

## THE SCIENTIFIC BASIS OF SOME CONCEPTS OF PIERRE TEILHARD DE CHARDIN

by *Donald R. Gentner*

Intellectuals in classical Athens believed that knowledge was all of one piece. By the second century before Christ, however, science and philosophy had become divorced in Alexandria. The Middle Ages saw a reconciliation, with Theology reigning as Queen of the Sciences. But the Renaissance was a time of new frictions, and by the beginning of the eighteenth century, Science had clearly left the traditional intellectual fold to go on a new and divergent path. The sciences themselves soon splintered into separate disciplines which were remarkably isolated from each other even though they presumably were trying to understand the same universe. Recently, however, we have seen a reversal of this trend; the barriers between the various sciences are proving to be artificial. The various scientific disciplines, which at first had been unified primarily by a community of method, are now becoming unified in ideas as well. Physical theories such as quantum mechanics now completely dominate theoretical chemistry, and molecular biology is primarily applied organic chemistry. With psychology already yielding to biology, can sociology and anthropology be far behind?

The success of science is loudly proclaimed by the omnipresent technology to which it has given birth, and the government has decided that the welfare of the country is dependent upon a high level of support for scientific research and development. Meanwhile, progress in theology has been slow, and an increasing number of people feel that science might be able to infuse some life into the old Queen. There are two approaches: first, to apply the scientific method to theological questions, and second, to find, within the present science, doctrines which will illuminate problems of theological interest.

Pierre Teilhard de Chardin has undertaken both approaches. In the preface to *The Phenomenon of Man* he writes, "If this book is to be properly understood, it must be read not as a work on metaphysics,

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still less as a sort of theological essay, but purely and simply as a scientific treatise. The title itself indicates that. This book deals with man *solely* as a phenomenon."<sup>1</sup> In addition to proposing to study man from a scientific viewpoint, Teilhard also uses current doctrines of science, such as evolution, in the formulation of his theology.

The writings of Teilhard de Chardin have been greeted by the scientific world with reactions ranging from enthusiasm to horror (although it should be noted that only a small minority of scientists are aware of his writings). The reviews of Teilhard's major book, *The Phenomenon of Man*, illustrate the range of reaction of the scientific world to his ideas. The book itself has an Introduction by Julian Huxley, a widely respected evolutionary biologist. As might be expected, Huxley has quite a good opinion of the book. What is most surprising, however, is that, although Huxley surely agrees with the main thrust of the ideas, he cannot accept many of the details of Teilhard's arguments. Scattered throughout Huxley's exposition of Teilhard's thought are phrases such as "If I understand him aright" and "This view admittedly involves speculation of great intellectual boldness" and "Here his thought is not fully clear to me." He eventually finds it impossible to follow Teilhard all the way to his destination, but Huxley is nonetheless enthusiastic about the early stages of the journey. Joseph Needham, a prominent English biologist, describes Teilhard's ideas as "simply the view of the universe held by the overwhelming majority of working scientists in our age,"<sup>2</sup> although he does fault him slightly for his bias toward Western culture and Christianity.

On the other end of the spectrum is the review of *The Phenomenon of Man* by Peter Medawar, an English geneticist. Although Medawar apparently now feels that Teilhard's ideas are merely "a dotty, euphoristic kind of nonsense," his original review was notable for its caustic and debunking tone. Medawar wrote that most of *The Phenomenon of Man* "is nonsense, tricked out by a variety of tedious metaphysical conceits, and its author can be excused of dishonesty only on the grounds that before deceiving others he has taken great pains to deceive himself." After recounting the many flaws which he finds in the book, Medawar ends the review on a note of despair that "it is possible for people to be taken in by such a bag of tricks as this."<sup>3</sup> Medawar's views (ignoring the vitriol) are surprisingly similar to those of George Gaylord Simpson, an American biologist who knew Teilhard de Chardin personally. Despite his admiration of Teilhard, Simpson takes him to task for deriving his conclusions, not from the phe-

