THE HUMAN PROSPECT AND THE "LORD OF HISTORY"

by Ralph Wendell Burhoe

In his *Inquiry into the Human Prospect* Robert L. Heilbroner, as some of our discussants at the symposium suggested, sounds like a good Old Testament prophet calling upon his people to see the error of their ways and warning them of a dreadful future if they do not repent them of their folly in seeking to do what is forbidden by the supreme reality that rules history.[1] And in spite of his avowed distaste for religion,[2] in his last chapter, "Final Reflections on the Human Prospect," he comes to the question, Is there hope for man? Under the inexorable rule of the reality system against which we have sinned and under our own incapacity to do otherwise, he concludes, "No, there is no such hope," at least "without the payment of a fearful price."[3]

If this kind of statement were the complaint of a single pessimist with a "morning-after" bellyache, we would discount it. But when it confirms similar reports by a large group of our best informed minds who have been scouting what lies ahead in the direction in which man is moving, grounded in the best information they can gather from all sources, then we do find that many of the people of the world share his dread of a fearful price.

Heilbroner recognizes that the absence of hope in his portrayal of the future might tend to stymie any positive human response and thus make matters worse. "Let me, therefore," he writes, "put these last words in a somewhat more 'positive' frame, offsetting to some degree that bleakness of our prospect, without violating the facts or spirit of our inquiry. . . . The human prospect is not . . . an inevitable doomsday toward which we are headed, although the risk of enormous catastrophes exists. The prospect is better viewed as a formidable

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array of challenges that must be overcome before human survival is assured, before we can move *beyond doomsday*." Then Heilbroner seems to change from the sternness often associated with a prophet to a harbinger of a more hopeful gospel: "These challenges can be overcome—by the saving intervention of nature if not by the wisdom and foresight of man."[4]

It is this almost good news of a gracious intervention that I wish to explore in this paper. This symposium on Heilbroner's challenge to religion and science was gathered for this purpose. My interpretation of the challenge may be summarized as follows.

The challenge to science is tied to freedom. Heilbroner sees man as essentially incapable of surviving very long if he possesses the expanded powers provided by scientific knowledge and at the same time the freedom to do what he likes. Man's likes and desires are basically short-term self-interest, whose free exercise, especially with the fantastic new technological powers provided by science, will bring him to disaster. Since man will not do it voluntarily, there must be coercive, authoritarian forces to bring him to terms with the requirements for the survival of society. Hence, in the first place, the challenge is to human freedom. But freedom is necessary for scientific inquiry as it is for technological adventure and economic expansion. But, says Heilbroner, "the search for scientific knowledge, the delight in intellectual heresy, the freedom to order one's life as one pleases, are not likely to be easily contained within the tradition-oriented, static society I have depicted" as the probable state to which post-industrial society will regress.[5] Thus he fears that freedom and science will be lost because men are not constituted to be sufficiently far-sighted and moral to choose voluntarily what is necessary for long-run viability. Freedom and scientific inquiry will have to be replaced by an authoritarianism that is to him "deeply repugnant . . . as well as incompatible with my most treasured privileges."[6] His challenge to science is basically his challenge to freedom.

Heilbroner's challenge to religion is that it is hardly significant enough to be mentioned in the book, and the book's indirect and unadmiring reference to "tradition," "ritual," and "authoritarianism" are as close as he brought himself to the mention of "religion." In a later interview he said he was "against religion," and he clearly implied religion is antagonistic to or incompatible with science.[7]

In the book he has already replaced religion with politics. He accounts for the restraint and control of selfish, not-too-social man by "the political dimension of human nature" which is possible because he finds that in human nature there is a " 'hunger' for political au-

thority and . . . 'fantasy' of political identification" which can motivate devoted service to a society.[8] The focus on politics instead of religion has been the attitude of intellectuals and liberals increasingly since the seventeenth and eighteenth centuries when traditional religion lost its battle with the modern sciences for a place in the "enlightened" mind. But, after saying there has been in the past some real power of states to provide some control of human behavior for the good of society, he concludes that "the ability of nation-states or socio-economic orders to take now the measures needed to mitigate the problems of the future" is doubtful because of their incapacity to provide a bond of concern that will motivate altruistic behavior for future generations of men.[9] In more recent papers he has increasingly turned toward a consideration of religion as perhaps necessary just because it seems to have had such a capacity.[10] Hence his real challenge to religion may be said to be not that religion is not necessary or good but that, since religion in his view tends to be incompatible with freedom, science, and rational understanding, to that extent a society cannot have both religion and freedom, science, and rational understanding.

The view that religion may be more necessary for human survival than is science and hence that authoritarian religion will wax while the incompatible scientific culture will wane or be forced out is suggested in his statement that the "free inquiry on which science is based would have a hard time . . . with the tradition and ritual that will come to pass."[11]

This symposium was designed to respond to these challenges to both religion and science. It is my task in this concluding paper of the symposium to show from a wider perspective of the scientific study of religion and a study of the religious implications of science that there is no need to fear that religion is necessarily incompatible with either the basic freedom or the basic rationality or truth of science. On the contrary, I shall provide evidence that religion has been what has made human freedom and the rise of science possible and at the same time does indeed have the necessary powers which Heilbroner concedes to it—the capacity to generate in men a readiness or motivation to the kind of social altruism and concern for the long-range future that is not possessed by governments.

According to Nicholas Wade's interview with Heilbroner: "What lies beyond the dark ages is as impossible for us to divine as it would have been for a citizen of the fourth-century Roman empire to foresee what lay beyond the dark ages that loomed over his civilization. What could such a man do? Heilbroner asks. 'Nothing but to go

on being a good citizen of Rome and enjoy it while it lasted.' "[12] I think our more scientific analysis of religion and its role in human history will allow us to divine the future more adequately.

But I do not intend to assert this alternative to a new dark ages (and man's reponsibility and capacity to do something about it) on the *non*scientific, "subjective promptings" which Heilbroner confesses were the only basis from which he could begin to speak about any consolation in the seemingly hopeless situation.[13]

My aim, rather, is to show that, even more convincingly than earlier theological traditions, the sciences depict a more-than-human reality that determines human destiny in very much the same manner as a traditional deity of religion. Heilbroner leaves a door open for such a perspective. He confesses that he has viewed "man as a creature of his socio-economic arrangements and his political bonds." It is this which led to his gloomy outlook. However, he also admits that perhaps "*from some other perspective* the prospect for collective human adaptation would seem brighter."[14] I believe a new synthesis of the scientific and theological pictures will provide this hope.

But before sketching this synthesis, first I shall look briefly at what other contributors to this symposium have already provided and what is left for me to do.

Langdon Gilkey throughout his paper rejoices over the implications of Wade's interview with Heilbroner that religion is not really "an ineffective and dispensable holdover from irrational times—as it was for the Enlightenment and for most of learned modernity, and as it remains for Heilbroner the man," but "in the future society that Heilbroner pictures, religion is an important, valued basis for the order and meaning of . . . culture's life. . . . religion is the 'substance' of culture."[15] I would rejoice with him in such findings. But Gilkey clearly finds science to be as incompatible with religion as does Heilbroner. It is my intent to show that the "Lord of History," which is one of Gilkey's favorite phrases for denoting the reality that determines human destiny, is nowhere shown to be more "meaningful and true" than by some of the recent revelations of the sciences.

Others besides Gilkey in this issue of *Zygon* have also pointed to the *necessity* of religion, if not to the *credibility* of the gods and the promises or programs for human salvation that religions make.

Donald T. Campbell, along with Gilkey, not only makes it very clear that individual man is in perpetual trouble because he is an innate sinner, selfish, and shortsighted, but also adduces evidence from genetics that Gilkey and Heilbroner are correct in despairing of man's capacity to redeem himself. Not only is it impossible for natural selec-

tion to make man socially altruistic and make him consciously concerned about long-term values, says the psychologist Campbell, but a counterhedonic force is essential if man is to be civilized. Whence cometh any realistic counterhedonic force to redeem human civilization? Elsewhere Campbell has suggested, in part, how religion has been able to do this.[16] Heilbroner in his more recent "What Has Posterity Ever Done for Me?" has heightened this seeming impossibility of man being moved to do anything constructive for the long-range future beyond his great grandchildren.[17] While in this later paper Heilbroner seems more aware of the power of religion to do the job of making man more altruistic, he seems convinced that "we know very little about how to convince men by recourse to reason and nothing about how to convert them to religion" and confesses in the end that the problem is so baffling and so impossible of solution that "I must rest my ultimate faith on the discovery by these future generations . . . of the transcendent importance of posterity for them."[18] Since I think we have some information from both genetic and cultural evolution on the role and capacity of reason to convince and convert, and since we have an obligation to our posterity now, I shall seek to set forth in this paper some scientific grounds for religious hope.

Victor Ferkiss has presented what seems like a more hopeful picture. He suggests that Christianity "still has considerable influence over millions of people"; and, "in cooperation with Providence, . . . we can . . . create a decent and livable future society."[19] But he does not explain why such a beneficent religion and Providence have allowed us to get into our present dire predicament, nor has he provided grounds to the unbeliever for believing Providence even exists, to say nothing of its being ready to help us. Moreover, his final position seems to be one that is not very consoling, after all, for he says that "what distinguishes the Christian from the non-Christian may be a willingness to accept even Heilbroner's most gloomy view of the future as something which may be God's *will* and therefore something which we *will* also."[20] I could agree that he may be right, but I should want to know what is likely to make the world population become so godly or Christian and ready to accept such a gloomy future. I shall seek to show new scientific grounds for understanding how the "Lord of History" produces saints and suffering servants.

Joseph Caggiano suggests in his paper that religion and science ought to get together, but he seems to raise more historical and logical reasons why they have not. I shall seek to adduce more evidence on how they can.

Edgar S. Dunn's paper proposes that "general government" (which

specifically includes religion as Heilbroner's "politics" does not) is the source of the values that can save men from the evils of the "bads" and the sins of man's "beggar thy neighbor" tendencies.[21] But we shall need, I think, to make clearer how his *processes* of the "evolutionary adaptive generalizations" may be said to be related to the gods of religion, on the one hand, and how, on the other hand, societal selection can run counter to the genetic selection that Campbell and geneticists have shown cannot produce altruistic creatures in a genetically diverse population. I think Dunn's newer perspective on the evolution of living systems is a prime source for our better understanding why simple, linear projections of disastrous futures for living systems are often invalidated because the "projections" of such disastrous futures often may be a part of the very negative-feedback mechanisms that prevent the disasters; but I shall try to indicate more fully how religions operate in such a context.

In this response to Heilbroner's challenge, I shall also draw on some of the papers and discussions of our symposium which could not be published in this issue of *Zygon* for various reasons.

In general, I shall seek to address myself to the elaboration of a scientific picture of religion that will be convincing to the scientific and skeptical minds who have not yet been provided with much scientific evidence for its virtues and potential. I shall build on the very significant elements of the situation presented by the other contributors to this issue and seek to provide additional information to show how religion (and the sovereign and often obscure system of transcendent realities to which religion has for thousands of years sought to relate us) may be reformulated and revalidated in the light of the sciences as salvatory for the present human predicament.

I should begin by summarizing some recent scientific studies that reveal religion to be one of the fundamental and perennial necessities for human life. This larger scientific perspective on religion will allow our vision to be lifted out of the parochial prejudices that tend to limit the vision of those immersed in some particular segment of a living culture, a limit which has necessarily been man's lot on the whole. A scientific perspective today provides a new peak of information from which we may gain a perspective upon a broad space and long time span of what religion is and does. This perspective should permit us, then, more effectively and properly to envision the human prospect.

Ancient Biological Roots of Religion

Religion has biological roots in ancient, genotypically programmed patterns of the central nervous system, traceable back more than a

hundred million years. Hudson Hoagland, founder of the Worcester Foundation for Experimental Biology, suggests religion

> is an inevitable result of the way the brain has evolved for integrative function. The brain is an organ of survival established by biological evolution. . . . Its main function has been to enable the organism to integrate sensory information into configurations that will enable the organism to adapt to its environment. . . . [The brain produces the] behavior we call curiosity . . . [which recently in man] has been systematized in various forms of complex activity, of which science, theology, and philosophy are obvious examples. Science, religion, and philosophy have been concerned with making sense of the universe so that we can respond in appropriate ways.[22]

Several have suggested that the gods are projections or symbols naturally produced by the human brain to fill the gaps in our understanding of cause-and-effect in vital areas of our experience.[23] These symbols, elaborated and selected as lasting social memories in cultural evolution, represent the "vital but not obvious aspects of the superpowers of nature" (a useful interpretation of the "supernatural")[24] that determine human destiny. In origin and in their explanatory function the stories or myths of the gods are essentially primitive scientific hypotheses, imaginative projections of the brain to provide suitable "initial causal termini" that enable logical or cause-and-effect statements. In the sciences such hypotheses may become so well confirmed, like "atoms," that they become "facts" from which science then moves up the ladder to new levels of its conceptual system.[25]

But in addition to the cognitive functions of scientific hypotheses, religions have sought to provide for man the *necessary symbolic and cognitive extensions, elaborations, and modifications* (mediated by the brain's neocortex) *of the feelings:* emotions, fears, desires, and hopes (largely generated in and mediated by lower and more ancient brain functions of the limbic system). These vital lower-brain functions are to orient and motivate animals (including *Homo*) adaptively, giving them proper fears and proper courage, providing direction and hope concerning the most sacred ultimacies for their lives so that their behavior will be directed to these even in the midst of seemingly overwhelming threats to life.

The description of religion in terms of biological theory might earlier have seemed rather indirect, unconvincing, alien, or irrelevant, particularly to those who associate religion with personal experiences of deep feeling often *not* expressible in rational language at all. However, recent scientific revelations have begun to provide more rational explanations of the dynamics of the brain, its evolution, and its role in producing human conscious awareness including perceptions, feel-

ings, and rational and "irrational" decisions. Recent findings, such as those of Paul D. MacLean, have clarified the roles for human nature and for religion of three phylogenetic levels of our brains: (1) the very old reptilian level which generates our *instincts* including those involved in religion, (2) the limbic system of our old mammalian brain which is involved in generating deeply religious feelings and emotions, and (3) the human neocortex, which can associate diverse elements from several sensory modalities into *symbols,* and then associate symbols and establish symbols of symbols of symbols in systematic hierarchies. The neocortex makes possible symbolic abstractions, including language and linguistic logic, and their projection in dynamic models of self and its world in dreams and linguistic symbols, motivated and fed by input from the "instincts" and "feelings" of the lower two brain levels as well as by input from the sensory modalities commonly "cross-referenced" and integrated to produce our conscious awareness of "things" and of our feeling-tones (hopes and fears) about them. These dynamic models of world and self in the brain are the stuff out of which are formed not only common sense but also such things as religious myth, philosophy, theology, and science. Such operations tend to integrate necessary elements from all three levels of the brain for complex understandings, decisions, and motivations that adapt our behavior adequately to the ultimate reality system around us.[26]

These functions of the brain provide new grounds for understanding the reality of religion, the usefulness and validity of deep religious feelings and emotions. They give a tangible basis for the power of religion to motivate morals as well as provide hope and courage. They give a clue on how the brain may mediate to us the rare spiritual mixtures of the combined products of all three of these genetically given levels of our brain, programmed from the outside by combinations of high cultural, genetic, and environmental information, to produce in conscious self-awareness the idealistic rapture and vision of deeper reality in the mystical experience of the love of God and beatific vision. That is, they allow us to account for religious experience. It also becomes clear how such projections may reflect validly not only man's needs but also a picture of the objective reality that is sacred for him and to which he must adapt.

