be exemplified in the future that has not in principle appeared in the past. For man's affairs as for all others, the thing that hath been is the thing that shall be, and that which is done is that which shall be done, and there is no new thing under the sun. The idea of altering humanity, of replacing what has been bad by what will be better, is a romantic fancy, one of those things that have no excuse for existence; an iridescent dream perhaps, but a silly one.

Mingle this perfect doctrine of mechanism, as has been done, with equal parts of the perfect doctrine of natural selection, and you get a potion, a cocktail, with a kick that is warranted to knock out ethics and civilization. Warfare and destruction have been the means of advance; the laws of nature are immutable; this then must continue. Rapine and murder are the means of progress. To try to stop them is to try to change the laws of nature; is to try to stop evolution. Gentleness, pity, humility and the rest of the "slave virtues" are mere weaknesses deserving of destruction and certain to get their deserts. The only conduct that is justified is that whose powerful violence leads to triumph in the struggle for existence. Ethics does not exist in the universe of perfect evolutionary mechanism; from the latter we learn the opposite of everything by which we aspire to guide our daily lives and to organize society. Such aspirations are mere sickly longings to oppose the course of nature; quite without effect on the course of events.

The tree that bears all these handsome fruits has its roots in the determinism of events, as conceived by mechanism; in the doctrine that whatever happens is determined by the pre-existing situation and could be computed from it. Only if we accept determinism is science possible, and these things, it is urged, follow from determinism.

2 "The Unity of the Organism," Vol. 2.

I believe that there is no escape from the conclusion that only on the basis of determinism is science possible; only on the basis of determinism is learning by experience possible. Determinism can not be given up without to the same extent giving up the possibility of science. A general abandonment of the conviction that what happens depends on the conditions, —with action based upon that abandonment—would go farther than any other conceivable step to drive man into savagery; nay, to bring about his immediate extinction; and just so far as indeterminism takes the place of determinism is that goal approached. What humanity needs is not less, but infinitely more, realization of the fact that what occurs depends on the conditions; a large proportion of its ills result from lack of that realization. Only through action based on that realization is man freed from his slavery to the forces of nature; only through that is he led to investigate, to invent; only through that does conduct become responsible. Indeterminism signifies the lack of all basis for learning, for science; it means absolute irresponsibility in conduct. We can not give up determinism in science or in life. If the doctrine of mechanism had a monopoly of determinism, then indeed a shift to any other doctrine would have disastrous consequences. There is an impression that mechanism does have such a monopoly; and this impression goes far in accounting for its hold on the minds of men of science.

But this impression has no justification. Emergent evolution makes no difficulties for the thoroughgoing experimental determinism on which depends the possibility of science. It is as things come into new relations that their properties change. Diversities in emergents follow experimentally upon preceding diversities in their constituent elements; in the interrelations of those elements. There is always an experimental cause for the change that occurs. The doctrine of emergent evolution, as I have tried to show, is a doctrine of radical experimentalism. Experimentation has no point if there is not determinism. So far as determinism fails, advance by trial and error is impossible. It is only because we can depend on the results of trial that we are able to discover what *is* error.

Now, examination will show that the doctrines set forth above, which involve science and life in a conflict, are not the fruit of that determinism which is required for the building up of an experimental science; which is required for the practice of life. The doctrines of the immutability of the laws of nature; of the computability and predictability of all that will happen; the doctrine that there is nothing new under the sun; the doctrine that ideas, purposes and ideals do not affect what happens; the doctrine that we are helpless to influence the course of events—all these follow only from certain assumptions, not experimentally justifiable, that mechanism makes as to determinism. They follow only from the *a priori* assumption that causality can hold only as between phenomena of certain types; only between the phenomena presented by the particles of matter moving by immutable laws. Mechanical science is forced to this assumption because only thus can it save the computability and predictability of events; and these it must save or itself perish in the struggle for doctrinal existence. Causal relations therefore can not hold between the mental and the physical. The physical can not affect the mental, and *a fortiori* the mental can not affect the physical. For if they did, computability and predictability fail. *Quod erat demonstrandum.*

In all this *a priori* argumentation, mechanism parts company with radically experimental determinism; with determinism based on purely inductive evidence; with the determinism that underlies emergent evolution; with the determinism that makes possible inductive science. That determinism is concerned only with experimentally discoverable relations. The only test as to whether one phenomenon affects another is experiment. Applied temporally, for questions of causation, the test is: remove severally each preceding condition, and observe whether this alters the later phenomena. If it does, this is what we mean by saying that one condition affects another; that one determines another. Such experimental determinism is not concerned with likenesses or differences in kind, as between mental and physical, nor with the conceivability or inconceivability of causal relations between them; it is purely a matter of experiment. It discovers empirically that when two cases differ in some respect, there is to be found a preceding difference to which the later difference is experimentally due. But what result shall follow from a given precedent diversity is known in the first instance only by experience, not necessarily by reasoning or computation. Emergent evolution, or radical experimentalism, leaves untouched the probable universality of this relation of experimental determinism. It leaves this universality an open question, the answer to which is to be approached, like the answer to all questions of inductive science, by continued experimentation. So far as it attempts to anticipate this answer, it asserts universal determinism only as an induction—the widest of scientific inductions—based upon cumulative evidence from experiments in all the fields of nature.