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nomena, but from his pre-existing religious beliefs. As Simpson states, "Teilhard was *primarily* a Christian mystic and only secondarily a scientist."<sup>4</sup> Another biologist with a similar view is Theodosius Dobzhansky, who accepts much of Teilhard's outlook but considers it to be of religious rather than scientific origin. Rather than developing a theology based on science, Dobzhansky says, "Teilhard saw science illuminated by his mystical insights."<sup>5</sup>

### FOUR CONCEPTS OF TEILHARD

There are four main "scientific" propositions in the theological writings of Teilhard de Chardin. These propositions are very closely intertwined, and so their separation here will necessarily be somewhat artificial. First, he felt that evolution has a major axis or direction of progress, specifically, in the direction of increasing complexity and consciousness. Closely related to this is the second concept, that of orthogenesis. Teilhard did not feel that random mutation and natural selection were enough to account for the rapid progress of evolution; additional forces were also at work to promote and guide new developments. The third idea introduced is that all things have two aspects: the *Without*, consisting of those properties which have been traditionally treated by science, and the *Within*, apparently not discoverable through science, but nonetheless having important consequences. Finally, Teilhard considers two types of energy: tangential energy, which is related to the types of energies known to physical science, and radial energy, which acts on the *Within* of matter.

Before examining these propositions in greater detail and trying to assess their scientific basis, I should first mention that Teilhard considered evolution to cover much more than the development of the present biological species from the first single-celled organism. He viewed the development of the galaxies and stars, the formation of the planets, the conjunction of atoms to form molecules and molecules to form polymers, the intertwining of polymers to form cells, the development of cells into the present biological species, and the progress of the species into the future as all part of the same consistent evolutionary pattern.

1. The thread that connects all these changes in time is the axis of "complexity-consciousness." The new units which develop are successively more complex, and, concomitantly, consciousness is constantly increasing. Most scientists would disagree with Teilhard's claim that the over-all trend of all processes in the universe is toward increasingly

complex arrangements. In fact, this may be a contradiction of the second law of thermodynamics, which states that the disorder (more precisely, the entropy) of any closed system is constantly increasing. Teilhard is aware of this contradiction, and I will discuss it later when we examine the concepts of radial and tangential energy.

Teilhard has more support when he discusses the trend toward increasing complexity-consciousness in biological evolution. All but the most obstinate scientists would agree that the average contemporary organism is higher than the first living cell on the scales of complexity and consciousness. ("Learning ability" or "plasticity of behavior" may be substituted for "consciousness.") But Teilhard says more; he states that the trend toward increasing complexity and consciousness is the main axis of evolution and can be seen in the history of the development of all biological species. On occasion some species have taken side roads which dead-ended, but these were only small perturbations from the clear main highway leading to man, the species which is currently the leading front of evolution. And man has even more significance than being the current top species on the main totem pole of the universe. For in man, complexity and consciousness passed a critical point, and self-consciousness developed. This breakthrough is equivalent to that of the development of the first living cell.

The majority of evolutionary biologists would find this picture of man's place in the world far too anthropocentric. New biological species develop in response to a constantly changing and varied environment. A species "ideally" suited to a moist temperate climate would quickly perish in a hot desert or with the coming of a new ice age. There are a multitude of axes to be found in biological evolution: increasing mass, skill in flight, metabolic efficiency, intelligence, visual acuity, brighter skin coloring, speed of movement, etc. Saying that the rise of consciousness is the main axis ignores most of evolution, such as the development of insects, to say nothing of the whole plant kingdom. Most biologists would be at a loss to find an objective basis for picking out one of these trends and calling it the main axis of evolution.

Teilhard predicts that man, in addition to being currently at the forefront of biological evolution, will continue to evolve both socially and genetically in the future, eventually (in perhaps a million years) achieving a breakthrough into the Omega state where the spirit will be freed from matter. Most scientists agree that man will continue to evolve in the future, but they would not be so confident of the direction of development, and the existence of spirit without matter is completely foreign to current scientific thought.

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Teilhard justifiably finds fault with those who imagine that evolution operated only in the past and that man as a species will survive forever without change. But he himself falls victim to almost the same temptation when he proposes that man will progress just one more step before ceasing to change. Of course, in Teilhard's picture that one step is into a non-physical realm, and so the case is not exactly parallel, but it is surprising that our vision of future possibilities is so limited.