Students of the brain have indicated how the "subjectivity" of religious experience and the internalization of human values are essential for ultimate moral or social as well as personal values. R. W. Sperry notes that "doctrine regarding ultimate values is closely tied to beliefs about the properties of the human psyche or conscious mind and its relation to physical reality."[27] He points out that the "ac-

cumulating evidence in neuroscience builds up overwhelmingly today to the conviction that conscious mental awareness is a property of, and inseparably tied to, the living brain."[28] As a result, he notes,

> the human brain is today the dominant control force on our planet; what moves and directs the brain of man will, in turn, largely determine the future from here on. Among that vast complex of forces that influence and control the brain and behavior of man, the factor of human values stands out as a universal determinant of all human decisions and actions. Every voluntary act and/or decision by an individual or a group inevitably is governed, overtly or implicitly, by value priorities. In essence, what a person or a society values determines what it does. The human-value factor, defined in this way and viewed objectively in terms of brain states that govern acts, thoughts, and decisions, may be seen to occupy a central position of strategic regulative influence in the total biospheric scheme of command.[29]

In his paper Sperry makes it clear that human values, even when socially communicated and when experienced at the highest level of conscious cognition, are inseparable from brain processes. But, before dealing with sociocultural and rational developments of human values mediated by the top level of the brain, we need to go back down the evolutionary stairs to look again at the lower levels of the brain and the genetic structures apart from which logically and socially necessary values fail to motivate corresponding behavior.

Since religions function to relate man properly to his fellow creatures as well as to the ultimate superpowers of nature which are responsible for the creation of the world and life and for determining human destiny, it is natural that for this relation to fellow man we find a special, ancient biological root. MacLean has found evidence that the very ancient, reptilian level of our brains is involved in "such genetically constituted behavior as selecting homesite, establishing and defending territory, hunting, homing, mating, forming social hierarchies, . . . [as well as] ritualistic . . . and imitative forms of behavior."[30] As we shall see later, ritual and imitation become central for communication and making man a voluntary social animal.

But these genetically programmed patterns of brain behavior cannot produce human social behavior or human society much beyond the nuclear family. As Campbell has noted in his paper, the geneticist George C. Williams has summarized strong evidence that natural selection can never produce individuals willing to sacrifice themselves for other than closely related individuals.[31] It might appear that natural, voluntary human societies were biologically impossible beyond the size of the extended-family societies common among other animals, primates, and primitive human tribes. This seems to be so fully in accord with the contemporary theory and evidence for

evolution of life that I feel bound to accept it. Moreover, I share Campbell's feeling, which he communicated to me when he first introduced me to Williams's book some six years ago, that it also accords with our religious and psychological knowledge of the frequent conflict of man's genetic instincts and his social duties. I think we are forced, therefore, to explain the social motivation and altruism necessary to structure and maintain human societies (at least those societies that extend beyond the range of close relatives) on grounds that transcend the information inherited from our gene pool.

Williams himself recognizes the need to explain the fact that man is a social animal. But in honesty to hard evidence he rejects the only way for natural selection to produce this: the biased survival or selection of groups.[32] He devotes about half his book to showing why "between-group selection" and "group-related adaptations do not, in fact, exist."[33] His own explanation of man as a social animal is that of

> an apparent exception to the rule that the natural selection of individuals cannot produce group-related adaptations. This exception may be found in animals that live in stable social groups and have the intelligence and other mental qualities necessary to form a system of personal friendships and animosities that transcend the limits of family relationship. Human society would be impossible without the ability of each of us to know, individually, a variety of neighbors. . . . Primitive man lived in a world in which stable interactions of personalities were very much a part of his ecological environment. He had to adjust to this set of ecological factors as well as to any other. . . . Simply stated, an individual who maximizes his friendships and minimizes his antagonisms will have an evolutionary advantage, and selection should favor those characters that promote the optimization of personal relationships. . . . Ultimately, however, this would not be an adaptation for group benefit. It would be developed by the differential survival of individuals and would be designed for the perpetuation of the genes of the individual providing the benefit to another. It would involve only such immediate self-sacrifice for which the probability of later repayment would be sufficient justification. The natural selection of alternative alleles can foster the production of individuals willing to sacrifice their lives for their offspring, but never for mere friends.[34]

Speaking of the hominid group, he suggests:

> This one ape, which must have had . . . a tendency towards predatory pack behavior, was transferred by evolution from an ordinary animal, with an ordinary existence, to a cultural chain reaction. The production and maintenance of such tributary adaptations as an enlarged brain, manual dexterity, the arched foot, etc. was brought about by the gradual shifting of gene frequencies at each genetic locus in response to change in the genetic, somatic, and ecological environments. It was this process that fashioned a man from a beast. The fashioning was *not* accomplished by the survival of one animal type and the extinction of others.[35]

Williams's "cultural chain reaction" is not further elaborated by his book, and the "natural selection" and "adaptation" of present neo-Darwinian theory with which his book is dealing has not involved itself in cultural evolution.[36] But a number of persons in biology, psychology, and anthropology during the past two decades have begun to produce a literature on cultural evolution and its analogies with biological evolution and the role of a selective process which is equally "natural." A pioneering paper was that of Alfred E. Emerson in 1954 entitled "Dynamic Homeostasis: A Unifying Principle in Organic, Social, and Ethical Evolution."[37] I shall now consider some of the significant elements of the conjoined genetic and cultural evolutions involved in human nature, together with the "secondary" biological adaptations and the emergence of religion thereby produced.

The ethologist Konrad Lorenz has provided an account of the phylogenetic evolution of ritual. Under processes of variation and selection, certain animal behaviors gradually became less useful as immediate responses of the individual organism to an environmental situation and more functional as symbols for communicating certain messages to other animals so as to produce suitable responses by them. Both the senders and the receivers of these messages have been attuned by natural selection in their central nervous systems to respond in ways that mutually enhance probabilities of life for the genetic line of each individual. The social life of higher animals and humans is shaped by such ritual behavior.[38]

An important and recently developed view of the operations of ritual to socialize or civilize a hitherto naked ape was presented in "The Biopsychological Determinants of Religious Ritual Behavior" by Eugene G. d'Aquili and Charles Laughlin, Jr.[39] My views in this paper largely correspond, and I commend that paper for many details which I shall not repeat. But it is necessary for me here to deal with a critical problem with which their paper did not seek to deal.

This is the fact that in man we find the emergence of something radically new in the evolution of living systems on earth. This is a new type of heredity mechanism, a new system of retention or memory and of faithful replication of specific patterns of new "beings" (phenotypes or living systems) on which nature operates to select the more viable and weed out the nonviable. It is this which we must understand in order to know how it is that man is the first and only animal species capable of being organized into societies of genetically diverse individuals within the species, possessed of specialized cooperative roles operating for the good of the society as well as of the individual. Because of the impossibility on genetic grounds of this being an "adaptation for group benefit," for society's or other

people's welfare, which we have just reviewed, the scientist (both social and biological, and even the theologian who is forced to complain that he often does that which he would not and fails to do what he would) will want some theory to explain this novel feature of man; and I shall give some attention to such an explanation that I have been developing in conjunction with others of how nature does select human societies, although not directly and specifically through the gene pool.

Briefly, the new system of memory is the information enculturated in a population of human brains, which I have called the "culturetype" in analogy with the biological "genotype." The new being or phenotype whose viability is selected is a sociocultural system in which the various individuals play their proper roles. I shall provide some further details here since an understanding is necessary for a scientifically informed response to Heilbroner's view that man does not have the capacity for social altruism for a long-range future and hence cannot have much freedom or science.

We must note that I have said that cooperative human societies are composed of *genetically diverse members of the same species,* not all essentially carbon copies of one another. They are individuals who are genetically much more diverse than cousins, but nevertheless are programmed or *motivated to "altruistic" behavior* (as technically defined by Campbell and others) by certain necessary additional *cultural* "information" (in the technical sense, as in the "information" in a genotype or computer).

By contrast, the unflinching "altruistic" social cooperation found in advanced cellular societies (organisms) and insect societies is programmed directly by genetic information. This is possible with them because in their case Williams's point that genetic competition limits the breeding of altruism beyond close relatives does not apply. Members of these societies have been removed from genetic competition either by their becoming genetically sterile or by their being genetically very close, or both.

The cooperative and self-sacrificial characters of the billions of cells which constitute a complex organism derives from the fact that most of these are somatic cells that are sterile and hence out of the phylogenetic competition, while the relatively small number of the organism's genetically varied and phylogenetically competing gametes or germ cells are kept segregated for their special function. The *varied* character and organized function of these cells, so as to constitute an organism with legs, muscles, glands, eyes, and brains, have to be produced in *epi*-genesis. In addition to the genetic sterility

of the somatic cells, the fact that they all possess identical genotypes that provide a common overall program essential for organic unity is a matter which will be important for us to consider in connection with understanding cooperation and unity in human societies.[40]

Insect societies are a similar discovery of evolutionary trial and error which enables social organization in the evolutionary process. Most of the individuals in the population of an insect society also are sterile and hence cannot compete in phylogeny. They are sterile *organisms* rather than sterile *cells,* and thus an insect society can be considered a "superorganism" made up of "cells" that are already organisms. The individual insects of a society are very closely related genetically, often as siblings and in the Hymenoptera closer than siblings because the males are haploid. Hence insect societies have been shown to come within the range where, in theory, population genetics can produce altruistic behavior. Again, in insects as in organisms, the sexually reproductive agents generally are not a part of the special categories of social operations (the "workers," "soldiers," etc.) but are segregated to perform merely their genetic reproductive functions.[41]

There are other not-fully or not-directly species-specific storehouses of information that provide for the memory banks of selected differentiation of patterns of structure and behavior of living systems, such as environmental boundary conditions, including the boundaries with other species with which a certain species may become symbiotically adapted, such as termites to their flagellates or men to wheat, corn, cows, and pigs. While the information that structures such systems may often be mutually beneficial to all the involved species and produce a stable (viable) ecosystem and hence may be said to be selected as one type of ecosystem in contrast to another, we need carefully to distinguish the mechanisms of this "biotic" evolution from that of organic evolution under the "memory" or "selective-retention" mechanisms of competing DNA genotypes in a gene pool.[42]

We return to the problem of how in human societies there emerged a significantly new mechanism, which operates at a level that transcends those of both the highly organized societies of cells and insects. In human sociocultural systems we have an organized and cooperating group of conspecifics that are *not* genetically closely related (but actually a wide sample of genotypes representing much of the total variability of the gene pool of *Homo sapiens*)—a group of genetically diverse, truly unique individuals, yet individuals whose cooperative capacities often reach the point of voluntarily risking their lives for their genetic competitors.

As Lorenz points out, "the properties of any human group which make it coherent . . . are *norms of behavior ritualized in cultural development.* . . . Without traditional rites and customs representing a common property valued and defended by all members of the group, human beings would be quite unable to form social units exceeding in size that of the primal family group."[43]

Lorenz points out something further which is of importance to our understanding how "wisdom" is accumulated in cultural evolution of religions without any such wisdom necessarily being in the thoughts or conscious awareness of the participants: "It is quite certain that it hardly ever was insight into a valuable function that gave rise to traditional norms and rites, but the age-old process of natural selection. Historians will have to face the fact that natural selection determined the evolution of cultures in the same manner as it did that of species."[44] I presume that Lorenz's use of "natural selection" here does not (indeed, cannot) refer to the "genic selection" that heretofore has been the prime concern of genetics but to the cultural analogue of genetic selection, of which I shall say more later. But because religion is the prime transmitter of values in cultural evolution, first we need to understand more about religion's role in cultural evolution, in a manner so that it makes sense in contemplating man from a scientific perspective.

Religion's Role in Cultural Evolution

What Is Religion? The anthropologist A. F. C. Wallace pointed out in his classic *Religion: An Anthropological View* that "the primary phenomenon of religion is ritual. Ritual is religion in action. . . . It is ritual which accomplishes what religion sets out to do."[45] Wallace and also others have pointed out that, in human life, ritual necessarily becomes intertwined with systems of belief, ranging from primitive myths to advanced theologies and sciences. "Belief, codified in linguistic structures, rationalizes ritual and renders it more effective than it would be by itself. . . . A myth [which is a part of a belief system] can be defined as a transformation of ritual."[46] The function of ritual is to relieve anxiety or generate order in a disorderly system. "An organism overwhelmed by information overload is incapable of discriminating response; . . . the goal of science and the goal of ritual and myth are the same: to create the image of a simple and orderly world."[47] Religious rituals and beliefs, then, are outgrowths of very ancient roots of genetically programmed modes for ritual communications directly tied to the genetically programmed mechanisms that mediate suitable feelings and responses to provide adaptive or viable behavior relative to fellow creatures and the larger environment.

Wallace points out that "religious propositions are the product of human cerebration . . . and invariably appeal to experience for validation."[48] Moreover, as Hoagland pointed out, the brain is genetically programmed to make sense and hence we can theoretically expect what Wallace concludes from extensive empirical experience:

> Religion can be seen as a general rationalizer for all those inescapable contradictions of expectation and experience with which even the best of all possible worlds must confront its most trusting traveler. . . . Religious belief and practice always originate in situations of social and cultural stress and are, in fact, an effort on the part of the stress-laden to construct systems of dogma, myth, and ritual which are internally coherent as well as true descriptions of a world system and which thus will serve as guides to efficient action. . . . But religion does not offer just any solution: characteristically, it offers a solution that assures the believer that life and organization will win, that death and disorganization will lose, in their struggle to become the characteristic condition of self and cosmos. Religion further attempts to elucidate and describe the organization of self and cosmos. Religion, then, may be said to be a process of maximizing the quantity of organization in the matrix of perceived human experience. . . . We must . . . postulate an organization "instinct"—an "instinct" to increase the organization of cognition and perception. Religion and science, from this point of view, would seem to be direct expressions of this organizational "instinct."[49]

Religion as Cultural Evolution's Agent for Transforming Apes into Men. Several of the group of scholars working on sociocultural evolution have begun to show important evidence for the hypothesis that there is a *selective process* operating in the evolution of human sociocultural patterns, even in individual psychological development, analogous to the well-known mechanisms of biogenetic selection.[50] This selection of human-culture patterns operates under nature's requirements for stability or viability of the system, regardless of what human conscious choices may be. For certain very long-range and complex problems, human choices may be considered for all practical purposes to be random mutations. *In cultural evolution, the unit of selection no longer is an individual body; but the unit is a sociocultural system.* In sociocultural selection the heritable information is stored not as a genotype in the DNA gene pool but as a "culturetype" in a "culture pool," in such coded memory patterns as rituals and languages inscribed in the neurological patterns of brains. The feedback insemination of this information—from the successful behavioral responses it produces—to shape the next generation of new "culturetypes" (the analogues of genotypes) does not require a biological generation but may even be immediate in a verbal response. Also, because culturetypes may be stored in "artifacts," the "sexual recombination" potential may sleep for fifty biological generations and come to life in

contemporary culture, as in the discovery of a nonliving artifact or book of a previous culture. For the past five thousand years or more, written languages have been increasingly important among such nonliving artifacts and have initiated significant new stages of cultural evolution, as in the Renaissance, for instance, by having retained the memory of an earlier and higher culture.

It must never be forgotten, however, that cultural evolution is *only a superficial modification* of biogenetically transmitted information. As G. G. Simpson has pointed out, culture in the end is a biological property—a property of living people.[51] If a culture's evolved system of information patterns does not produce viable organisms or phenotypes, then, as a "higher court of judgment," nature (the total reality involved in the system) obliterates those phenotypes and hence that culturetype, just as she obliterates inadequate DNA information in biological evolution.[52]

This weeding out of less valid information by the death of organisms has been the *only* possibility in the evolution, improvement, or wider adaptation of genetic information thus far. But, for the evolution of culturetypes, because the information is stored in a population of brains where each brain is genetically endowed with capacities to learn (recalibrate its values instantaneously on the basis of new information input), there have emerged several other ways to correct errors. This enables cultural evolution to move at a much more rapid rate than biological evolution where the critical information for programming living behavior is stored in the gene pool and unalterable for a generation. As a result, a number of biologists have joined Julian Huxley's position that for all practical purposes the evolution of cultures has now in *Homo sapiens* become much more significant for our future than further genetic evolution.[53]

Central to understanding the difference between men and other animals is to understand this emergence of cultural codification and transmission of information that shapes man's central nervous system and behavior. The impact of cultural information in the brain, essential for making us human, is an overlay and transformation of the structures and behaviors programmed by our "instincts" and other genetic heritage. The emergence of variant, more or less stable, and reproducible cultural patterns in variant integrated units (sociocultural "ecosystems") of the human population is what enabled the selection of ever more viable or adapted patterns to create a social animal out of a mammalian population, thus overcoming the in-species barrier to genetic selection of altruistic behavior pointed out by Williams.

