Commentary

ORDER AND DISORDER: THERMODYNAMICS, CREATION, AND VALUES

by Afif I. Tannous

The December 1984 issue of *Zygon* is outstanding, for it covers a crucial subject and provides significant contributions by six highly qualified thinkers in science, theology, and philosophy toward bridging the gap between science and religion. Each covers the subject of thermodynamics, especially its entropy aspect, from a different perspective, and the resulting whole is striking with its insights, conclusions, and general coherence. Thanks to this outstanding intellectual endeavor, our understanding of thermodynamics, a main pillar of scientific knowledge, has been substantially enhanced in relation to basic human concerns such as order/disorder, evil/good, evolution, and creativity and values. In response to some of the authors' challenging thoughts, I wish to make a few comments which may shed additional light on the subject.

In "Thermodynamics and Life" Arthur Peacocke writes that "The *state* of a system (macroscopic state) is determined by its *properties* just insofar as these properties can be investigated directly or indirectly by experiment" (p. 397). This is true as far as it goes, but what about those properties of a system that do not submit to experimental verification and which underly the tangible properties? For example, the existence of a web of nonlocal connectedness among the components of a system and among systems is now being considered as a possibility. Also, from the general systems theory and from actual experience we must conclude that the reality of a system (especially a live system, culminating in the human brain/mind, par excellence) cannot be explained by the realities of its parts. What is, therefore, that intangible source of such a superseding reality that arises at every ascending step of the organizational ladder? What is it that makes the mind something more than the 100 billion cells of the nervous system, with its seemingly infinite web of connections?

"Are living organisms actually, in some way, breaking the second law of thermodynamics . . . ? The brief answer to this question is 'No,' . . ." (p. 402). Then Peacocke goes on to explain the paradox of the organizing capacity of life versus the disorganizing flow of entropy in terms of a balance being maintained between ". . . a *decrease* in entropy" withing the organism and ". . . an *increase* in

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the entropy" of its environment; also, he points to randomness and nonequilibrium, especially in reference to the earth as an open system, as additional responsible factors or conditions (pp. 402-5). Still the probing mind is not satisfied, and the nagging questions persist. What is the force responsible for the creation of nonequilibrium from randomness? What is the ultimate outcome of it all, except heat-death, as the second law is carried to its logical conclusion beyond the open biosphere system, the open earth system, and the open universe system? Equally questionable is the assertion that there is a ". . . drive towards an increase in complexity at the molecular level . . ." (p. 412) and that ". . . the laws of thermodynamics provide the basis . . ." for such an increase. That is fine as far as it goes, but we are concerned with the ultimate flow of increased entropy beyond the molecular level toward the realm of maximum disorder, chaos.

I support strongly Peacocke's concluding statement (p. 430) of faith in the continuing course of evolution, the continuing ascent of life on the organizational ladder, human consciousness, self-awareness and creativity; but I cannot see how all of this building-up creative process can be contained within and in the *long run* supported by the laws of thermodynamics. The metaphor provided by the author (of an entropic stream moving as a whole in the direction of increasing disorder, which ". . . *itself* inevitably generates . . . very large eddies *within* itself . . ." that move in the opposite direction, toward order and organization) is neat, but illusive. The eddies of a river are always minor occurrences relative to its mighty flow, and they are absolutely restricted, space-time events, never building up into a mighty stream of their own flowing in the opposite direction. That is exactly what the creative process of the universe has done, culminating in the mighty stream of life, *seemingly* in defiance of the laws of thermodynamics. How can that be?

In "The Rediscovery of Time" Ilya Prigogine comes a long way toward answering the basic question raised above and resolving the dilemma. First, he declares that ". . . the second law of thermodynamics is not universal" (p. 437). Thus, he puts entropy in its proper domain, and he is most qualified to do so. Then he brings to bear upon the whole process of irreversibility via entropy a potent internal factor—*time in its new dynamical meaning*. He explains convincingly how "Internal time is quite different from the usual parameter time," how it operates as an integral component of unstable systems and therefore of irreversibility, and how its arrow from within points the direction of evolution. He further introduces another basic feature of the process—nonlocality. "Once we use internal time and partitions, we have lost the local point of view of classical mechanics. Instability leads to *nonlocality*" (pp. 438-41). We have here a significant breakthrough, which amounts to a declaration of the existence of a different kind of internal force that seems to keep entropy and organizational development in balance and to maintain the evolutionary ascent of life.