There is another, less important objection that can be raised to the placement of man at the apex of evolution. The reason that Teilhard puts man at the top is that, of all the species, he judges man to have the highest levels of consciousness and intelligence. But these qualities are difficult to perceive in themselves, so Teilhard must award first place to man on the basis of the visible fruits of his consciousness and intelligence, such as technology and language. Some people who have spent time with bottle-nose dolphins and killer whales claim that these animals are more intelligent than the average human. (The killer whale's brain is four times the size of man's.) How can we be sure that self-consciousness is restricted to man?

2. Modern evolutionary biologists feel that the present species developed by the process of natural selection operating on organisms which change only by random mutation. While the possibility that organisms may have a preferred direction of change cannot be ruled out, there is at present no evidence for this, and practically all biologists feel that random change coupled with natural selection is sufficient to explain the development of species. Teilhard takes exception to this with his principle of orthogenesis. Unfortunately, Teilhard's writings are somewhat unclear on this topic, but he definitely feels that random mutations are not a sufficient basis for evolution. With only random mutations, he says, life could have differentiated in some minor ways, but "it would have never taken off." No really fundamental improvements are possible without direction, what Teilhard calls "groping." His definition of groping is typical of the confused parts of his thinking. "This groping strangely combines the blind fantasy of large numbers with the precise orientation of a specific target. It would be a mistake to see it as pure chance. Groping is directed chance. It means pervading everything so as to try everything, and trying everything so as to find everything."<sup>6</sup> But this does not make sense. In what way can a process which pervades everything so as to try everything be called directed? Except for the mention of orientation to a specific

target, this passage could be an exposition of random mutation and natural selection. Nonetheless, Teilhard does think that mutation in biological organisms is at least in part directed; "natural" processes are not enough. "The impetus of the world, glimpsed in the great drive of consciousness, can only have its ultimate source in some *inner* principle, which alone could explain its irreversible advance towards higher psychisms."<sup>7</sup> The ultimate source of this inner principle turns out to be the Omega, which is eventually identified with God. No scientist, as a scientist, could accept this invocation of supernatural causes.

I might note here in passing that many French biologists share, at least in part, Teilhard's doubts about the adequacy of the neo-Darwinian theory. The main question at issue is whether the process of mutation is to some significant extent directed or whether it is completely random, as the neo-Darwinians claim. Tending to follow their countryman, Lamarck, these French biologists feel that the present species could not have been produced by a random process and therefore require some sort of directed mutation. The main problem with this view is that they focus almost exclusively on mutation and fail to realize the supreme importance of selection, which determines both the direction and speed of evolution.<sup>8</sup>

3. The concepts of the Within and the Without are central to the thought of Teilhard de Chardin. The Without essentially consists of those aspects of things which are in the normal purview of science. Teilhard introduces us to the Within of things by first making the point that every quality which exists in one thing must also exist in every other thing, although perhaps in only a small or imperceptible degree. "Properly observed, even if only in one aspect, a phenomenon necessarily has an omnipresent value and roots by reason of the fundamental unity of the world." He then applies this principle to human consciousness. "It is impossible to deny that, deep within ourselves, an 'interior' appears at the heart of beings, as it were seen through a rent. This is enough to insure that, in one degree or another, this 'interior' should obtrude itself as existing everywhere in nature from all time. Since the stuff of the universe has an inner aspect at one point of itself, there is necessarily *a double aspect to its structure*, that is to say in every region of space and time—in the same way, for instance, as it is granular: *coextensive with their Without, there is a Within to things.*"<sup>9</sup> Teilhard is here proposing a realm which is outside the range of science, and therefore of course it cannot be criticized by science. But by the

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same token, Teilhard is no longer writing the purely scientific treatise that he advertised at the beginning.

4. The concepts of the Within and the Without are closely related to those of radial and tangential energy. Tangential energy is similar to energy as used by physicists and acts in the Without of things. Radial energy is spiritual energy and its primary realm is the Within of things, although it seems that the effects of radial energy may be observed in the physical world.