This overlay of cultural information in symbiosis with genetic in-

formation of the hominids in the past million years was an emergent achievement in living systems that can be ranked in evolutionary history as comparable with the emergence, some billion years ago, of the "symbiosis" that is the basis for life as we know it. This was the union of the information in ribonucleic acids (genetic DNA) with the information in the then existing "phenotypes" shaped by amino acids in the context of the boundary conditions of the natural, dynamic chemical patterns that had been provided by a very narrow and specialized habitat in the earth's water pools.[54] According to Gösta Ehrensvärd and others, this symbiosis structured the heretofore relatively amorphous and undifferentiated life processes into distinctively unique and separate individuals. The distinct individuals provide the concrete alternatives from which nature could select because of the specificity and stability or homeostasis which the DNA supplies.

Henceforth the rapidity and effectiveness of life's evolution were raised to a new level thousands of times faster. The sociocultural units, bonded by the common concerns established in a population of brains, provided complex new hierarchies of societal cybernetic norms and machinery which constitute the sociocultural superorganismic ecosystem in which individual persons play their proper roles voluntarily because they find membership in the system on the whole advantageous to both their phenotypes and their genotypes. On this basis the better adapted societies persist and others fade, giving rise to sociocultural evolution.[55] The socially transmitted information in these systems I have called the culturetype.

In the case of culturetypes that could bind a population of persons with diverse genotypes into unique, individual, homeostatic sociocultural systems, again we find the emergence of a radically new level of power for rapid evolution. Within the past one hundred thousand years, cultural evolution has adapted *Homo* to new levels of complexity and range of ecological niches at a rate at least a thousand times as fast as that of prior genetic evolution, I would estimate. By the "symbiosis" of cultural and genetic information patterns in a "pool" of brains and their joint selection as sociocultural units, man has been transformed into a social animal—even more, into a self-conscious animal, and conscious of his own true being as more than his soma or bodily mechanism. It is significant to note that the culturetypic information in this population of brains is essentially common to each brain, even though the genotypic information in a large society is essentially as varied as in the species.

To understand this miracle of a culturally generated and naturally selected social and spiritual animal, of which *Homo sapiens* seems to be the only existing species on earth, we need to reflect again on the role

of information, transmitted in ritual and belief, in shaping man's adaptations to his environment and his fellowmen. This function of ritual and belief is essential in any sociocultural system, I suggest, because it provides the bonds that tie the motivations of separate and otherwise competing animals to a common sociocultural system. The system then becomes a higher-level unit of evolution, which in one sense is akin to the constellation of species to constitute an ecosystem.

The bond is *the information.* In sociocultural evolution this information is at first communicated unconsciously by "conditioned" behavioral responses to the behavior of others in the group (involving ritual and "imprinting"-type experiences) but later becoming conscious perceptions through communication by myth, theology, and science. The content of the information is that the personal welfare and viability of a human being are enhanced by his voluntary association in and service to an ecosystem larger than his body. This larger system—which always has been essential to the reality of his being —has now in fact become a conscious element of his personal nature, especially through the information encoded in his brain by the sociocultural system. For the individual, as a properly cooperating member of this system, the probability of his genes being replicated in the future is much greater even if—often exactly because—he participates in the sociocultural aspect of such a larger ecosystem to the point of sometimes risking his own life for the welfare of this larger, more than genetically structured, element of the self.

Dunn's paper in this issue presumes that something operates to do this; Campbell's shows that it cannot be done by natural selection of genotype. I have just provided here a bare outline of the transformation of the units of selection (phenotypes) in sociocultural evolution from competing somata to competing sociocultural units whose "specific" informing patterns are replicated in a population of brains instead of in a population of DNA molecules in a population of cells.

The emergence of the conscious feelings of self as more than the body, as a larger being with sociocultural loyalties and cosmic connections, has been provided by the evolving systems of socially transmitted rituals and beliefs, usually called religions. Their dependence upon and difference from their genetically programmed somatic substrates is beginning to be revealed by several disciplines of the sciences, and readers of *Zygon* can find throughout its volumes dozens of key papers by top investigators that open doors to new vistas in these matters. But, as a succinct and independent presentation of very much the same story of the emergence of biocultural man that I am seeking to present in this section, I would commend a review of

"Evolutionary Perspectives on Purpose and Man" by Solomon H. Katz.[56]

I suspect that new research on these problems in the next few decades will greatly advance the field of cultural evolution over its present diffuse network of concepts which are not yet so tightly connected and validated as is the case for many elements of genetic evolution. The conceptual system or model of cultural evolution that has been developing in me during the past forty years has gone further even than the positions presented by the above-mentioned associates to cause me to conclude that the present crisis in human cultural evolution will require and will produce the emergence of a reformation of traditional religions that will unite traditional, deeply felt, emotive, pietistic, religious feelings with fully scientific "myths" or beliefs.[57]

Here I am speaking of the role of beliefs as a necessary intermediate stage in the generation of attitudes and motivations. I do not overlook the necessity, on the one hand, of the underlying stages of genetics and rituals, or, on the other hand, of the overlying stages of the moral, societal, and ecological values which are aims or goals that are motivated. Speaking, then, of beliefs as a necessary intermediate stage in man whenever he has reached the level where beliefs influence his behavior, I would say that, for those exposed to scientific beliefs, the scientific extension of previous myths and theologies would be as essential to aesthetic and motivational religion of the twenty-first century as were the informational patterns of the DNA necessary for the evolution of cells and organisms. It also seems to me that such an interpretation of religion in terms of modern natural philosophy or science is as necessary and as big a step in the advancement of religion as was the synthesis of Platonic and Aristotelian philosophy with religion in the preparation for Western civilization as successor to the classic Mediterranean civilization.

I shall present some brief account of why I think this, but first I would summarize the present section of the paper as suggesting that evidence is becoming overwhelming that religion is a part of man's basic and perennial nature and is simultaneously biological and cultural. The perennial necessity for *Homo* to produce adaptive behavior to meet the requirements of a sociocultural life in the real world and the impossibility of this being done genetically assure us that religious rituals and beliefs (or their equivalents) will continue to flourish and evolve with man as long as he survives as a sociocultural animal. From this history of the total ecosystem controlling human destiny in the long and short ranges of its biological and cultural evolution, one

could properly conclude that the system has ordained the evolving religious systems and their rituals, myths, and theologies to enculturate our deepest reverence for this total system, which contains our ultimate resources and specifies what is required that we may have life. It is this system which thus far has produced such an awe-inspiring transformation of the dust of the earth into living forms so fascinating to us as ours. But let us proceed with caution.

Even if scientific evidence became overwhelming for the view just presented, that religion is the agent in cultural evolution that has transformed the basic perspectives and motivations of a genus of apes into social and spiritual humans, we are still faced with several distressing and difficult questions presented by Heilbroner and perhaps by most thoughtful people:

1. How can religious beliefs be effective in a population enlightened by scientific understanding of reality, an understanding which is required if we are to enjoy the fruits of its technology?
2. Even if we grant that religious information or control may be necessary, how can religion ever be other than authoritarian and repressive, requiring us to give up our cherished freedoms attained in recent Western civilization?
3. Even if we "regressed" to a firm religious faith, is there any evidence that it could motivate a sufficient devotion to consequences in a distant future so that men would voluntarily deny the satisfactions of their present desires if those should conflict with the requirements for life in that future?
4. Even if we found a religious faith that could survive in the light of modern science, that would provide as much freedom as we want, and that could motivate devotion to the long-range future, would not such findings exemplify more the characteristics of human engineering for this-worldly human benefits than the operations of some "ultimate reality" or "Lord of History" implied by traditional religions?

The next four sections of this paper will respond to these questions.

The Evolution of Scientific Theology

The Emergence of Religious Beliefs. In the long period of its evolution, religion has gone through several stages, each more advanced than the previous but also completely dependent upon the previous stage. This is the character of evolution in general. It also is a common character of living systems that, in some rough way, "ontogeny recapitulates phylogeny." That is, in the development of each new or-

ganism from zygote or seed through embryo to mature organism, there tend to be a series of stages that in some ways resemble the stages of the long-term evolution of the species. In the development of a human, the zygotic first stage is always a single cell, like a protozoon; then he becomes a primitive multicellular colony and passes through two- and three-layered stages, a fishlike stage, and continues to develop complexities in the same general order of stages as that of the evolution of life from lower to higher orders. A similar parallelism of stages has been observed between the development of religious experience from babyhood to adult and the stages of the long-term evolution or history of religion.[58] I will mention for our purposes here only four gross stages of religious evolution or "phylogeny" involving four stages in the evolution of communication: (1) *primitive ritual,* (2) *primitive beliefs or myths,* (3) *theology,* and (4) *scientific theology,* a stage upon which I believe we now are entering. We can estimate these as roughly equal steps in the evolutionary process whose beginnings (as is often the case in evolutionary developments) are found at points spaced at an exponentially decreasing series of numbers of years ago. In this series the beginnings were, respectively, some few times 10^7, 10^5, 10^3, and 10^1 years ago. The emergings of these levels of religion are tied to certain stages of the evolution of brains and cultures. In the next section I want to discuss the *third* major step, theology, which took place between one and three thousand years ago. In the section after that I shall discuss the *fourth* and latest step in the evolution of religion, scientific theology, which started in recent decades and which is central for our consideration.

The Emergence of Theology from Myth. Wallace and others have estimated that recent cultural "genera" of religion appeared at least one hundred thousand years ago and that there have been more than one hundred thousand species of them, from which present religions have been selected because of their capacity to provide the specific sociocultural wisdom needed to shape human brains for the viable patterns of social life.[59]

Without going into details on the evolution of the religious cores of human cultures, one can say that, as the development of the human brain and its cultural-information content expands and enables man to perceive ever wider horizons of potential futures, man passes through several stages of religious development. The emergence of new stages in evolutionary history of both genotypes and culturetypes is usually the product of a relatively radical stress on the living system produced by a relatively radical new circumstance in the environment.[60] In fact, it is widely known that the brain is so devised

that it will automatically switch to wilder and wilder or less well-established or less habitual operations as new circumstances cause the habitual responses to produce increasing failures and frustrations. There is also evidence that, in the prior genetic phylogenies, radical changes in circumstances may even select genetic programming for greater genetic variability, which increases the proportion of novel trials and likewise, of course, of failures.[61] Both our cultural and genetic phylogeny have prepared us with ways for more rapid and radical adaptations when crises force us to acquire them.

Karl Jaspers has suggested that some twenty-five hundred years ago there was, in several major cultures of the world, a radical change which produced what he has called an axial age or period, a time of turning when there emerged such new cultural phenomena as Confucianism, Buddhism, Zoroastrianism, the Judaic Prophets, and the Greek philosophers.[62]

A central case, for our purpose, was the rise of Greek philosophy (a precursor of modern science), with a consequent decline of more primitive religious beliefs and rituals as the intellectuals, and later others, came to view them as logically unreasonable or incredible in the perspective of the new philosophy. Although the efforts of the philosophers themselves to deal with problems of human destiny and virtue became a step toward a new level of man's rational cognition and control of culture and social behavior, rational philosophy like rational medicine remained a very ineffective and insufficient instrument for motivating wise behavior as compared with the long-selected and not yet very fully cognized but more ancient and more fully adapted wisdom. Greek philosophers were nearly as unaware of this unconscious *wisdom of the culture* as modern medicine was of the genetic *Wisdom of the Body* until brought out by Walter B. Cannon in a a book by that title in 1932.

The repair of this flaw in philosophy was begun—although too late to maintain the morale, meaning, and morals necessary to save Greco-Roman civilization from the Dark Ages—by the union of significant elements of Greek philosophy and the Christian offshoot from the already highly rationalized Judaic system of beliefs and ritual. This union of philosophy and religion into theology came in two great waves. The first wave was the neo-Platonic synthesis of the "Church Fathers" in the first few centuries A.D. from such New Testament apostles and hermeneuts as Saint Paul and Saint John to Saint Augustine. The second was the Aristotelian synthesis of Saint Thomas in the thirteenth century. Christian theology came to a climax just before the Renaissance, the Reformation, and the rise of

modern science. These two waves constitute a grand step toward the rationalizing of religious myth, a rationalizing properly restrained by its incorporation or keeping of the hidden, unconscious, or not yet rationalized wisdom of tradition.

Moreover, this restraint on hypothetical reasoning involved the Judaic tradition's strong pragmatic demand for historical, empirical, or concrete evidence concerning the nature of the deity and of human salvation. Some have suggested that it was this very mixture of Greek logic and imaginative hypotheses with Judaic insistence on the empirical evidence of actual, historical events that made Christendom or Western civilization the seedbed from which sprouted modern science.[63] In any case, Christian theology was a high step toward converting primitive or "mythical" explanations of religious ritual into the sophisticated, rational, scholastic, or theological "myths" of Greek philosophy.

The Emergence of Science and a New Religious Crisis. This brings us to the present situation and in particular to Western civilization. The psychosocial conditions to engender and tolerate both the Renaissance of classical knowledge and the explosion of scientific knowledge within Christendom in recent centuries would seem to have been made possible by the deep, widespread, and effective enculturation of a life-generating faith which was credible and hence viable in the light of the philosophical rationalism of Plato and Aristotle. At the same time this faith provided meaningful feelings, attitudes, and motivations, which produced in the population a relatively high degree of social altruism combined with psychological freedom and satisfaction.

However, the explosion of modern science since about 1500 became a threat to the existing level of cognitive sophistication of the religious traditions just as did the earlier explosion of rational knowledge in classical Mediterranean civilization. And I suggest that now, as well as a couple of thousand years earlier, the breakdown of credence in the old traditions comes more from the lag in finding adequate interpretations of the hidden wisdom of the old tradition in terms of the new cognitive scheme than from the absence of wisdom in the tradition.

For understanding the relation between religion and other elements of culture and the relation of these to the more slowly changing information that shapes our biological nature, it may be helpful to use an analogy nicely provided by some terms common in contemporary computer technology, where "hardware" denotes the electronic and material machinery and "software" denotes the special linguistic or logical

rules that program the machinery with information that makes it useful for human purposes. Before each new job, the software is fed into the machinery by information on punched cards or magnetic tape as the machine's program. The machine "reads" this program or incorporates it so that it becomes a part of itself. In analogy we may say that culturally formulated or evolved religious information became the basic motivational software of the hominid *Homo sapiens,* to program this "ape" to become the human nature we know. The hardware in religion is the fixed, genetically programmed motivational mechanisms of the lower brain centers to which religiously evolved ritual behaviors and beliefs tied the new, culturally transmitted information about self, society, duty, and hope. The special hardware to "read" programs from cultural software is the brain's neocortex. It is this new, cultural, socially transmitted level of information or software that provides the characteristic human patterns of feeling and logic in conscious choice making. In several thousands of years of evolution the hardware of the human gene pool has changed little. It is the software (or belief systems) that has evolved increasingly rapidly and has become for all practical purposes the program that motivates (so long as it remains cathected to the hardware) man's sociocultural behavior.

