

Editorial

Although people of ancient societies often developed acute powers of observation and introspection, modern science has opened up new ranges of experience that must be taken into account if thinking about life's purpose and meaning is to be credible in a scientific age.

When one studies the beliefs and practices of traditional societies, one is struck by the acute powers of observation developed by ancient peoples. Not only did tribal peoples develop refined observational knowledge of the natural world, but some ancients also developed keen powers of introspective analysis, enhanced by elaborately evolved practices that gave rise to altered states of consciousness. The aphorisms of the yoga master Patanjali exemplify the sophisticated analysis of human experience achieved by some of the old masters. Such analysis of ordinary and extraordinary human experience still rivals some of the modern developments in the psychological sciences. The reason for this is not surprising: although modern analysts of human experience have the advantage of centuries of thought, in terms of the experience itself nothing much has changed. Ancient traditions continue to present, in Donald T. Campbell's words, "well-winnowed" insights regarding human nature (*Zygon* 11 [September 1976]: 167-208).

Today the modern sciences are opening up whole new areas of experience that at times challenge, at times complement and extend, older views of the world. One new area of experience is being opened up by astronomers and astrophysicists. With the computer processing of signals garnered by radio and X-ray telescopes we are beginning to "see" what no human has ever seen before. It should not be surprising that this new type of experience might challenge some religious views of the universe. For no religious tradition has been privy to this information regarding the nature and evolution of the universe. Hence, traditional religious cosmologies, cosmogonies, and doctrines of creation, which are developed without benefit of this new information about the universe, may be found to be out of touch with our expanding experience. It is not just that we have new ways of thinking about things; we have new experience that must be taken into account by anyone who wishes to relate his or her understanding of human life to the origins and ongoing workings of the universe.

Another new realm of experience is being opened up by brain research, in which the analysis of neuronal electrical and chemical activity is being correlated with human behavior and with subjectively felt experience. While the new experience of the astronomers opens entire new vistas on what has been created and on the processes of creation, which may lead to significant reformulations of traditional world views, the findings of brain research may have the possibility of being more compatible with ancient thinking, because it is possible that neurobiology is simply giving the externally perceived, physical counterpart to what has been internally sensed and felt for millennia. *Zygon* has already published some articles in this area, and it will continue to do so as scientists and scholars find fruitful correlations between contemporary neurophysiological research and moral and religious activity.

This issue of *Zygon* explores still a third area in which new experience, combined with scientific analysis and theorizing, can be fruitfully interrelated with some of the experience upon which traditional religion is based. Throughout history many human beings have had the general experience of the generation of ordered states of affairs and the corruption of order into disorders of various kinds. In fact, this two-fold experience has been so prevalent that Anthony F. C. Wallace suggests it is the central theme of religion:

The central theme of the religious event is the dialectic of disorganization and organization. . . . On the one hand, men universally observed the increase of entropy (disorganization) in familiar systems: metals rust and corrode, woods and fabrics rot, people sicken and die, personalities disintegrate, social groups splinter and disband. On the other hand, men universally experience the contrary process of organization: much energy is spent preventing rust, corrosion, rot, decay, sickness, death, and disillusion, and, indeed, at least locally, there may be an absolute gain of organization, a real growth or revitalization. This dialectic, the "struggle" (to use an easy metaphor) between entropy and organization, is what religion is all about. The most diverse creeds unite in the attempt to solve the Sphinx-riddle of the relationship between life and death, between organization and disorganization; the ideas of soul, of gods, of world cycles, of Nirvana, of spiritual salvation and rebirth, of progress—all are formal solutions to this problem, which indeed is felt intimately by all men (Anthony F. C. Wallace, *Religion: An Anthropological View* [New York: Random House, 1966], p. 38).

Because the experience described by Wallace is so prevalent, it is not unreasonable to say that not only does religion have as a central theme the relation between organization and disorganization but also that this is a central theme in science. For occidental science and religion both have as their basis the notion that the cosmos in which we find ourselves is essentially an ordered reality. It is fundamentally rational and hence capable of being intellectually grasped. Although science and theology both recognize that human experience often results from randomly occurring events, they nevertheless do not see such events as being without cause but rather press forward to see how all that happens to us is part of a cosmic order that is potentially knowable and intelligible. One purpose of the various disciplines that make up the sciences is to seek out the invariant patterns or laws that govern what human beings experience and thereby to explain the wide variety of the phenomena of existence. Theology also seeks to discern some underlying order to things in such a way as to generate reliable guidelines for interaction between human beings and the rest of the cosmos.