If we rely solely upon experiment, the production of mental diversities by preceding diversities in physical conditions is the commonest experience of mankind; a brick dropped on the foot yields other mental

results from a feather so dropped. Such determinism stands up under the most critical analysis, so far as the latter is restricted to experimental considerations. In so far as this relation is a universal one; in so far as diversities in mental state are always preceded and accompanied by diversities of physical state, an analysis of the situation shows that experimental determinism also holds for the production of physical diversities by preceding mental diversities; for experimental determination of the physical by the mental. One result follows when a certain mental state precedes; another when another mental state precedes, and this is exactly experimental determinism. No ground based on experimental analysis can be alleged for the assertion that the mental does not affect the physical; this is a purely *a priori* notion.

According therefore to radical experimentalism, consciousness does make a difference to what happens; particular types of consciousness make a difference. Emergent evolution asserts this from another point of view; the conscious emergent is one that acts on different principles from the unconscious one; the two doctrines are here again one. Emergent evolution so does away with that monstrous absurdity that has so long been a reproach to biological science; the doctrine that ideas, ideals, purposes have no effect on behavior. The mental determines what happens as does any other determiner.

This carries with it a very different outlook on nature and life from that implied by the contrary view. The situation completely changes as to fatalism and materialism. Among the determining factors for the happenings in nature are those that we call mental. Thought, purpose, ideals, conscience, do alter what happens. That is, a man with an idea behaves diversely from a man without one; just as a man grasping the electrodes of a powerful battery behaves differently from one not connected up with the battery. As suspected by the philosopher quoted earlier, purpose does make a difference; intelligence *is* practical and a source of power. It is not strictly true that "popular approval or disapproval will not alter the course of nature"; that is one of the main factors in the course of nature as including man. The desires and aspirations of humanity are determiners in the operation of the universe on the same footing with physical determiners.

Furthermore, since a particular emergent individual may be a unique exemplar, mentally and otherwise, he may act in ways that are unique, in ways that are diverse from those of any other individual under the same outer conditions. Such an individual is free from the tyranny of general law; is free from determinism by conditions outside itself; is free to act in accordance with its own nature alone; and yet in its acts there is no breach of experimental determinism.

Such determinism, it is clear, does not imply that what is to come in the future is predictable from what has occurred in the past. The statement that the laws of nature are immutable must not be construed to mean that new laws shall not be exemplified as new conditions arise. Because things have occurred in a certain way in the past it does not follow that they must thus occur in the future. This has not been the history of evolution in the past; there is no ground to expect it to be so in the future. There is nothing in science or scientific method that makes it unreasonable to hope for the appearance in the future of what has not been seen in the past; that is incompatible with striving to realize ideals that have never yet been realized.

Acceptance of emergent evolution, carrying these things with it, will possibly tend to make us dwell more peacefully with our fellow students of the various series of emergents. The physicist, the chemist, shall have his way with the inorganic; the zoologist with animals; the humanist with man; their results supplement one another but need not coincide, for they are studying diverse emergents. Like the lion and the lamb, in that day they shall all lie down together. Patrick[3] suggests that even the fundamentalist and the evolutionist approach one another in this doctrine; but I fear that never that twain shall meet in peace till one is inside the other. The fundamentalist that subtly assails the foundations of science by attempting to destroy the basis on which it rests; or the cruder variety that assaults it with legal and physical restraint—these are the enemy, with whom there is peace only in defeat or victory.

In sum, acceptance of the doctrine of emergent evolution would, I believe, work out to the benefit of science and of humanity. It combines the advantages of mechanism and of vitalism, dismissing the ineptitudes of each. It offers no obstacles to the continued progress of science nor to its formulation. At the same time it sets no limits as to what science shall discover. It recognizes that science is never finished, that it must continue to develop so long as evolution continues. We need not make the doctrine of emergent evolution a dogma; one must hold doctrines experimentally, as he practices science experimentally. But the world behaves as it would if emergent evolution were a correct doctrine. Science I believe would find itself more adequate to that world if it too would try for a while behaving as if emergent evolution were a correct doctrine.

H. S. JENNINGS
THE JOHNS HOPKINS UNIVERSITY

[3] "The Convergence of Evolution and Fundamentalism," *The Scientific Monthly*, July, 1926.