What is *in fact* believed does in fact determine behavior. Here "*in fact* believed" means a belief (or disposition of neurological behavior) whose reality is tested by nonverbal behavior (deeds) rather than merely by verbal behavior (words). A biblical awareness of this union of "software and hardware," "science and technology," or "belief and behavior" in religion is reflected in such phrases as "As a man thinketh in his heart, so is he" or "Faith is the substance of things hoped for." More recently, Nietzsche and the God-is-dead theologians have called attention to the fact that a lack of belief is equivalent to the death of the effectiveness of a concept. Belief is the substance of religion and theology as it is of science. When credibility is depreciated, the religious system's capacity to provide men with meaning, hope, and moral motivation breaks down.

Arnold Toynbee pointed out that Christianity came to the end of its effectiveness in the seventeenth century—I think he meant particularly among the literate or intellectual elements of the population.[64] The Enlightenment of the eighteenth century was akin to the rise of Greek philosophy. The philosophes (early social scientists) really called out the death of traditional religious belief a century before Nietzsche and two centuries before the God-is-dead theologians.

As one would expect from an understanding of the nature of reli-

gion and human history, there arose, beginning in the eighteenth century particularly, widespread responses to provide more "scientifically" acceptable formulations of traditional religion without losing its long-evolved wisdom, for example, Joseph Addison's "Creation" hymn, or the sermons of America's greatest theologian, Jonathan Edwards—both reflecting on the Newtonian physics and its new world view. Also there arose then, and ever since, various salvatory programs whose authors did not distinguish the living baby of religious belief from the dirty bath water of the incongruous mess of its expression in an outmoded Greek physics or metaphysics which had become incompatible and incredible in the context of a new physics. These programs, such as Auguste Comte's scientific religion or Karl Marx's and Sigmund Freud's beliefs and rites for psychosocial salvation, were attempts to provide "more scientific" alternatives to traditional religion.

At the same time, just as Greek philosophy (science) earlier had spread its impact over the Mediterranean basin and the whole Roman world, the impact of Western culture and its modern sciences has spread around the whole world's ocean basins and has begun to erode the religious beliefs of the other cultures great and small. Marxism with a new prophet has covered China already. University students and cultural leaders in the bulk of the countries of the world find little in their traditional religious beliefs that grips their hearts. Youth around the world are showing symptoms of anomie, meaninglessness, and existential despair. There are prophets of doom who perceive that every culture is losing its meaning and that the glue that once bonded social and psychological order is coming unstuck. Among intellectuals and sensitive artists first, and spreading to others later, one finds increasing evidence of diminishing faith and hope for the future of either their own culture or of mankind.

There are countercultural movements of all kinds, political and violent as well as ideological, ranging from the absurd to the constructive. The proliferation of new cults and the decay of traditional ways and institutions are suggestive of the decline of classical civilization around the Mediterranean, only now the evolutionary time scale is faster, thanks to scientific communication systems.

Immorality, private and public, seems to be increasing—or at least is not under the same pressures and clear focus of public censorship obtaining a few decades earlier. For the envied "leaders" of industry and state who can afford it, there is increasing indulgence in hedonistic practices less inhibited by moral concern for the public weal—a sort of fiddling while Rome burns. Declines in the work ethic and

institutional loyalties are widespread. The proportion of "inner-directed" persons is declining. In this century two world wars and rumblings of worse social instabilities, private and international hijacking, and threats of nuclear holocausts have led to widespread loss of hope and rising anxieties.

Even if the internal decay of societies today were no worse than it was in the second-century Roman Empire, there is something far more dangerous for our future than anything that existed then, and which, in spite of all the warnings from the relatively few who really understand it, is not yet sufficiently recognized to lead to effective precautions. This is the instability produced in contemporary societies by modern scientific technology, of which the atom bomb is only the best known element, and of which population explosions and irreversible damages to the ecosystem upon which our future is dependent are only some of the other better known elements. Moreover, the ability to use all the present technologies, wisely or lethally, is on the verge of becoming worldwide and hence forcing us to become a single technological community on spaceship Earth, wherein that which relatively small groups in any part may do may have drastic impacts on what happens to others everywhere. In such a situation, we face threats far more radical than those faced by the internally decadent Roman Empire.

Hence in a time when the enculturation of high-minded spiritual and social values is declining, our technological vulnerability requires them to be far higher than they were in the most saintly religious communities of the past. While the improper use of atom bombs can to some extent and for a short time be controlled by "physical" rather than "moral" superior force, sooner or later the control of its use will have to be internalized within the nervous systems of the potential users as has the proper use of knives in primitive human cultures or the proper use of their fangs by wolves. An inadequately controlled atomic-bomb fang among the cubs of *Homo* would be a nightmare of death in the living systems of the earth.

In view of all this, Heilbroner's sophisticated and conservative *Inquiry* found "the outlook is for what we may call 'convulsive change,' " a prospect before which "the spirit quails and the will falters."[65] Something worse than a new Dark Ages is possible. If religious software is the only answer allowed by our analysis of human nature—rather than the hardware of animal instincts or of political (military or internal police) power—then something grander and more effective than the emergence of Christian theology is called for. Let us look then into this.

The Coming of Scientific Theology. In contemplating the present decline of effective religion and the threats to the future of civilization, we should bear in mind the long evolution of religion which we earlier rehearsed to show that there always have been elements in the genetically programmed ancient centers of our brains designed to motivate us to suitable meaning, direction, courage, and hope in our dealings with our environment as that environment has been up to the present. We should also keep in mind that in civilized man these ancient brain mechanisms have been overlaid or enculturated by evolving systems of human meaning, purpose, goals, and values whose deep level motivation is fed by various socially evolved software programs of the rituals and beliefs of religion. The religions program the basic or central values, goals, or motivations (ultimate concerns), while other enculturated patterns (arts and technologies, languages, etc.) provide culturally evolved means for realizing them.

We should keep in mind that these software programs, like the hardware programs before them, have been open systems that evolve by their capacities to respond to changes in the circumstances and hence in the requirements for continuing as living systems. The environmental changes produce stress on the system. The feedback from sensors of the stress operate in the brain's hardware to engender loosening of the system's rigidity and open up its capacities for mutation or change in brain patterns or cultures.

In primitive cultures (and often still, even in high-level scientific engineering) most of the program changes were not usually consciously planned or developed on the basis of any systematic knowledge. They were simple, often random, explorations of signs or symbols of the elicited ritual behavior or released behavioral repertoires and of the ensuing consequences. The higher the culture, the more individuals there are who participate at conscious and rational levels, drawing upon the culturally accumulated software models of the nature of self and the world that interlace with their unique genotypic hardware structures to program their brains.

Greek philosophy represented the breakthrough to a recognition that rational thought, using ordinary, unconsciously evolved language, is in fact a fairly useful map or model of the real world, whose careful pruning and use can provide answers to many problems about the real world and even predictions concerning wise behavior in the future. A most successful case was the Greek geometers. There, a special language or symbol system had been pruned and cultivated to the point where, in Euclidean geometry, its logic could calculate or project such astounding information as that the world was a ball

rather than a table. Moreover, the logical manipulations of this symbol system gave fairly closely the actual size of the earth simply by measuring the length of the sun's shadow at noon at two points in the Nile valley!

It was out of such greatly enhanced powers of conscious and rational thought, as we have seen, that a Western theology arose to adapt religion more adequately to a culture in which this kind of thinking had become a characteristic at least of the leaders, a thinking which raised the Greco-Roman sociocultural system far above the level of intellectual, technical, and aesthetic powers of surrounding barbarians. The necessity for a theological or philosophical rationalization of earlier-evolved and tested myths or beliefs arose from the decreasing effectiveness of the traditional religious beliefs as the new philosophy made them dubious. The societies dominated by Greek philosophy began to lose their capacity to enculturate the necessary meaning and morals to motivate adequate behavior for a complex civilization. Although the new theology was not sufficiently finished and effective in time to prevent the moral and spiritual inviability of the Roman Empire from erasing much of its high Greek culture, I suggest that it was this theological or rational overlay of the more primitive myths and rituals of religion that later did in fact provide a society with the socio-moral and spiritual character in which there could be a Renaissance of the Greco-Roman level of consciousness and in which there would be generated the second wave of science that has far surpassed the initial science of the Greeks.

We must also be clear that the increasing of rational and logical powers in no way diminishes the emotive or aesthetic character of human behavior. Ever since Archimedes cried "Eureka!" on his discovery of the principle of specific gravity, scientists as well as other discoverers of new knowledge have reported the ecstasy that goes with the solving of even a puzzle in ordinary knowledge. In theological puzzles which are of even higher or more sacred concern, the intellectual solutions and convictions may be accompanied with even higher levels of feeling or ecstasy.

At the same time, on the behavioral side, we should be clear that the rationality of a conviction in no way lessens the likelihood that men will act as they morally should, even self-sacrificially if necessary. There is a widespread illusion abroad in contemporary society that reason and science are aesthetically and morally cold. The cause of this may be the experience of doubt and indecision when reason fails to provide clear convictions, when reason becomes confused by conflicting reasons. This, indeed, is what has happened to theology in the past few centuries, and hence the religious response such an un-

convincing theology produces is cold and generates no great enthusiasm for its alleged spiritual or moral precepts. It is exactly the failure of clear rational conviction that makes for a weakened religion in an intelligent and educated population.

From the first century A.D. until a few centuries ago, there was in certain roots of Christian culture a strong integration of all levels of religion from the basic instinctual, gut-level aesthetic feelings in ritual all the way through traditional myth to the top of the flowering of rational theology. But, since the rise in the sixteenth and seventeenth centuries of the new world view of man and nature produced by the modern sciences, there has been decreasing integration at the top rational level in religion, and, in spite of the increasing need for religion, it has been declining in effective power and wisdom. What is it that prevents an integration of religious belief or conviction with modern science such as was achieved by Christian theologians with the earlier thrust of the Greek rational world view?

I suggest that basically the barrier has been the split or segregation of Western civilization into two cultures, the human-value culture and the scientific-technology culture, a split intended to save the sacred but which in the end may prove to be fatal if we persist in it. I suggest that the breakdown of this barrier is occurring as the crises it is producing increasingly threaten what is sacred for man and that some of us (a tiny minority at the beginning) are active agents with the inevitable historical or evolutionary processes in bringing it about.

In this connection, it is interesting that many of the scientifically informed intelligentsia are beginning to take a new look at religion; that some of those who have taken the scientific pictures of reality most seriously as indicators of dangers ahead for humanity have been forced to conclude, along with Jay W. Forrester, and Heilbroner, that perhaps the only solution to the problem of motivating mankind to viable social life may be religion, even when they have little personal experience with or sympathy for religion.[66] For many the outlook seems bleaker for science than for religion.

My own views of the nature and the future of religion have been shaped by a group of scientists who started looking seriously at religion several decades ago. Many of them are authors in *Zygon*. The evolutionary view I have presented above is a product of this experience and provides me with what I judge to be simultaneously deep religious experience and sound scientific understanding. On the basis of this perspective I see a more hopeful future for science, for religion, and for mankind because of the possibility for the genuine integration of the best in both.

In spite of the persistence for several centuries in Western civiliza-

tion of a dogma that the sciences cannot deal with moral and religious problems, I suggest that before this century is out we shall see all over the world an increasing integration of information from the sciences into the heart of the belief systems of traditional religions. I prophesy human salvation through a reformation and revitalization of religion at a level superior to any reformation in earlier histories, a level as high above that of Jaspers's axial age as that was above the primitive religions of 10,000 B.C. Instead of adapting to Greek philosophy or some other lesser rationalism that came into being in that period, the religious reformation now, already begun but not yet widely known, will be a theological adaptation of traditional religious beliefs and rituals to the modern sciences. The new religious and theological language will be as high above that of five centuries ago as contemporary cosmology is above the Ptolemaic, as contemporary medicine, agriculture, communications, and transportation concepts are above those of the fifteenth century.

Modern science is the new revelation about human nature and the world that is universally credible and compelling for most men today, as already shown by the spread of scientific medicine and other scientific technologies to all cultures of the world. When it becomes successfully integrated with religious traditions, scientific understanding will tend to pull them more closely together, as it has pulled the world's varied medical beliefs and practices together into a more universal system. At the same time, the scientific theologies will find genuine virtues and validities in each of the great religious traditions and will adapt themselves to each local culture, as scientifically based medicine or agriculture has adapted to the local situation's particularities without losing its universality.

One need not fear any domination by scientists, as one now may properly fear domination by one or another political dictator, for science is the element of human cultural evolution that has learned most deeply to understand that the evolution of valid knowledge is not to be entrusted to any individual human wish, prejudice, or person.

One of the prime distinctions of modern science, in contrast to Greek science, is its sacred ritual for validation, its insistence on getting a truth-value judgment from *the external reality system itself,* no matter how plausible or well confirmed a new hypothesis or statement might be within the rational scheme of the scientists making it. As far as validating knowledge or finding out what is really so or *true* is concerned, no community in the world is more religious than the scientists in bowing down before what they conceive to be the ultimate

reality system, which they call by the name of "nature," seeking its judgments on their handiwork and brain work.

Since I agree with theologian Gilkey's position that the essential matter is that we find a religious perspective to be both *meaningful and true,* and since I find overwhelming evidence that the modern sciences have far surpassed any previous human experience in approaching *truth* or reality, I have to conclude that the sciences are a fundamental resource for theology. But it is clear that Gilkey's requirement that religion be *meaningful* causes many to doubt the relevance of the modern sciences for theology and religion. We need to clarify this point a bit, even though in a single paper and in a climate of opinion that for centuries has been conditioned to understand theology and science either as enemies or as basically separate worlds of discourse I can only briefly touch what seem to me some high spots.

As I have suggested above, the split of our belief system into two separate cultures is exactly the problem. The human-value culture is what provides *meaning,* and the scientific culture is the rapidly expanding source of new *truth.* I suggest that religion's "meaningfulness" lies basically in its function or capacity to provide men with an orientation to their destiny in the world such that it will make good sense to them, will appear worthwhile and hopeful, in spite of the fact that life is full of dangers and defeats, even death. The more conscious, aware, and informed of the nature of himself and his world man has become, the more he has required hypotheses about the true nature of his own being and his world that is not fully or immediately apparent to common sense. Traditional religious myths can be said to be equivalent to scientific hypotheses, but always for the purpose of justifying man's meaning, hope, and duty in the scheme of things. To answer the great emotional drive that men have for such knowledge of what they may truly hope for their own long-range future is what distinguishes religious and theological understanding from other understandings of reality. Such concerns have been called sacred or ultimate. However, aside from this practical requirement of sacrality, religious and theological knowledge in previous cultures have been structured about the same system of reality as secular knowledge. The sacred and the secular elements of belief evolved at a similar pace in most cultures. Such explosions of knowledge as we have seen in classical Greek and modern scientific culture are exceptions.

As I have already indicated, when Greek philosophy provided a radically new outlook on the nature of "true reality," this produced a crisis for traditional religious formulations, which was largely resolved, for Western civilization, by the emergence of Christian

theology. (In painting this picture of the West in relatively few and broad strokes I am forced to leave out a lot of complicated detail about the continuing evolution of the Judaic tradition, the Islamic reformation, and others, and to focus upon the world view most widespread in the West.)

In Christian theology the symbol of the ultimate and true reality which created man, shaped and shapes his destiny, and provides meaning, purpose, hope, and direction for human life is the term "God." Central in religions generally are such symbols for the ultimate source and context of human life. In a world that has been converted to a very different world view from that of Plato and Aristotle, the effectiveness of this "God" symbol requires its credible translation into the new world view. In the new scientific world view, the "reality" which possesses very similar attributes is called "nature." In the sciences, "nature" has come to denote the total reality system, including the laws or ways in which it operates in time, the dynamic history of its sources as far as they can be traced in time and space, and hypothetical entities or constructs that may not be directly observable but on the basis of which what is observable logically follows.