However, in spite of the underlying assumption that there is order to the cosmos, even if it is hidden order, both science and religion recognize the fact that there are disordering forces in the natural world and in human society. One of the ways in which science recognizes disorder is exemplified by the second law of thermodynamics, which involves the concept of entropy, a concept which is the focus of the various essays in this issue of *Zygon*. In religion the experience of disordering processes has often been expressed through symbols and myths of evil. The inadequacies in various theological treatments of the problem of evil, which leave evil still an enigma to rational thought, may be analogous to some of the difficulties in scientific comprehension of order and disorder, for example, the debates over the significance of chance.

In light of what has been said thus far, one might conclude that the scientific concept of entropy and the religious concept of evil are associated primarily with disordering processes. However, new experience and thought from the contemporary sciences suggest that this would be a gross oversimplification, if

not a major mistake. In general, the new scientific information suggests that disorganization is not simply, as Wallace implies, something to be overcome, to be evaluated as intrinsically evil. Neither is the scientific concept of entropy to be interpreted strictly in terms of disorganization. Rather the new experience and thought suggest that disorganization and entropy may be aspects of the process of creation itself. If order is conceived not simply as something that is static but as something that is continually coming into being, then disorder may be a necessary part of the processes that lead to the emergence of new order. Each essay in this *Zygon* issue is an attempt to overcome the oversimplification of referring the general human experience of disorder and the scientific concept of entropy to something that is evil, to something that has to be overcome in order to have meaningful human life. Based primarily on recent work in nonequilibrium thermodynamics, exemplified by such scientists as Ilya Prigogine and Manfred Eigen, these essays explore both the positive and negative implications of the interrelationships between disorder and order.

In a carefully thought out and provocative opening essay, Arthur Peacocke outlines the historical development of classical thermodynamics as the "science of the possible," emphasizing the role of the concept of entropy as a measure of irreversibility in natural processes and its relation to order, precisely defined according to the classical mechanical model. He then delves into the problem of relating entropy to the concepts of complexity, order, organization, and information arising out of the study of complex natural systems in irreversible thermodynamics and of thermodynamic interpretations of evolution. What becomes apparent is a distinction between two kinds of order: one characterized by simple repetition of pattern (perfect crystals) and one characterized by complex organization (biological organisms). From Peacocke's analysis it becomes obvious that the experience of disorder is open to more than one interpretation. From the perspective of classical thermodynamics, disorder is the inevitable corruption of perfect forms; however, from the standpoint of contemporary irreversible thermodynamics of living systems, disorder is to be viewed as the source of order as it provides the fluctuating ambience necessary for the evolution of life.

One of the issues that has separated much of scientific conceptualization from more general human experience in recent history is that the sciences have operated with a mechanistic, deterministic world view. On this view natural processes are modeled on the basis of idealized reversible mechanisms and in terms of state functions which do not reflect the course of development of observed states of a system. As R. G. Collingwood says, it is as though "the movements which [the world] exhibits, and which the physicist investigates, are imposed upon it from without, and their regularity is due to 'laws of nature' likewise imposed from without" (*The Idea of Nature* [Oxford: Oxford University Press, 1960], p. 5). This scientific approach flies in the face of the more general human experience of historical time, namely, that time is intrinsic to the development of things which have a self-generating capacity operating within the constraints of their larger environment. Nobel laureate Ilya Prigogine shows how recent research in fields such as nonequilibrium thermodynamics and statistical mechanics reveals that irreversibility (broken time-symmetry) is an essential element in our understanding of nature. This newly developing perspective allows for an integration of the physical time of classical mechanics—time as external to physical objects—and the historical time of human experience—time as intrinsic to things, having such characteristics as irreversibility, evolution, and creativity. Entities now are considered to have an

orientation in time: recapitulating the past and anticipating the future they participate in the construction of the present.

Robert John Russell next brings Christian theological traditions into the discussion as he explores both the positive and negative implications of disorder by analyzing the possible relationship between entropy and evil in terms of metaphor. Using John Hick's identification of two traditional Christian interpretations of evil—the Augustinian and the Irenaean—Russell probes the similarities and differences between them as well as the meanings of entropy in classical thermodynamics and statistical mechanics. The Augustinian interpretation of evil bears more of a similarity to the negative sense of entropy as a measure of increasing disorder, while the Irenaean interpretation is closer to the dynamic sense of entropy as the condition for the creation of order out of chaos. Building on the work of Prigogine, he argues that it is necessary to assume that time has a direction if one is to use concepts such as evil and entropy in a meaningful way.