Yet, Prigogine refrains from going further along his breakthrough line to include the role played by the most significant reality that has emerged from the evolutionary process—the reality of the human mind with its attributes of consciousness and self-awareness. He talks appropriately about human embeddedness in the universe, but quotes G. Steiner to the effect that "the human person and self-consciousness are not the center, the assessors of existence. Man is only a privileged listener and respondent to existence" (p. 446). As I see it, the reality of the human being is much more than that of a "listener and respondent to existence." It is even more than that of an observer and prober; it is the reality of an active participant in the creative process of the universe. This

is so by virtue of the solid human heritage of a continuing evolutionary ascent, reaching back to the beginning of life and beyond, culminating in the great leap of the human brain/mind, the most complex system of the universe. This is also so by virtue of the general systems theory principle that a complex and open system manifests qualities or properties that cannot be explained by those of its components. In this case we are talking about the qualities of consciousness, self-awareness, and related higher mental capacities, which, like the arrow of internal time, constitute a propellent force in the creative evolutionary process.

In response to Prigogine's enlightening explanation of the deeper meaning of time as a basic feature of the organizational growth of a system, I wish to add a supporting view from a different perspective. At the human level, this is manifested in the conscious perception of reality. I perceive (I experience) a phenomenon, which means I participate in the creation of an event (according to quantum theory); this means I am no longer the same, nor is the universe by virtue of that encounter. This is the continuing creative process—from being into becoming. Here is the root meaning of time—"being" (which culminates in self-awareness at the human level) experiencing new events in the light of, or on the basis of previously experienced events. From this subjective/objective base arises our sense of external time as measured by particle and astronomical motions. In the latter sense, it is a convenient conceptual tool in our encounters with events; but we are in trouble when we make of the tool an independent physical reality. Put in different words, time is the creative transformation of a system; and, at the human level, it is self-awareness across self-transformation through experience of events.

Like time, the dynamic meaning of space arises from another essential feature of a system, its form, which identifies a system in terms of its spacial relationships, within and without. Without form both system and space lose their meaningful identities. Thus the two basic phenomena of time and space are integral components of the total reality of a system, from which they derive their existential meaning. The dynamic relationship involved can be stated as follows: *Time* is the successive manifestations of the identity of a system in different *forms* along the infinite evolutionary course.

In "Entropy and Evil" Robert John Russell succeeds in providing us with additional insight into the phenomenon of entropy by exploring its possible relation to the most poignant and universal human concern with the phenomenon of evil. He wisely explores such a relationship in terms of a metaphor rather than in terms of a causal identity. In doing so he brings forth the destructive aspects of entropy, as emphasized by classical science, and its constructive features, as emphasized by the new science. Parallel with these he delineates the negative and the positive features of evil in the universe as portrayed by Christian theology. Then, in his concluding section he says, "In sum, entropy seems a surprisingly pliable concept. It is related to processes of despair, decay, degeneration, and to the perfecting of creation as the signature of God's continuing creative participation in the evolving universe" (p. 466). This is a reasonable conclusion that should be acceptable both to liberal theology and to the emergent holistic paradigm of science.

My argument with Russell (or rather with the general trend of Christian thought) relates to the nature and meaning of evil. I begin with the basic assertion that any scientific or humanistic concept is the creation of the human mind—a potent tool, or frame of reference, for the ordering of human perceptions (experiences) of outer natural phenomena and of inner psychological/spiritual phenomena. It follows, therefore, that concepts must be open for

modification or repudiation according to the growth of human knowledge through the infinite reach of the mind. Otherwise, outmoded concepts with their accretions of rationalization tend to become tyrannical entities that frustrate the flow of creative growth. The concept of evil is a model example of this tendency, which has bedeviled theological and philosophical thought since the early beginning of human culture.

In the light of these psychological and historical realtities, I shall now summarize my appraisal and understanding of this dominant concept. I see no evil in physical nature—droughts, floods, earthquakes, volcanoes, and entropy notwithstanding—even though I can fully understand why early humans feared them and attributed them to an evil spirit or to gods inflicting punishments on evil humans. Likewise, I see no evil in seemingly destructive biological phenomena. I see in all a continuing challenge to humans (endowed with the freedom to choose and the capacity to create and evolve) to adjust to and harmonize with the ways of nature and thus enhance the total creative, evolutionary process.