As I have been seeking to point out in this paper, in recent decades the sciences have tended to coalesce in providing what some like to call a general-systems picture of the way things are. Although there are a number of conceptual levels, where size ranges from subatomic to galactic proportions and complexity from the simple molecular aggregates in sand to the vastly complexly ordered aggregates in brains, and while there are logical gaps between the various conceptual systems, there has arisen an increasingly coherent picture of all these varieties of experience. The scientific picture tells us how the often inexplicable or seemingly irrational world of our commonsense experience is the natural and rational product of a long history or cosmic evolution of a system of hitherto hidden or unknown particles and forces, portrayed in different aspects by various sciences and yet all essentially integrated around a common, universal, everlasting, all-determining "ultimate reality system." I shall say more about this deterministic picture in the section "What Is Man's Freedom?"

To the extent that there could be shown to be an equivalence between what is denoted by the theological term "God" and this scientific term "nature," to that extent we could say that scientists are engaged in the attempt to talk about God and hence are doing theology. But I would guess that in the last fifty years more than nine hundred out of a thousand people I have known in the sciences and in theology do not see any relation remotely approaching identity between "nature" and "God."

I have already suggested that the increasing number of serious conversations by first-class scientists and venturesome theologians, such as those who have been associated with *Zygon,* is beginning to break down the wall separating the two cultures and beginning to provide the new synthesis of religious thinking within the scientific world view. A wide range of the complex, intellectual problems that needed resolution has been resolved. However, the resolution has not yet been wholly adequate, nor has it yet spread into the thinking and enthusiastic convictions of a sufficiently large sample of those influential people whose views dominate the scientific and religious subcultures to bring this illumination for a new scientific theology above the horizon of the accepted knowledge in general culture and provide the much needed light for a new day in human history. But there are significant and increasing signs of the dawn of that new day just in the first ten volumes of *Zygon* as well as in other places. While I cannot here review or even summarize in any systematic way what has been accomplished, it may be useful to mention briefly some of the more significant problems that have been at least partially resolved in the minds of some of us.

Perhaps the most general observation is that the scientific approach to "true knowledge" about "ultimate reality" seems to have become unbounded and universal. Because good scientists are the first to know how little knowledge they have and that they cannot, perhaps in principle, know any ultimate truth or reality, I have put these terms in quotation marks. But the explosion and universality of scientific technologies, including agriculture and medicine, are testimony to the unsurpassed validity of what science says.

The seemingly safe strategy of theologies based on the Greek world view to retreat to discourse about God in areas not yet touched by the sciences, sometimes called the "God of the gaps" strategy, has been closed off as the sciences have more and more encompassed the range of all human experience, including not only cosmologies and creation stories but the inner realms of human feelings and thoughts. Probably most people today, even in Western universities, are not aware of the fact that human values, feelings, even consciousness and religion are currently being understood in new ways as natural parts of cosmic evolution, reflected by numerous papers by outstanding scientists in *Zygon* and elsewhere. Even the old Western concept of the independence or separation of mind from body or conscious feelings from matter is fast becoming incredible and the distinction irrelevant.

For those theologians who have given up God but who view the social ethics and values of the tradition as still safely separated from science by a gap, the recent growth of papers accounting for social

behavior, values, and morals as natural products of the evolutionary scheme of brains and sociocultural systems is foreshadowing the end of the Greek world view as the basis of religion and ethics. A whole new "metaphysics" has grown out of what is now called "physics," a new epistemology, ontology, and cosmology or natural history.

To summarize this section on how religious beliefs can be effective in the light of contemporary science, my view is that as much as our being on the brink of a new Dark Ages we are also on the brink of a new stage in the intellectualizing of religious belief. I have suggested that this has happened before in religion's adaptation to the radical rise of Greek philosophy. The grounds for the new intellectual understanding are the "philosophy" of science with its view of human nature and the total nature or reality of which man is a part—and of the requirements which that nature demands and the opportunities which that nature provides for man's future. I have indicated some scientific grounds for believing that there is no real separation of intellect from feelings and behavior and that a highly rational and a scientific theology can provide as much spiritual and moral power as any previous religious beliefs. Scientific theology can fill Gilkey's requirement for meaningfulness as well as truth. I have suggested that the time lag in religion's response to adapting to the new circumstances, consequently causing a split in our culture and our brains, has brought the world to a crisis in religious need which will force some such adaptation as a scientific theology. One could say that nature or God is leading man into a new age. I think I have given a partial response to Heilbroner's fear that religion is necessarily antiintellectual and antiscience and shown that the recent opposition can be understood as a temporary state caused by a time lag that has put two primary sociocultural divisions out of phase in their recent evolution.

It should be carefully noted that in speaking of the last two major stages of religious evolution, rational theology and scientific theology, I am in no way suggesting that prior stages of religion will be replaced. Rationally unanalyzed cultural traditions of belief and ritual as well as the unconscious information in phenotypes and genotypes that produce religious experience will continue to be as necessary in the future as in the past, just as genotypes and brains are necessary if we are to have philosophy or science. In fact, if children at the right stages of life are not by their societies institutionally enculturated through suitable rituals and traditions about which we may have only the most superficial knowledge, a society may have no possibility of ever enculturating them with what may be spiritually and morally

essential—at least if we are to take seriously the implications of the various scientific evidences for the hierarchical stages necessary for life systems. Rational or scientific theology by itself is as impotent as rational or scientific textbooks to people who have not yet learned to talk or read. My argument for scientific theology is only for those who function in the outer cortex of brain and scientific culture. But this is exactly where we find the breakdown to which Heilbroner and others are pointing. It is here that the earlier rational theology and related religion have broken down, as I have sought to demonstrate.

I shall leave to following sections various other characteristics of the coming scientific theology. The relation of the gods to the natural forces of physics will come in the last of these, except that we need to deal with it somewhat further in the beginning of the next section on human freedom.

What Is Man's Freedom?

Individual Freedom apart from Society. The problem of human freedom and responsibility is tied to the problem of man's meaning in a reality system, whether we call it God or nature.

Since the rise of modern science, religion has had a difficult time presenting credibly its primary message that man is created by a creator which actively continues to care for, supervise, and lay down and enforce laws for man's behavior, thus providing an objective or real frame for man's purpose and meaning in the scheme of things. Christian theology from the beginning quite properly conceived of God as transcending nature, as long as nature denoted only the naturally obvious phenomena of experience; and hence nature was understood as merely one phase of God's productions. By the seventeenth century, the Newtonian world view tended to remove any concept of a God involved in the material world to a distant remove from man. The Deist or "clockmaker" view of God sought to relate to that new scientific world view by suggesting that in the beginning God created all things after the fashion of a clock maker. He then wound up the clock to set it going, and after that all went according to Newtonian mechanics. The mainstream of Christian theology properly avoided that solution, but, to do so, it had to separate its realm of spiritual and moral values from the scientific world view and thus remove itself to a "God of the gaps" position in which it has been withering as the scientific world view proceeds to fill the gaps.

In the past century, interpretations of the second law of thermodynamics as implying eventual destruction of all organized complexity and life have been deemed a death blow to any faith that the

cosmic reality cares for man. The interpretation of the Darwinian and neo-Darwinian evolutionary theory as indicating that life is the product of random rather than planned activity has been considered similarly. But, in a brilliant exposition (first published in *Zygon*) of the second law and of evolutionary theory, J. Bronowski shows exactly what is wrong with those interpretations.[67] Employing some of the recently developed and not yet widely recognized theory of the evolutionary process—a systems theory integrating the evolution of atoms, chemicals, life, consciousness, and culture—he shows how man instead of being an alien in the cosmos is, indeed, a special feature of it. For those who are concerned to develop an understanding of the sacrality of man's relation to the various levels of the ecosystem and his meaningfulness and duty in the cosmos, this paper by Bronowski provides basic ground. I give some quotes that I think are of great significance for a philosophy and theology of man in the light of the sciences:

> There is therefore a peculiar irony in the vitalist claim that *the progress of evolution from simple to complex* cannot be the work of chance. On the contrary, as we see, exactly this *is how chance works, and is constrained to work by its nature.* The total potential of stability that is hidden in matter can only be evoked in steps, each higher layer resting on the layer below it. The stable units that compose one layer are the raw material for random encounters which will produce higher configurations, some of which will chance to be stable. So long as there remains a potential of stability which has not become actual, there is no other way for chance to go. . . .
>
> The Second Law describes the statistics of a system around equilibrium whose configurations are all [equally probable], and it makes the obvious remark that chance can only make such a system fluctuate around its average. There are no stable states in such a system, and there is therefore no stratum that can establish itself; the system stays around its average only by a principle of indifference, because numerically the most configurations are bunched around the average.
>
> But if there are hidden relations in the system on the way to equilibrium which cause some configurations to be stable, the statistics are changed. The preferred configurations may be unimaginably rare; nevertheless, they present another level around which the system can bunch, and there is now a countercurrent or tug-of-war within the system between this level and the average. Since the average has no inherent stability, the preferred stable configuration will capture members of the system often enough to change the distribution; and, in the end, the system will be established at this level as a new average. In this way, local systems of a fair size can climb up from one level of stability to the next, even though the configuration at the higher level is rare. When the higher level becomes the new average, the climb is repeated to the next higher level of stability; and so on up the ladder of strata. . . .
>
> When there are hidden strata of stability, one above another, as there are in our universe, it follows that the direction of time is given by the evolutionary process that climbs them one by one.[68]

But Bronowski is only one of many who would correct popular misunderstandings, even the misunderstandings produced by such excellent physical scientists as Jacques Monod in his *Chance and Necessity*.[69] Theodosius Dobzhansky and George Gaylord Simpson, pioneers in the neo-Darwinian view, seem always to have seen natural selection as a nonrandom or determined process—working, to be sure, upon the random variations provided by another aspect of nature, just as indicated in Bronowski's paper. The emerging picture is well represented by Bronowski and is based on hard physics for its "new concepts in the evolution of complexity" both in its "stratified stability and unbounded plans."[70]

In general, I would say that the new scientific pictures of man's creation by natural selection again allow for the restoration of the validity of a god concept as a reality which maintains perpetually a concern for what is going on in the cosmos, even a complete control of the process. This concept of "complete control" or "scientific determinism" is another stumbling block with which theologians themselves have been struggling since long before modern science began. How can one speak of "God" as designating that which controls everything and yet allows man freedom to make choices and be responsible for his choices?

While many earlier theologians did not hesitate to interpret God's sovereign power as completely determining human destiny, there has grown to be an aversion to this interpretation in the contemporary world which finds it necessary to limit God's power to explain human freedom. But, as in many paradoxes, both of the seemingly opposite or self-contradictory aspects are in fact true. What makes them paradoxical is the inadequacy of the language in which they are expressed. The amount of published material on the question of man's freedom and God's omnipotence (or nature's determinism) suggests that for most people the language they use is not yet sharp enough. I shall point to some developments for making the language sufficiently sharp or clear so that freedom may be understood without emasculating God's or nature's (scientific explanation's) determinism. I will start with a statement from traditional theology.

Jonathan Edwards, who carefully digested Newton's theories, found no problem in equating Calvin's predestination and scientific determinism and at the same time in showing how man is nevertheless free to make, and be responsible for, his choices: "Yea, if once it should be allowed, that things may come to pass without a cause, we should not only have no proof of the being of God, but we should be without evidence of the existence of anything whatsoever, but our own immediately present ideas and consciousness. . . . If things may

be without causes, all this necessary connection and dependence is dissolved, and so all means of our knowledge is gone."[71]

Edwards's analysis is as good for scientific determinism as it is for traditional theology. It can be remembered that science, knowledge, and even language are systems of symbols in which explanations take the form "If *x*, then *y*."[72] If the statement does not prove to be true within the framework of the language, then the language has a flaw. Arithmetic is a special language where for most operations internal flaws in the language have been carefully ironed out, although we know from Gödel's theorem that no logical system (even arithmetic) can from within itself be proved to be without inconsistency. A scientific statement is systematically tested beyond the logic of its symbols or language to require some consistency between the structures of the linguistic statements and observations of nonlinguistic events in our experience of the "real" world. Again, if the scientific statement of the form "If *x*, then *y*" turns out to be logically true but not true in the results of observations of consequences in the real world, then the scientific statement is possessed not of a logical but of a factual error.

It is exactly this capacity of linguistic symbols to provide a model whose logical operations explain (show intelligible and useful relations among) the otherwise disconnected or chaotic events of our experience that makes language or science of value to human understanding. Hence determinism is a necessity of what it means to understand; it is built into the heart of our explanatory system, both in ordinary language and in our best scientific symbol systems.

Edwards would seem to be agreeing with scientific explanations that would say that whatever freedom man has to make choices and to be independent of circumstances or of other men, such freedom is itself a capacity that is provided or determined—in Edwards's language, given by the grace of God. Edwards summarized the whole business this way: "Let this be laid down first as a postulate before treating of those doctrines about free will: that whatever is, there is some cause or reason why it is. . . ."[73]

The following gives more of my view of what the sciences today imply concerning *human freedom as a fact that is determined* or caused by nature or God.

With the scientific picture of an omnipotent and sovereign environment within which man is a small and completely dependent incident, we come into a problem of human motivation found by earlier theologies depicting a sovereign God's foreordination or predestination of man. Does this scientific picture invert our commonsense and moralistic notions of the control of man's behavior? We may well ask whether we should be worried or concerned to exert ourselves if, in

fact, all that will happen is a predestined fate. Since today as in the past such an attitude of resignation is known to be debilitating if not lethal, it is important to explain why faith in the scientific (or the ancient theological) hypothesis that man is determined or controlled by superhuman powers outside of himself does not necessitate the conclusion that man has no freedom and hence no responsibility.

By carefully following the scientific picture and by a more careful use of language, we can resolve this ancient theological and philosophical paradox. The following is a condensed statement of the resolution but may be helpful: In the scientific picture of man, both his freedom and his responsibility are determined or given him by his environment. Responsibility means that man has a *goal* or value which he wants or must attain.

One meaning of freedom is that man is free to, or has the capacity to, pursue and accomplish *that goal,* even though his immediate environment is pushing him in another direction.

Fish and men may have both the responsibility or goal and the freedom or capacity to swim upstream. Fish and men differ from a floating chip in that fish and men, by a long history of environmental selection, have goals or responsibilities inscribed in their genotypes and central nervous systems and also have there inscribed the freedom or capacity to swim upstream. Were it not for the long and costly selection program of the larger environment, now internalized in them, fish and men would have no such freedom and responsibility to carry out the goals for living in their present environment and would be carried downstream like the floating chip.

A second meaning of freedom is, when man has not yet found the way or power to maintain himself in a new environment, he is forced into an open and at least partially random search for it. The scientific picture again helps us understand this second connotation of freedom as something also determined by the larger cosmic nature or environment. From the beginning, nature seems to have provided or determined that in the world there should be random variation and that also there should be countless hierarchically arranged niches of partially stable energy-flow patterns to be filled when variations should hit upon them, by chance or otherwise. In living beings, random variations from the environment (most of which are lethal) constantly provide slight changes in the relatively stable pool of genetic information. Variations are also programmed in a more efficient way: within the gene pool of a population by sexual recombinations; within the history of any phenotype by the variant patterns of response to the immediate environment; within a culture by the trials of variant cultural patterns; and within the brain of man by his imaginative search

for ever more coherent conceptual systems for understanding and living. All this variation (deviance or freedom from the norm) has been and is eternally programmed by the environment. The larger environment's multiplicity of ever-emerging ecological niches as well as the continuing supplies of energy for searching for them provides man with (i.e., determines) his enormous freedom to find ever richer patterns of life.