Philip Hefner carries the discussion forward by showing how the second law of thermodynamics and the concept of entropy have been related at one time or another to five types of general human experience: running down, degeneracy, mixed-upness, irreversibility of time, and the emergence of new possibilities. The dominant philosophical-theological tradition in the West evaluates these experiences negatively, thus making entropy anti-God. A minority tradition, exemplified by Nicholas Berdyaev, has underscored the fact that we live in the context of a basic polarity—being and nonbeing, chaos and order, good and evil—and hence evaluates these experiences positively, placing entropy within God. Hefner proposes that the quest for the meaning of existence will bear most fruitful results if we follow the minority tradition, for it appears that the researches of scientists in relation to the second law provide physical and biological testimony to the polarity at the foundation of reality.

Finally, Jeffrey S. Wicken argues that the distinctions between creation and degeneration or good and evil should not be regarded in terms of the dominant Western tradition as dual, antagonistic principles but that they should be seen as representing a unity in polarity. He considers the thermodynamics of evolution in terms of processes of creation driven by entropy dissipation. Then he explores the analogies this conception bears to the Hindu image of nature as the changing mist of a universal breath which, in mythical treatments, flows rhythmically through two aspects of the Godhead, Brahma the creator and Shiva the destroyer. Using this image, he shows how the second law of thermodynamics implies that chance and law cooperate hierarchically in the unfolding of a world which is teleological without being the product of express design, for it is open in its development to conscious ethical decisions.

This issue of *Zygon* has its origins in the deep concerns of Sanborn C. Brown for "the development of religion toward an understanding of the operation of society based on knowledge of the world about us" (*Zygon* 6 [December 1971]: 269). Brown was cochair of the Joint Publication Board of *Zygon* and one of its chief scientific advisors since the founding of the journal in 1966. He was constantly open to how the insights and methods from the sciences might be used in the development of a contemporary theological expression that would overcome the alienation of humanity from nature endemic to humanism and traditional theologies. Brown believed that "mankind is searching for ways to cooperate perfectly with the laws of the cosmos" and that "it is our responsibility to discover nature's requirements and adapt to them" (*Zygon* 14 [March

1979]: 49-50). "Religion is the place where policy for society is formed" (*Zygon* 6 [December 1971]: 268). We ought, therefore, to turn again to develop "a theology—a theory of God—which is rational, fits with modern science, and leads to persuasive religious and moral guidance" a theology which uses "the greatly advanced scientific information about human nature and the nature of the world that created and supports us" (*Zygon* 14 [March 1952]: 52). Brown was persuaded that this theology based on science, which equates God with the forces of Nature, leads inescapably to the human, religious concepts of good and evil (*Zygon* 14 [March 1979]: 48). He firmly believed that scientific information about the laws of nature must be used as essential building material for a religious system of values that would avoid a narrow anthropocentric obsession with the survival of the human species. William Allis summed up Brown's concerns: "As Brown progressively relinquished research, education, and Count Rumford, he concentrated more on the need for a theology compatible with our vastly increased knowledge of the laws of nature and their universality, and of a religion to consider our frightening power to destroy life by nuclear explosions or to render it valueless by over population" (*Physics Today* 35 [May 1982]: 98-99).

In 1980 Brown suggested to the Institute on Religion in an Age of Science, one of the copublishers of *Zygon*, that the 1982 Star Island Conference be a careful examination of the interrelationship between order and disorder. His research in cryptography, microwave discharge phenomena, plasma physics, and the life and work of Count Rumford had led him to see the relevance of thermodynamics for understanding values in the broader cosmic context. He proposed that the most recent scientific thinking about the concepts of entropy and the best theological reflection on religious symbols of evil be explored for possible new insights arising from an enhanced understanding of the dynamic interplay between ordering and disordering processes.

Sanborn C. Brown died in November 1981, but his cochair, David Breed, and the other members of the conference committee continued to attempt to bring his concerns to fruition. The result is the collection of papers in this issue of *Zygon* and some others to be published in upcoming issues. They are offered as a memorial tribute to honor a leading scientist who was deeply concerned with integrating the findings of science with the understandings of the meaning and purpose of human life expressed through religion.

We appreciate the various kinds of support offered by family and friends of Sandy Brown, which have made this memorial issue of *Zygon* possible.

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