I should perhaps preface this discussion by some remarks on Teilhard's general view of energy and thermodynamics. Teilhard is very disheartened by his reading of thermodynamics. The first law of thermodynamics states that the energy of a closed system is constant. According to Teilhard, "Every synthesis costs something," and if energy is conserved the universe cannot progress indefinitely, but is "a closed quantum, within which nothing progresses except by exchange of that which was given in the beginning." The second law states that the entropy or disorder of a closed system constantly increases. This is even worse news, for "something is finally burned in the course of every synthesis in order to pay for that synthesis." Unlimited progress is not possible; the universe must eventually die, and life is merely "an eddy rising on the bosom of a descending current." Teilhard concludes, "So says science: and I believe science: but up to now has science ever troubled to look at the world other than from *without?*"<sup>10</sup>

Obviously not, but Pierre Teilhard de Chardin has, and he finds the Within perfused with radial energy. Radial energy draws things together, toward the center, and toward increasing levels of complexity-consciousness. Unlike the energy of the physicists, the total radial energy in the universe is not a constant; as things are drawn closer together, the total radial energy increases, thus exerting an even greater central force, which draws things even closer together and further increases the radial energy, etc. Radial energy is the crucial element in evolution; it is the force behind orthogenesis. In fact, since in Teilhard's view the increase of entropy is opposed to life, radial energy is a necessary condition for life itself. "Thus something in the cosmos escapes from entropy, and does so more and more."<sup>11</sup> Teilhard equates radial energy with spiritual energy and psychic energy, and eventually identifies it as love.

There is no direct conversion between radial energy and tangential energy, although they are interrelated. While in some places Teilhard equates tangential energy with the normal energy of physical science,

he actually postulates two sorts of tangential energy, "one of *radiation* (at its maximum with the lowest radial values, as in the atom), the other of *arrangement* (only appreciable with the highest radial values, as in living creatures, man in particular)."<sup>12</sup> This latter form of tangential energy is also constantly increasing, and its differentiation from radial energy is not clear to me. In any event the tangential energy of arrangement would be measurable by science, but Teilhard explains that, since it is not very significant below the level of man, scientists still consider the first law of thermodynamics to be valid.

What can a scientist reply to all this? First of all, there is not too much that can be said about concepts such as radial energy which are defined to be outside scientific experience, except to note that such concepts should not appear in a book which is labeled a scientific treatise. I think that Teilhard's view of the first and second laws of thermodynamics is a bit glum. All syntheses do not cost something. In fact, many important biological syntheses give off energy rather than require it. Also, the fact that the entropy of a closed system is constantly increasing does not work against all synthesis. For example, the chemical compounds on the primitive earth are thought to have consisted almost exclusively of small molecules such as carbon dioxide, methane, ammonia, and water. Now, a system containing only small molecules is not as disordered as one containing a mixture of small molecules along with larger molecules of various sizes. And so the tendency of the disorder of the universe to increase almost surely was an important force leading to the formation of the larger organic compounds, such as amino acids and proteins, from which life developed on the primitive earth. So we see that the first and second laws of thermodynamics are not always opposed to life, as Teilhard seems to feel. Nonetheless, he is essentially right when he says that the first law puts a limit on the total amount of energy in the universe and the second law describes a universe which is irreversibly going downhill toward what is sometimes called "heat death."

Now, before postulating a new force in the universe, one should show that the present forces are inadequate to account for our observations. Probably Teilhard's main reason for postulating new forces is that the first and second laws do not allow his eschatology. But a scientist cannot deduce principles from his metaphysical conclusions. Teilhard also feels that the energy described by the first and second laws is not sufficient to explain the present nature of life and its evolution from the primordial atoms. Now this may be proper scientific reasoning; but, in my opinion, the facts do not support his conclusion.



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It appears that life processes do in some way involve a decrease in entropy, but these processes require large inputs of energy (in the form of food or sunlight), and it seems likely that the entropy of the surroundings is increased by a greater amount, thus giving a net increase in entropy for the total system. There has certainly been no demonstration that living systems can in any way violate the second law. In particular, any system which violates the second law should be able to extract energy from the heat in its surroundings. It is well known that no animal or plant can for long survive in a warm room without food or light.