We can properly say that freedom (whether as capacity to maintain life's present patterns or to search for potentially better patterns) has been and is determined by inputs from man's environment. Instead of requiring freedom from determinism, man's responsibility or duty to carry out goals or values turns out to be completely dependent upon it. Duty to some goal is determined by having been inscribed in the "heart" (central nervous system) of man by the larger environment. However, we must not forget for a moment that, while man may—by using the information implanted in him by his cosmic environment in the course of his development—do many things in the cosmos, such as swimming upstream or rising against the pull of earth's gravity, he can never violate the ultimate laws and facts of the cosmos. Man does not and cannot repeal the law of gravity when he flies. On the contrary, by grace of information internalized in the heart of his being through a long history of environmental selection of genes and cultures, man incarnates a larger realm of cosmic information, including such of nature's laws as those of aerodynamics (also embodied in the genes of bees and birds), which give him the capacity or freedom to fly to the heavens. The overwhelming fact that man was created by and now is sustained by the environment, just as is a waterfall, is forgotten at our peril. If a self-centered vanity leads us to suppose we are independent of the larger realities of our environment and we choose to violate them, we are lost and disappear just as a waterfall disappears if there is no stream bed and no supply of water.

From the present scientific pictures of *Homo sapiens,* it could be said that man's freedom from the disordering elements of his environment is an ordered (determined) cybernetic or homeostatic system that provides that freedom; that this system itself has been determined by natural selection; and that nature's evolving systems insist upon or determine that he continue an open or free search for ever higher adaptive levels. Man's freedoms constrain him to compete in an everlasting program to maintain and extend the ever-expanding hierarchical levels of dynamic patterns of stratified stability (or of dynamic homeostasis) of the open-ended flow patterns of dissipative energy that we know as life.[74] From this task or ordination, estab-

lished and continued for billions of years by the specific parameters of cosmic processes on earth, man has no possibility of escaping. *Man has no freedom to do other than adapt to what this "nature" requires—except to cease to be.* As ancient theologians have said, to be a slave of the true God is man's greatest freedom. That is, to cherish and ever to seek better adaptations to the cosmically given or determined patterns of how to live and to evolve is the way unto life. But in this process man has far more of the first kind of freedom (the freedom to maintain life's dynamic patterns against myriads of disruptive interventions) than any other creature on earth. He has infinities of the second kind of freedom (the freedom to search and find better patterns of life).

The problem of political and social freedom is clarified if we understand the preceding analysis of freedom and determinism in terms of traditional theological or modern scientific pictures. Heilbroner's fear that a return to authoritarian religion under a sovereign God would be repressive is no more true than is a fear that the invariance or determinism of nature's laws of mechanics or thermodynamics is repressive to human well-being. Man possesses his freedom to live (his capacity to be relatively independent of alien forces in his environment) exactly because there is incorporated in his neurological structures the genetic and cultural heritage of information of what the reality system has determined is necessary for life. By consciously following this same program of learning or incorporating in himself the requirements determined by the reality system (internal as well as external) for higher levels of the flow patterns of life (new adaptations), he exercises his second-type freedom to achieve new first-type freedoms to live under these new and advanced circumstances. Submission to what the ultimate reality system requires is indeed our greatest freedom. This is as true for social systems as it is for individuals. Both adapt to a larger nature. It is also as true for the individual's adapting to his sociocultural system, which is indeed an enveloping part of the sacred nature which created and sustains him.

Individual Freedom in the Context of a Society. In our symposium Karl Peters reminded us of the centrality of the problem of freedom and control for our discussions. In a response to this, Donald R. Ploch made a significant commentary on the relevance for this problem of Émile Durkheim's notion that it is impossible to be a human individual without also being a member of society, and this raises the question of how we retain our sense of individual freedom while remaining a member of society.[75]

This is the question that Campbell and others have indicated is insoluble in terms of genetic selection and hence impossible if left to

man's natural instincts alone. It is the problem whose answer I have suggested is given in the capacity of religious traditions to modify genetically programmed responses or behaviors through religion's transmitting a heritage of software programs. The virtues of these cultural programs for adaptation and evolution have grown symbiotically with the evolution of the brain for communication and for learning from other brains what is best for a larger capacity for life. Religions, as we have seen, started with primitive heritages of programs to reinforce or condition certain ones among the increasingly numerous potential responses allowed by a brain that increasingly, in its symbiotic adaptation to sociocultural structures, permitted modifiers from the upper-brain levels to be inserted between the stimulus and response (input and output) mechanisms of the genetic or hardware operations of the central nervous system of *Homo.* From such origins, religions have evolved, as Wallace and others have pointed out, to involve *belief,* which "rationalizes ritual and renders it more effective." During the past three thousand years, religious beliefs evolved to flourish in the context of new emergences of highly rational or philosophical belief, and I have suggested that we are at the beginning of an integration of religious belief with the far more powerful, recently emerged sociocultural instrument for generating "truth," the modern sciences—to generate a scientific theology.

Essential everywhere in this process is the basic principle pointed to by Campbell, Williams, and others, and which I will generalize into a tautology: In natural selection processes at any level, no unit (organizational type or kind) is or can be selected except for itself. That is, "selfishness" or self-maintenance is built into any unit that is selected. It is logically impossible to do otherwise. In this sense, there is no escape from selfishness. The resolution of this as of other paradoxes comes from a more careful logical analysis. The escape from "selfishness" provided by religion (as in all prior evolution) is accomplished by the integration of some of the units of a prior level of units or selves into a community or society of selves constituting a new self at a new level. This always must be done in such ways that the lower-level units flourish as participants in the new or higher level, just as atoms continue in being when bound into molecules and molecules continue in being when bound into the open-flow systems of living cells. Religions bind (perhaps the presumed Latin root, *ligare,* to bind, of the word "religion" has an added prescience) individual selves into a new level of unit, a sociocultural system, which took its first big step in the long history of life on earth when *Homo sapiens* arrived.

Man's brain (and hence consciousness), where this binding takes place, consists of two levels of information: genetic and cultural. It is

in the brains of a population that the union or binding of the genetically programmed bodily self with society takes place. At times the "structures that integrate" (the information, in a technical sense of that term) these two levels of human nature are inadequate for the task, and societies and the individuals in them break down and are selected *out* of *Homo sapiens.* But always selected are those patterns of information which more effectively integrate the smaller self with the larger self since the union or symbiosis is a more viable or stable system than the smaller selves by themselves.

Religions provide the escape from selfishness to altruism by engendering internally within each brain a harmony of the information from man's two "natures"—genetic and cultural—so that a new-level body (this term "body" may be read as "phenotype" for purposes of the evolutionary theorist), which integrates both "natures" (both sources of "information" or boundary conditions), flourishes and flourishes better than populations of nuclear families informed by genetic information alone. (Among Christian theologians this understanding of a new nature has been anticipated and called the "New Being," although from New Testament writers to Paul Tillich none of them had the advantage of the new richness of understanding given by recent evolutionary theory.)

There is an inevitable conflict and internal disintegration produced whenever the two natures are not properly harmonized by the rituals, myths, and (for those living at a more advanced cultural level) the more logical or consciously rational theologies. If the internal tensions in the brain exceed a certain threshold, the situation becomes unstable and both societies and psyches break down. One can interpret both Marx and Freud as efforts to resolve respectively the social and psychological tensions of an ailing religious system. They were not sufficiently integrated prophets of religious reformation, for not only did they fail to integrate the internal brain with the societal system but they failed to capitalize upon the rich wisdom of the existing religious system, a wisdom for the integration of the smaller genetic self with the larger social and cosmic self. The basic grounds for such an integration still lie within the basic religious tradition, even though inoperative because within the newly risen scientific and technological conceptual scheme they are incredible in their formulation in terms of the conceptual scheme of Greek philosophy and its legacy that dominated the Middle Ages and still continues to dominate the nonscientific culture of today's two cultures.

When reformulated to provide the kind of interpretation or hermeneutic which is credible in the culture of the modern sciences, this ancient tradition remains superior to those of both Marx and Freud

for reasons I have presented in previous papers.[76] When thus properly translated or interpreted, not only our traditional Western religious species but all the great religions can again become more effective in enculturating in the "brain pool" of mankind an integrated and unifying perception of the self as larger than the "natural" or commonsense self of the body, a new being that integrates not merely with the immediately ambient sociocultural system but ultimately with the species and with the ultimate reality system called "nature," the "natural system," or "the way things are"[77] in the sciences and called God or the Kingdom of God in Christian theology.[78]

In this symposium we are seeking to understand not merely how man has been and still may be a creature who will readily cooperate in altruistic social behavior but even more how he will do this and also cooperate with the still larger system in which his society as well as his body is a subunit at a different hierarchical level. Heilbroner and many ecologists and economists are asking how man can be persuaded to cooperate with the more basic conditions of the world's ecosystem. The above reference to integrating the self-identity perspective of the body not only with society but with the world ecosystem (not only with human brotherhood but with the transcendent realm of God's Kingdom, to use more traditional theological terms) shows that the traditional religious system already anticipates and has provided a category of wisdom above that of either Marx and Freud in harmony with contemporary considerations of man as a being with an ecological niche that involves self-identification with a sacred world as well as with a sacred brotherhood, community, or society. But we shall turn to the higher level of the "suprahuman" later and return now to focus more specifically on self-identification in the sacred human society.

For an objective understanding of the self-identification problem, we should remember that in man (as contrasted with organisms and insect societies) there are two separate sources of basic information —the genetic and cultural—which are symbiotic, not synonymous. However, the "expression" of this double set of information in structures of brain and behavior (including consciousness) is always in a single "phenotype" (the bodily structures and behaviors) which is what is selected by the nature of the situation for its relative stability or viability under the prevailing circumstances of the larger natural system. The secret of man as a social animal is the remarkable capacity of his brain to learn or be modified in its output. Neurological learning, like genetic learning, in the end is always selected in terms of some viable program for remaining alive, in being. One never escapes this kind of selfishness. In another paper I have shown how I (and

other investigators of the problem) relate personal and social choices to a "lower court" of first judgment in the selection process, which is always subject to a "higher or supreme court" of ultimate judgment or selection by nature.[79] But, increasingly in sociocultural evolution, there are more and more choices presented to the lower courts for decision in individual brains or in the somewhat higher or superior courts of the societies constituted by a collectivity of brains. Even so, we should keep in mind the humility implied in Herbert A. Simon's statement: "A man, viewed as a behaving system, is quite simple. The apparent complexity of his behavior over time is largely a reflection of the complexity of the environment in which he finds himself."[80] Moreover, even the events within us of which we are conscious are but a tiny fraction of the internal events within more than 10^{11} cells each containing more than 10^{11} dynamically active atoms, whose delicately regulated behaviors are essential to our life.

The human brain from infancy is subjected to the enculturation of the mores or the ways and wisdom of a sociocultural system. This enculturation proceeds as does evolution generally through a series of stages, each of which is necessary for the next stage.[81] In this process, as I pointed out earlier, the basic motivational pattern is transformed through a complex of programs reinforcing selected instinctive responses. This is done by programs of which the learner may be unaware and later by programs communicated verbally and symbolically of which the learner may be increasingly conscious. If the sociocultural system is adapted internally to its individual human units as well as externally to its surrounding ecosystem, then all goes well with this complex procedure for transmitting vital information or values about how to live. The sociocultural system and the multitude of genetically diverse individuals within it prosper, and their genes flourish better than those in primitive, extended-family tribes.

Through this process the individual has come to identify or discern that the best interests for fruitful continuation or survival of his genetically programmed body may be best served by his acceptance of the wisdom of his culture and by his cooperative and even altruistic devotion to the well-being of the sociocultural unit. The well-being of his sociocultural unit (i.e., of his nongenetic "brothers") becomes more closely identified in his unconscious and almost "instinctive" habits with the well-being of his own body, and not infrequently this enculturation may produce men who volunteer to sacrifice their bodies for the welfare of their society far beyond the bounds of nuclear family. In brief, we can now say on some scientific grounds that religions evolved to transmit to the conscious mind a wider horizon of the reality of the significant self and its values than was possible for the

combined input of genetic and "uncultured" environmental information. It is this enculturated motivation, to preserve a self which is correctly perceived or identified as far larger than the body, that provides what is called "altruism."

If a sociocultural unit or system is properly attuned to the diverse genetic-somatic requirements of the individuals who constitute it, it will attract the cooperation of all those diverse units, always, of course, on the basis that its reinforcements of the genetically programmed requirements of each of the individual bodies with their diverse private needs have a statistical mean which is positive. Statistically, their genetic heirs will need to flourish longer than the genetic heirs of less socialized groups and species of *Homo.* The genetic diversity in the larger social units of *sapiens* is probably the basis for the disappearance of all closely competing subspecies and species. The genetic diversity provides a diversity of talent that significantly enriches the collective power or viability of the group. *Homo sapiens sapiens* is not only a species but an ecosystem of symbiotic cultural genera and kingdoms that are endowed with a capacity for rapid evolution and many other special features not possible for species equipped to evolve only by the natural selection of the gene pool.

In man the possibility of a society consisting of random samples of the genotypes in a species has been possible, as it is not possible in social insects, because in man it is not a genic and organic adaptation but is what Williams denotes as a "biotic" adaptation.[82] The nature of a sociocultural system is as if man had found an ecological niche in a new habitat or ecosystem which statistically favored his individual life when he played a certain role with respect to a creature of another species, such as feeding and caring for a cow which can provide him with milk. It is as if a society as a whole were such a creature (different from himself, even though constituted of a population of conspecifics) but a creature with which reciprocal exchanges provided added advantages. This technical point must always be kept clearly in mind if one is to understand the true nature of man. One could say that *Homo sapiens socialis* or *religiosus* is an emergent biotic phenomenon.

But social and, for that matter, cow-milking man or English-speaking man is not specified by genetic information alone. To understand the answer to Ploch's question as to how we retain our sense of individual freedom while remaining bound and faithful to the requirements of a human society requires this understanding of man's brain and his motivational system as consisting of two natures: genetic and cultural. When a man's genotype and culturetype are not well integrated or when the other members of his society have expec-

tations different from his, then he feels torn within and finds it impossible to satisfy both elements of his nature. Ploch's question is a part of the same question to which theologians have responded with their doctrines of "original sin." An earlier and related religious myth responded, and essentially correctly, in the story of Adam's fall after eating of the tree of knowledge.

Man's social freedom, man's being at ease and at peace in a society, therefore, depends on the state of mutual adaptation of two essentially different units, both resident in his central nervous system but only one of which is resident in his genotype.

Once a man is born, his genetic information cannot be significantly and satisfactorily changed; hence sociocultural systems must adapt themselves to the statistical requirements of the population of genes in the gene pool. The secret of this adaptation lies in the malleability of the human central nervous system, which can change the patterns of the sociocultural system to be more or less satisfactorily adapted both to the major requirements of most of the varied genotypes in the gene pool of the population and to the requirements posed by the information or boundary conditions of the ecosystem within which the population dwells.

While the actual situation is much more complex than this summary picture, we cannot here go into all the details of the perpetual breakdown of a smooth integration of the operations of brains because of inevitable accidents that produce mismatches internally in a single brain or in a population of brains, except to say that there have to be and usually are sociocultural institutions that operate to bring cures and programs of prevention in addition to some genetic programs. In general the sociocultural value-transmitting institutions had their origins in religions. The mismatches between the programs of sociocultural systems and an individual's biological drives have caused the problem of evil and original sin to exercise mythmakers and theologians from the beginning, undoubtedly, of human culture. All this has now become absolutely essential for human life because man has evolved so far into being a social animal that he is no longer viable on his own. Wild children, without some minimal endowments from a culture, are not viable for long. Men have become as symbiotically interdependent with human societies as have the cellulose-digesting intestinal flagellates with their termite hosts.

Such is the close interdependence of individual man with the larger "beast" in his environment, the sociocultural system. Natural selection has no problem even in genetically adapting one "species" to another for mutually beneficial symbiotic exchanges, and man's adaptation to human societies is in its genetic structures of this type, such as the

evolution of his brain during the past million years to provide him with human language capacities.