The source of evil, therefore, is not out there in a devil lurking in the underworld, or a god angry at humans, or a mischievous and merciless nature; it is only in the mind, heart, and actions of Homo sapiens. By virtue of our great intellectual and spiritual (divine, if you wish) endowments, we create evil, we are responsible for its destructive effects, and we are capable of redeeming ourselves. No longer can we seek illusive rescue and safety in mythological fantasies. We have done so for ages, and look where we are now—at the precipice of nuclear self-destruction. What is the essence of this human source of evil? It is, as Paul Tillich affirms (p. 455), in the abuse of human freedom—so simple, yet so meaningful; and truth is always simple. Stated in more tangible terms, evil is any act or lack of action by an individual or group, by a religious or secular doctrine, or by a political or social-economic ideology that abuses the cosmic (divine, if you wish) spark of creative freedom in the human being and in nature.

Very appropriately, Philip Hefner in "God and Chaos" discusses the basic issue of the personal meaning that the individual must derive from the entropic process. Am I running down irretrievably into the abyss and ending there, or do I contribute to "the insurgence of creative chaos that augments my possibilities. . . ." "Is there a degree of unclarity in the concepts of thermodynamics?" (p. 474). In response, I may state my answer as follows: There is much more to me than the purely physical matter of my body particles ultimately "going beyond the Milky Way to fertilize the far reaches of the universe." There is my consciousness, my self-awareness, which according to the general systems theory must interface with a superseding system of cosmic consciousness, intelligence, or Creative Spirit, where the laws of thermodynamics, as currently formulated, cease to operate. Here is a different order of reality that goes beyond and is basic to the realm of quantum theory, which in turn is qualitatively different from our ordinary world. Thus through my mysterious mind phenomenon I participate in and contribute everlastingly to the Cosmic Creative Process. This is the essential meaning of the winding-up irreversibility of my system, which is also manifested collectively by Life as it continues to evolve toward higher mental/conscious forms.

Finally, it is indeed fitting that Jeffrey S. Wicken's "The Cosmic Breath" should be the last article in the series, for it constitutes the capstone for the edifice of thoughtful discussion provided by the other authors from various perspectives. Wicken brings the discussion of the subject to the level of an

integrated whole by highlighting the roles played by certain key factors or realities. He talks of "unity in polarity" (the principle of complementarity of quantum theory) as exemplified by "change and teleology," the dissipative and creative properties of entropy, and "God as the ultimate polarity of immanence and transcendence" (p. 503). He talks of the crucial role played by "the human agent" as "the missing dimension of our experience of time as a vehicle for self-determined change—our power of choice to make a real difference in the course of things" (pp. 498-99). Also, he tells daringly and explains convincingly why ". . . philosophy and science can never be . . . fully rational exterprises" (p. 488); why it is hopeless to look for ". . . the concept of entropy to supply a value-free model to illuminate the moral domain . . ." (p. 491); why "Evolution requires above all that life, including its sentient dimension, should fit with the rest of nature," and how evolutionary theory has failed to meet that requirement (p. 497); why "Chance may be blind, but it is never free; it is always conditioned by the higher-order framework of the thermodynamic law" (pp. 497-98); that "There is a deep sense in which we, in our self-determining humanity, are participants in the cosmic breath . . ." (p. 499); and how all of this translates into ". . . a sense of God's immanence in a process of creation that is ongoing rather than completed at a stroke" (p. 503).

This philosophical-theological-scientific stance (which I generally support, and which I tried to indicate in my comments on the preceding four articles) is especially meaningful, as it is declared by a scientist in the basic discipline of biochemistry. It is another promising manifestation of the emergent paradigm of holistic human knowledge in which the sciences and the humanities are integral components of an indivisible whole. In the brighter light and broader perspective of this holistic paradigm or world view, we shall eventually gain a liberating breakthrough into a much deeper understanding of natural phenomena and the meaning of human existence in the universe. We shall continue to use the analytical, reductionist method of science, but we shall redeem its blinding dogmatic claim that it is the only source of authentic knowledge by subjecting it to the holistic approach of synthesis and to the liberating insights provided by the humanities. We shall not neglect the role of sensory perception in our encounters with and understanding of natural and societal phenomena, but we shall complement and enlighten it with the images, insights, and visions from the realm of inner perception. We shall bridge the illusive gap between subject and object, and see objectivity in its true light as the consensus of qualified subjectivities. We shall continue our search for component particles and mechanisms and use them appropriately to our benefit, but we shall be freed from the chronic, blinding illusion thay they can explain higher order systems and provide the key to unlock the physical door to the mysteries and meaning of the universe and our destiny in it. Above all, we shall securely grasp the legitimate centrality of life, culminating in its human manifestation, within the universe. We shall declare life as a purposeful participant in the creative evolutionary process, with the human mind as partaker of the creative Cosmic Mind.

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