### CONCLUSIONS

I am afraid that this has been rather harsh on Teilhard. Actually, I find his vision exciting and persuasive. In many ways he has pointed the way to a whole view of science and history. Although Teilhard finds the current scientific viewpoint completely inadequate to understand the most important processes in the universe, he always insists on the fundamental unity of all things. Life is viewed as continuous with non-life: "The phenomena of life and consciousness . . . might well be nothing more than the properties peculiar to matter when carried to a very high degree of arrangement and centration."<sup>13</sup> Many great scientists have shared this feeling of the essential unity of all experience, and it is in communicating this view that Teilhard touches a responsive chord with so many people. *The Phenomenon of Man* is the work of a poet and visionary of the first rank, but it is not a scientific treatise.

At the end of the book, Teilhard sums up his ideas: "To make room for thought in the world, I have needed to 'interiorise' matter: to imagine an energetics of the mind; to conceive a noogenesis rising upstream against the flow of entropy; to provide evolution with a direction, a line of advance and critical points, and finally to make all things double back on *someone*."<sup>14</sup> The scientist must ask if it was really necessary to introduce all these new concepts. In the past, science has made great progress by trying to explain new phenomena in terms of the already existing concepts and introducing new principles only when the old ones were clearly shown to be inadequate. The fantastic progress of molecular biology in the past few years (the role of DNA has been understood for only fifteen years) suggests that few, if any, new basic principles will be needed to understand life and thought.

Teilhard eventually judges his own case when he writes near the close of his book: "Man will only continue to work and to research

so long as he is prompted by a passionate interest. Now this interest is entirely dependent on the conviction, strictly undemonstrable to science, that the universe has a direction and that it *could*—indeed if we are faithful, it *should*—result in some sort of irreversible perfection. Hence comes belief in progress.”<sup>15</sup> George Gaylord Simpson, commenting on this passage, writes; “But the direction of evolution toward an irreversible perfection is the whole theme, and not merely a philosophical appendage, of the book. Hence we have a book submitted purely as a scientific treatise and yet devoted to a thesis admittedly undemonstrable scientifically.”<sup>16</sup> This is the crux of the problem: Teilhard’s “scientific” ideas are not derived from science.

Many thoughtful people feel that religion is currently in serious difficulties, although the need for it is as great as ever. It may well be that the application of the methods or doctrines of a dynamic science can transfuse new vitality into religion. Unfortunately, this will almost surely be a slow and difficult job. I do not think that Pierre Teilhard de Chardin has successfully started the journey, but his vision will almost surely stimulate others to seek the path.

#### NOTES

1. Pierre Teilhard de Chardin, *The Phenomenon of Man* (New York: Harper & Brothers, 1964), p. 29.
2. Joseph Needham, “Cosmologist of the Future,” *New Statesman*, LVIII (1959), 632.
3. P. B. Medawar, “Critical Notice, ‘The Phenomenon of Man,’” *Mind*, LXX (1961), 99.
4. George Gaylord Simpson, *This View of Life* (New York: Harcourt, Brace & World, 1964), p. 225.
5. Theodosius Dobzhansky, *The Biology of Ultimate Concern* (New York: New American Library, 1967), p. 115.
6. Teilhard, *op. cit.*, p. 110.
7. *Ibid.*, p. 149.
8. For an exposition of the “French” view, see Michel Delsol, “The Mechanisms of Evolution,” in *Encyclopedia of the Life Sciences*, Vol. II: *The Animal World* (Garden City, N.Y.: Doubleday & Co., 1965), p. 31. A good discussion of the two viewpoints is given in reference 4 therein.
9. Teilhard, *op. cit.*, p. 56.
10. *Ibid.*, p. 52.
11. *Ibid.*, p. 271.
12. *Ibid.*, p. 65.
13. Pierre Teilhard de Chardin, *The Appearance of Man* (New York: Harper & Row, 1965), p. 214.
14. Teilhard, *The Phenomenon of Man*, p. 289.
15. *Ibid.*, p. 283.
16. Simpson, *op. cit.*, p. 227.