But the most interesting point about that somewhat alien creature called the "human social unit" with which man is symbiont is that it is found inside man's own skin, inside his central nervous system, in a manner quite different from such internal symbiotic parasites as the intestinal, cellulose-digesting flagellates that make possible the early ecological niche of the termites. Human societies are "beasts" which never did and never could exist apart from a population of men that possess central nervous systems in which could be planted a common culturetype.

Freedom to be, to exist, can come to man fully only insofar as he recognizes what is good or right in three separate systems: (1) his organism, (2) his society, and (3) the total ecosystem which is ultimately the creator and sustainer of his society as well as of his individual nature. If his attitude and behavior are correctly informed concerning what to do with respect to the two superior, transcendent realities which enable his organism to *be* or to have life, then he will have the first freedom or power for maintaining life and also the second freedom or power for participating in the creation of new and better life—the two rather different meanings or kinds of freedom that I have described above.

From this it should be clear that the freedom of a man within a society and a world never can mean his independence or his right to indulge in uncultivated, uncivilized, and merely genetically programmed desires, without regard to his symbiotic duties to his wheat, cow, or society. When he neglects them, he is at the same time neglecting himself. Freedom is never to make man "independent" of the sources of his life but to adapt him to understand or feel how truly his own soul is identified with them. The term "freedom" has been grossly misunderstood since we have lost confidence in the religious myths and theologies of our dependence that once informed us. Without valid information from a culturetype to inform us, a shallow vanity has led us mistakenly to presume the powers given to us to be only for the satisfaction of our genetically programmed desires. Hence we are not so readily moved to altruistic service to fellowman and to the realm of the ultimate reality upon which we are utterly dependent. The new scientific pictures can revitalize this ancient religious wisdom by showing better than ever its essential validity or truth. Briefly, man's greatest freedom comes from his proper service to his society and God; man's freedom is a heritage or gift ordained or fully determined by the reality system that produced us.

Man's Capacity to Sacrifice His Present for His Future Self

"An Essay on Depriving the Living to Insure the Survival of the Unborn" is the subtitle of Heilbroner's "What Has Posterity Ever Done for Me?" to which I have already referred.[83] It is an expression of the natural fears of man when he recognizes how impotent to produce altruistic and high-minded behavior is genetic information or common sense by themselves. In this section I shall respond to these fears by showing how traditional religious myth and theology as well as modern scientific theology provide essentially the same answer, which is: Man has, can, and must gladly deny present satisfactions, even to the point of risking his life, to provide for the welfare of future generations far beyond his great grandchildren.

First, let us look at all living creatures prior to man, where we find how this capacity has already been selected to be real for them. I have already indicated that, in insect societies and in the societies of cells that constitute organisms, the individual unhesitatingly sacrifices itself if necessary for the welfare of the society or the organism. The natural history of all organisms shows that self-sacrifice for the larger whole of which it is a part is the order of the day. Also, the invention of sex and death in the evolution of living systems probably some billion years ago was perhaps the greatest step forward to making possible the evolution of higher and more stable forms of life. Death was the invention of giving up the present individual genotype and phenotype for the sake of a newer and possibly better one. Sex was the invention of the systematic provision of new variations on which natural selection or the "Lord of History" could operate to produce life ever more abundant. The variations provided by sexual recombination were far more likely to be viable than variations produced by mutations of genes. I shall not belabor this fact of the inbuilt, even genetically inbuilt, readiness of all higher species to give up "this life" for a better "future life." A portion of this information is presented in a paper by Alfred E. Emerson and me in *Zygon*.[84]

Second, I have also shown in the first section of this paper that, as far as the evolution of his genetic information is concerned, man performs this self-sacrifice for the welfare of future generations as readily as other organisms. Genetically, it is established by the X and Y chromosomes that man must ever procreate new variations of genotypes (and the corresponding bodies) from the gene pool of which he is a part, and he does this "gladly," as do all other creatures. Man's somatic death is also prescribed genetically, although there are many, even some otherwise sound biologists, who are not really clear

about this, perhaps because so great is their misconceived desire for the indefinite continuation of life at the level of the individual body that the truth of the essential goodness or virtue of somatic and genotypic death is not acceptable to them.[85]

It should be noted that prehuman plants and animals do not have the brain or cultural capacity to anticipate or to be anxious about death—"Behold the lilies of the field!" Hence there never was any selection pressure to provide a genotype that would give a gladness of heart for conscious anticipation of self-sacrificial behavior and death. Animals are genetically programmed naturally to like to go about this necessary business, oblivious of what good they are doing. But when the growing symbiosis of brain and culture more than one hundred thousand years ago caused it to dawn upon man that he must contemplate the end of his body, that fact, together with his genetic programming to maintain the body as long as possible, produced unbearable internal conflicts of feelings or emotions, to which primitive religions necessarily responded to provide those men who were thus afflicted with the capacity to contemplate such realities.[86]

Without the enculturation of special information about the naturalness of somatic (and genotypic) death and the fact that something else far more important for one's own nature remained and would go on, certain kinds of men (often the most valuable for sociocultural evolution) could not have stood up emotionally to increasing awareness of death. It is significant that a theology based on contemporary scientific pictures of what is real and essential about human nature may provide even sounder information with essentially the same effect: that there is indeed something very much more important than the transient soma and the present selection of a particular genotype from the gene pool—that selection indeed is no respecter of persons (somata)—but that the selective process does support the true reality which is the significant core or soul of the process necessary for the long-range continuity of life.[87] It is exactly a revival of this ancient mythical and theological truth, together with the significant rituals about man's "true self" as more than his "somatic self," that can replace Heilbroner's fears by a joy in living for a distant future transcending the certain death of every body and the many other misconceived threats to human hopes.

The "kingdom of heaven," as I have suggested, is a term which connotes a higher perspective on the human prospect and raises man's vision of himself above the level of the sin, error, and tragedy which is the inevitable perspective of him who has not yet been graced with the good news. To live in the "kingdom of God" or in the "new being" as it may be called in Christian theology (or to live in the

perspective of true reality rather than of the limited and hence false views of common sense, if we may generalize the basic message of all the great religions) is possible for man here and now.

The great religious traditions have left us a heritage of various ways of perceiving the more than somatic reality of man and his relation to the ultimate reality which determines all things but whose ways are not necessarily readily justified by only commonsense information. I have already pointed to the insights of those who, in Jaspers's great axial age or turning point of some twenty-five hundred years ago, provided new and more universal rationalizations of the more primitive religious myths or stories about man's reality, duty, and privilege in relation to the source of his being. Confucius, Buddha, Zoroaster, Isaiah, and Socrates all presented more adequately rational accounts of the necessary understanding man must have in order to transcend the more limited information given by his genes and primitive cultures. The cultural information, the good news or enlightenment, that these men represent has indeed inspired men to amazing altruism and lifted human behavior at times to the sainthood of blessed service to fellowmen and the kingdom of the "Lord of History."

Moreover, while the pictures presented of the human predicaments faced by the great religious heroes are ones that would cause any commonsense spirit to quail and any ordinary will to fail, the clear message is that these holy and sacred men have regarded their vision, enlightenment, or divine revelation of the true character of self and world as enabling their suffering and sacrificial service to be freely, even gladly, willed for the glory of a divine program in which men are privileged to participate and the triumphant outcome of which is guaranteed by the true determiner or "Lord of History." This provides a perspective that is different from the horribly irrational, impossible, and never desirable prospect which many enlightened minds, whether in the first or the twentieth centuries, cannot help but see until their enlightenment is extended to account for their ultimate or religious concerns.

The primary point of this paper is to show that now there seem to be dawning in the recent pictures of man and his relation to the "ultimate reality" as portrayed by the sciences a clarification and substantiation of the basic insights of the great religions, but with much more concrete detail and evidence. It is this synthesis to which I give the name "scientific theology."

It can be noted that the paradox of selfishness versus altruism, like all paradoxes, is resolved not by forever restating them to show the obvious contradictions but by presenting a more adequate frame of reference within which the antinomies disappear. The paradox of

how I can be altruistic and still respect myself sufficiently may be resolved by noting that looking out for "number one" becomes altruism when number one is reconceived in the dimensions of the larger self, sometimes called soul, which is more than the body and which extends in time and space to embrace a larger part of the domain of the reality that is "my" life system—a domain that includes my nongenetic "brothers" in society. The ancient religious hypothesis of the soul dwelling in the realm of the gods makes new sense when we take it as a real entity also revealed by the scientific pictures of living systems.

In the scientific picture, man's "common sense" is generated from a genetically programmed system of perceptions of a self operating in a world. The commonsense picture is obviously only a small part of the total reality. It is an awareness adequate enough for guiding animal life or human life in early childhood or in primitive societies but quite inadequate for the expanded consciousness of civilized man. When the expanded consciousness of civilized man puts before him the image of his own demise as the demise of all that is meaningful to him from the perspective of his common sense, he cannot accept it. Nor can he gladly accept any threat that would diminish the self that he holds sacred. Because genetically programmed, commonsense consciousness of self cannot be selected to provide the information even about the true self's immortal *biological* significance in its gametic contributions to the sacred gene pool and ecosystem of advancing life forms, it has become necessary with the advancing of knowledge in cultural evolution for the culture to provide the expanded vision of one's own reality beyond the commonsense level. For an adequate scientific as well as religious picture, it now turns out that a superficial view of the bodily life of a particular phenotype is only one small part of the significant totality of a man. Who I am, my identity in the real scheme of things, is a concept that must evolve in consciousness through an advancing system of cultural information.

For the religious saint, it is a very *proper selfishness,* from the perspective of his larger soul, to strive to serve that soul (which includes pertinent elements of the society of fellowmen and of the ecosystem in the sovereign creative process), even when that service might demand self-sacrificial altruism as it might seem from a perspective that merely sees the risk to the temporary bodily self. What seems a loss to the eyes of the unenlightened may be seen as a gain from the perspective of a redeemed soul.

In this context of a larger frame of reference of the more sacred dimensions of the self or soul which is to be preserved or saved, the threats to what now appear to be lesser aspects of the total reality

become of less concern. The promise or hope for the attainment of a higher and more realistic level of life outweighs the fear of the loss of the less significant aspects of the self to attain that end. Even ordinary common sense does not fear the loss of the fingernail clipping.

This picture also helps further to understand the relation of freedom to responsibility discussed in the previous section. The freedom (the power or capacity) of man to act so as to protect his true life against the forces (internal and external) that would destroy it is, by the vision of the larger self, transformed from a selfish aggrandizement of a too narrowly conceived self to a responsibility, duty, and purpose to serve the welfare of the "brothers" in the society with which the "soul" or larger self is identified. This *freedom* is in fact *determined* by this vision, just as the *freedom* of animals readily to procreate and die (apparently "willingly" or even "gladly") in the program of finding better adaptations for their species is *determined* by the information in their genes interacting with their circumstances. At the level of those who "dwell in the kingdom of God," of those whose vision of the self is thus transformed, altruistic service becomes a responsibility to the self that comes naturally.

My argument for the religious programs for salvation is based on the view that the newer scientific pictures of man's role in the scheme of things provide new evidence, only a part of which I have presented in this paper, that the general form of the traditional religious solution is better than most recent semiscientific schemes, like those of Marx or Freud or welfare societies. The main problem with the religious visions is that they have not been translated sufficiently into the scientific world view to be credible and effective, and such a translation thus becomes our primary task.

In sum, we can now understand scientifically how the traditional religious or sacred aspect of cultural evolution has provided man with the unprecedented privilege of being a free or independent and yet a social animal, with a way of understanding himself and his relation to his creator and his fellowmen that allows him not only to be altruistic but to be unabashedly aware of the finitude of his bodily self to the degree that is enabled by his new awareness of the larger, true nature of his being in the perspective of the everlasting kingdom of the ultimate "Lord of History." A restored religious belief in man's true and ultimate concerns could indeed provide the motivation for his long-range goals that Heilbroner and others say he must have.

Natural Selection and Human Salvation

The fourth and last question to which I promised to respond was: "Even if we found a religious faith that could survive in the light of

modern science, that would provide as much freedom as we want, and that could motivate devotion to the long-range future, would not such findings exemplify more the characteristics of human engineering for this-worldly human benefits than the operations of some 'ultimate reality' or 'Lord of History' implied by traditional religions?"

We cannot expect a single symposium or issue of *Zygon* to provide adequate answers to all the problems involved in the hypothesis that a worldwide religious revitalization, enabled through a newborn and worldwide scientific theology, will deliver us from the evil that Heilbroner and others say we face. For scholars of religion or devout believers and institutional leaders, as well as for secular or humanist skeptics, I must make clear that this salvation stems from a program in the realm of the ultimate reality, which transcends the ordinary realm that man's mind naturally or readily perceives. The term "supernatural" has been used to designate this realm.

Wallace wrote that "it is the premise of every religion—and this is religion's defining characteristic—that souls, supernatural beings, and supernatural forces exist."[88] According to him, religion involves recognition of "a power apart from that at the disposal of muscles, brain, wind, fire, and other tangible physical sources of energy," a supernatural power.[89]

At the beginning of the section "Religion's Role in Cultural Evolution" above, I have already quoted Wallace's observations on the efforts of religions to make their myths or beliefs "*true* descriptions of a world system" (my italics) and the fact that they "invariably appeal to experience for validation." In this, Wallace has portrayed a real kinship between religion and science. Another distinguished anthropological student of religion, Clifford Geertz, has noted that operative religious beliefs must be and are clothed "with such an aura of *factuality* that the moods and motivations seem uniquely realistic."[90]

I have already in previous sections provided some grounds for the scientific picture of human destiny as completely determined by forces entirely beyond man's control, quite superhuman. These forces are entities in a realm of scientific conception sometimes many stages removed from the ordinary, commonsense realm that man's mind "naturally" perceives and in this sense are indeed "supernatural."

I have suggested above that such terms as "metaphysics" and "supernatural" actually connote this realm already penetrated by the conceptual system of physics to describe reality or nature at higher levels of abstraction than ordinary sense perceptions. Thus the language of modern physics has in places already far transcended medieval or ancient metaphysics in establishing levels of conception

and analysis that transcend everyday experience and yet are logically and practically useful and validated by chains of evidence rising from everyday experience.

It is this last which distinguishes modern physics from traditional metaphysics and gives modern physics its credibility for statements about entities in the realm of reality beyond everyday experience. The miraculous applications of applied physics in electronic, biological, and other technologies have made "science says" the synonym for "truth." If the term "supernatural" is thus translated, I think we shall have little trouble in finding ways to link scientific and religious truth.

I have also shown that in this realm of scientific analysis it turns out that the essential core or true reality of human nature (man's "soul") is also describable in scientific, "super-natural" language.

I shall conclude this section with a brief extension of the argument that the nature of the system of entities and forces portrayed by the sciences is the modern equivalent of the realm of God or ultimate reality of the higher religions and theologies, with characteristics very close to those of the monotheistic God or ultimate reality of certain of the traditional high religions.

But first, if religion is, and has been, speaking significantly about the ultimate nature of reality, about the ultimate or long-range concerns of man, and about his salvation through a proper relation to the reality system, we may wonder why religion has been withering in an age of science, whether it has any real role in the future, and, if so, what role.

Religion's Role in the Future. In contemporary society there is such a prevailing skepticism about God and soul, and such a discounting of their reality, that religions have been rapidly losing their essential power as valid truth for guiding human attitudes and conduct. If the "enlightened" or educated man understands God as an illusory projection of human imagination, as Freud put it, or understands the reality of the soul and the supernatural as a deceptive propaganda to provide an opiate for the control of the suppressed masses, as Marx suggested, then religious belief is indeed a salt that has lost its savor. Educated or enlightened persons today, including many theologians, tend to think that the notion of a real God is dead. The great religious wisdom embodied in the concept of a soul is also faded. Even the bereaved and their hired servants at funeral rituals often seem not to experience the religious wisdom that the soul, the true core of the self, has not died.

Furthermore, even the scientific scholar of religion, such as Wallace, tends to think of religion as having a very limited future just

because of the incredibility of its reliance upon the "supernatural" in the context of scientific knowledge that seems to show that there is no such thing: "The evolutionary future of religion is extinction. Belief in supernatural beings and in supernatural forces that affect nature without obeying nature's laws will erode and become only an interesting historical memory."[91] Such is the common academic, informed attitude toward religion. Certainly, religion seems to be dying all over the world, beginning in the enlightened minds and gradually following their lead down the chains of communication in sociocultural systems. The reason for the resistance and exceptions to this rule will become clearer in what follows.

Does religion really make a difference? Is it really something significant for the future? Here it is important to note that we have not been talking about particular parochial forms of religion and that we are not asserting that human-value cultures or religions are any more perfect in the information they transmit than is the biological gene pool. We have already shown how all real harm to or inviability in living systems (including unadapted subsystems, even harmful religions) is sooner or later weeded out by nature's selective processes. There are religious institutions that are not very effective, that even do more harm than good, in the values they transmit; there are also religious institutions which are quite ineffective in transmitting values at all; some have lost their credibility and thus their capacity to communicate anything; but all these are dying. What seems clear from any realistic and scientifically based analysis of human evolution is that cultural institutions during the past million years have increasingly been involved in providing some of the information on the basic values necessary for human life and that these are properly called religious. Since it is clear from the genetic picture that it is not the genes alone that make man a social animal (beyond the close family), we have sketched how in cultural evolution there have developed a new unit or phenotype called a sociocultural system and a corresponding "seed" or cultural-information pool, particular samples or seeds from which ("culturetypes") shape or inform that societal phenotype.

Selection is the name of the process by which certain discernible patterns or *units* attain the *information* (boundary conditions, negative feedbacks, habits, or memories, etc.) that, under the *nature* of the conditions that exist, do in fact produce patterns of matter-and-energy flow that are stable. In the actual world, selection produces a hierarchy of levels, progressively moving up a ladder of increasing complexity and adaptation to wider ecological niches (greater freedom for living under more diverse conditions), each level further removed from the thermodynamic equilibrium of the previous level.

In living systems the *units* are open systems of energy-matter flow far from thermodynamic equilibrium.[92] Hence *societal structures* are *selected,* or remain in being, insofar as they contain the effective information that shapes the behavior of their constituent parts in such ways as to remain in being as a metastable pattern of energy flow in its environmental setting. Not only have religions done this, but their successors in this function today (under whatever name) are as essential as ever to supply the information necessary for *Homo sapiens* as genetic primates to be civilized.[93]

Under such a picture, we must understand that even with the diminishing impact of some elements of religious traditions there are equivalent functions being carried on within each extant society. It is important in this connection to recognize that evolution has at all levels tended to select and incarnate in each species of life several lines of reserve information to maintain living structures under the inevitable periods of stress and transition that *nature* itself presents. There is usually more than one instrument to carry on sacred or essential functions of living systems. There is more than one seed to shape the next generation and more than one cell in a brain to remember and communicate vital information for future behavior. Human societies are such living and very complex structures, wherein many subtle, diffuse, and often unnoticed mechanisms in the sociocultural mores see to it that sacred values are not swept away by sudden changes.

Moreover, we know that the human gene pool has itself adapted to the new ecological niche of *Homo* as a symbiont with a sociocultural unit of his fellow creatures and that the totality of the brains in any sociocultural system is indeed, at certain significant levels of enculturated information (such as languages and values), structured as "identical twins" or "cells in an organism" by essentially similar information and values. And we know that the varied samples of unique genetic information of the component individuals are adapted to this symbiosis with a single sociocultural unit, such as through special brain structures required for human language and through special motivational systems that produce tendencies akin to the "imprintability" of more primitive animals—in man, tendencies to "suggestibility" and to "other-directedness"—to avoid conflict with their social group, even though this group is not constituted of close genetic relatives. As implied in my quotation from Hoagland at the beginning of the section "Ancient Biological Roots of Religion" above, there are indeed genetically programmed tendencies that may properly be called "religious instincts." In the context of certain experiences these integrative tendencies of the brain produce primitive or beginning "religious experience," the religious and mystical feelings of awe and fear that

the self and what it values will be lost in a world dominated by overwhelming powers that threaten. Such religious experiences are different in different individuals, according to their genotype and circumstances. The ultimate solutions, however, for any individual and any group or society of them come when unconsciously or consciously generated integrative patterns adapt or convert the individual's perceptions of himself to a reunion with the supreme powers of the real world. This integration necessitates some transformations of how the individual understands or perceives his own nature, the nature of the dominant power system, and the relation between them. Since all brains are genetically endowed with this need to make good sense for self while adapting to the ultimate powers dominating reality, we can say religion is genetically programmed, permanently necessary, and will always appear among men in one form or another. Because the very life of the self is at stake, critical religious experience is one of tremendous stress and relief. Tremendous anxiety or fear is replaced by hope, joy, and often ecstasy when the key to the self 's salvation within the realm of the transcendent powers is found.

Such genetically programmed needs and capacities in the brain for finding new, more adaptive perceptions of a viable relation between the self and the ultimate "powers that be" provide the "environmental constraints" or "information" at the genetic level that have engendered the evolution and development of religions through several stages of cultural evolution. But, as in the case of the genetic grounds for language, the genes do not specify the solution—the particular ways of perceiving and behaving that are adaptive or maintain the self 's ultimate concerns. These religious perceptions, when discovered by one individual in an intercommunicating or cultural community, rapidly spread from the discoverer to the whole community in ways akin to any technological information from stone tools and fire making to religious ritual and myth.

Thus within a sociocultural system there are, in addition to pressures and guides for religious life from the genotype, also pressures and guides from the culturetype. These cultural environmental constraints or informing patterns also are built into sociocultural systems at the level of purely sociocultural heritage. This heritage carries, in many subtle and often not yet well understood or analyzed forms, the information that transmits the whole hierarchy of earlier as well as later stages of cultural cumulation of man's proper relation to the ultimate powers that be. It also carries a corresponding pattern of how the individual is to perceive his own true nature ("soul") as not limited to his "natural" or genetically programmed perceptions of his

body and to perceive his soul's true relation to the ultimate powers, which are not limited to his "natural" or genetically programmed perceptions of his environing world.

These new perceptions of self and world are in this sense "supernatural." But, translated in modern scientific language, this "supernatural" still means the more truly real, the "real" for whose discovery in our day physics has replaced the earlier metaphysics. But the earlier stages of the culturetype, more connected with the information inherent in the genotype and its interaction with the environing forces, always underlie and undergird the stages of philosophical metaphysics, theology, and science. Our languages are infused with the ancient myths and earlier rituals that gave them meaning. Our farthest-out scientific concepts are tied to our basic organic and neurophysiological modes of sensing.

Thus religion is inescapably built into human nature. Like habits painfully learned in childhood, such as walking or riding a bicycle, religious wisdom fades into habit and we may even be unconscious of it (forget it) when all is going well. Nevertheless, it is the wisdom of this earlier heritage of information cumulated in our genotype and culturetype that is the source for the fact that all is well. The full understanding of man requires us to remember or rediscover this basic fact of our nature: that a whole system of genetic and cultural heritage is required for us to adapt to the ultimate realities—that is, to be saved or enter the kingdom of God or whatever may be our accustomed name. Salvation or the safety and well-being of what is really sacred or of ultimate concern for us as living beings is the most basic or general formulation of what it is that is selected in our nature. Religion, as the sociocultural cumulated wisdom for salvation, cannot be bypassed.

At the wave front of expanding evolving systems of ever greater complexity, however, the already established information in a culture is never enough, never an adequate adaptation to the always arriving new conditions to which the systems must adapt. Religious traditions are no exception, and, as in ancient biological programs for metamorphosis and genetic recombination, superficial or last-established levels of structure or information begin to break down to be reassembled in new patterns for the next stage of life. I have noted that since the Renaissance and the rise of modern science this has been happening in Western religion and that we now appear to be at the beginning of an axial period more extensive than that of some twenty-five hundred years ago.

But we must not suppose that all the necessary structures of culturally accumulated values and their transmission are completely broken

down or that new thrusts to replace or repair them have not been made. Various subtle elements of influence of prior stages continue to be operative. One of these is what Robert N. Bellah has called "American Civil Religion."[94] Although the United States was in part established under the philosophy of the Enlightenment with its anti-Christian revolt, it was also done in the context of the religious colonization of the Atlantic seaboard of North America. There was thereby created an historic, new, and officially independent relationship between church and state as these two cultures operated together to shape the lives and patterns of a most remarkable society. Bellah shows how, nevertheless, the ultimate character and support of the state rested upon the religious convictions still permeating the population.

Sidney Ahlstrom has, in a different and much more detailed way, shown the basic religious underpinning in the establishment and continuation of this nation and joins Bellah in ascribing its present weakness to a decline in the spiritual nourishment of its population.[95]

As already pointed out, Kluckhohn and many other scholars as well have indicated how fascism, nazism, and communism—like the older politico-religious states—are political movements that require and do involve religious rituals and myths for their authentication in the minds of the populace. It is such a totalitarian, politico-religious system that Heilbroner fears and which, according to our theory as well as his, must come to pass as certainly as a vacuum will be filled, unless some better alternative is supplied.

Very prominent institutions in contemporary American society, but not commonly perceived as essential religions propagating rituals and myths or belief, are the popular arts embodied in novels, magazine stories, motion pictures, and television programs, including the advertisements. I suggest that these are the major religious institutions of the American twentieth century, saturating the population with daily rituals and myths for human salvation. The fact that they are often not very closely connected with traditional biblical symbols in no way lessens the reality of their religious function. They, too, are a part of the necessary reaction, as some of the more "rational" theologies and religious symbol systems atrophy. The TV "theology," its intellectual substance, is largely derived from the general secularized faith of post-Enlightenment intellectuals of the West. This faith is also formulated in and propagated by the universities, where the "humanities" subculture has for C. P. Snow taken over the value-transmitting function of what in our longer, historical perspective is generally called religion. The faith of this presently regnant religion is dominantly a humanism, in which man is perceived to be himself, alone, master of his fate and determiner of his destiny, whose every private wish can

be fulfilled by a technological fix—which this century's history is teaching us is a kind of fool's freedom and paradise.

Nevertheless, even in this degenerate religion now regnant in the media, man's sinfulness and his need to reform and be a "good guy" are perpetually propagated in endless rituals and myths, even though there is no explicit or convincing theology to explain why goodness will in fact pay off. These secular religions now lack this virtue of Christian theology with its sovereign "Lord of History," who would inescapably judge men, and reward or punish them, even when society or the state could not. But the point I wish to make is that, nevertheless, there exist partially true and partially effective forms of religion at the popular level. Their message concerning what is good and evil, saying good will be rewarded and evil punished, is widely heard and statistically sufficiently confirmed in experience to generate at least for a time a tolerable level of morals and morale, even if it is not the clearer vision of true reality necessary to inspire a level of meaning, hope, and joy required for participating in the higher levels of the ecological niche or realm now offered man by the "Lord of History" in an age of science and scientific technology.

The True Lord of History. The fact that in the long run technological fixes and popular, commonsense desires and ways of life cannot persist unless they are in accord with what is required by the Lord of History—the real nature of the total ecosystem (both internal as well as external to man)—means that spiritually unenlightened, merely human-desire-oriented, technological fixes are doomed. This is the message of Heilbroner and many other high-level intellectual interpreters of our times. Hence we have the fact that merely man-oriented sociopolitical institutions cannot save themselves by lifting themselves by their own bootstraps. This has become manifest in the weakening of the integrity and virtue of Western civilization. Perceiving this, existential literature has produced a widespread, prophetic judgment suggesting that these hedonist, humanist myths are false and that man is without meaning, even absurd. I would view these skeptics of humanist hedonism as harbingers of a move toward a more solidly based "theology," one where man's meaning will again be found grounded in a credible reality that is transcendent to man.

So, societies whose value structures are changing, like organisms undergoing metamorphoses, are protected by various complementary mechanisms from radical dissolution and total loss of the sacred memory of what was good and proper to do in order that there may be continued life. This protection applies to the more sacred and social-gluing moral values during periods when religious institutions

seek new adaptations to new conditions. It provides some degree of grace of time to discover the errors of our ways and to discover and adopt more suitable ways. The mechanisms include dynamics to produce such reforms and new adaptations.

What this picture means is that man need not worry too much about his fate or his society merely on account of the fallibilities in himself or in his fellowmen or worry too much about the consequent, relatively weak condition of his sociocultural system. The reality picture from the sciences, as from traditional theology, is that man is neither the designer nor the determiner of the ultimate destiny of either himself or the cosmos. He is a creature whose viability is a grace given by the information, already accumulated in the genetic and cultural reservoirs of *Homo sapiens,* about the evolving nature of the cosmic scheme as it operates here on earth insofar as its requirements for life are concerned. Our life and destiny may be scientifically as well as religiously hypothecated to be fully determined by the only partially understood operations and trends of that vast, omnipotent system of the *nature* that created us, shaped our societies, and even shapes what we are thinking and feeling and willing at this moment. At least the possibility of explanation, and hence this basic hypothesis that events are "caused," is the faith implied by the scientific community as it continues to search for and find ever fuller even if never ultimate "explanations."

Admittedly, the scientific community does not and cannot have *ultimate* explanation. Of this its leaders are quite well aware.[96] But the basic aims and presuppositions of science imply no limit on the phenomena of our experience that can be shown to make sense or be explained. Otherwise there would be no point to scientific research, and the expansion during the past century of our power to explain ourselves and our world would not have been undertaken, nor would it have been successful.

Hence, for the scientific community, there is presupposed a system of reality that far transcends man, which is in fact determining the destiny of the cosmos and of man within it. For most of my scientific friends, who have been examining man through many disciplines from anthropology to zoology, the most complete and most useful set of entities and dynamics ("ontology," "philosophical cosmology," "metaphysics") for understanding are those elaborated in the natural sciences to describe cosmic evolution all the way from the most primitive particles to the most complex structures of human mind, behavior, and society. While the scientific entities and laws for explaining man may always be insufficient, most of this community is per-

suaded that any filling of the gaps will best be done by extensions and modifications of the scientific conceptual systems or paradigms.

Furthermore, provided we could believe that the scientifically described cosmos was concerned about us, we could adopt even a Skinnerian scientific determinism about human behavior, as easily as we do about mechanics of the world in general, without being upset. We would then find ourselves not far from some traditional religious hypotheses of God's absolute sovereignty.[97] I am suggesting that a translation of the gods of religions into the determining forces of the "nature" or universe that the sciences reveal will prove to be the best way to recover and make effective for contemporary man the wisdom still embodied in those ancient traditions. Moreover, I am suggesting that such a translation could provide the necessary reformulation of that religious wisdom to make it more pertinent for the new, worldwide sociocultural system being forged under scientific technology. I believe that the time is fast approaching when scholarship, both scientific and religious, is becoming aware of the possibility and the necessity of some such scientific theology for the salvation of the species.

If we understand the "nature" described by the sciences as the system of laws, according to which events in the history or evolution of the underlying reality system proceed in time, which, together with the given or "initial conditions" and the "hidden relations" or "preferred configurations"[98] of the reality system, explain (as far as man can explain it) the varied history or evolution of the universe and the living systems (including human minds and societies) in it, then we do have a concept akin to the ultimate reality or God of the high religions. It possesses the aseity (absolute self-sufficiency), omnipotence, and other traditional attributes of God that make it natural to speak of a "Lord of History." I have argued this logical isomorphism of nature or natural selection and God in a number of papers.[99] Here my argument is not merely theoretical but for showing the way to the practical salvation of mankind from the doom and impotence portrayed by such careful prophets as Heilbroner and increasingly felt in a world fast becoming religionless, where all the old gods are fading from men's minds.

The Role of the Soul in Salvation. This Lord of History revealed by the sciences does indeed make it as difficult for us to understand moral responsibility and freedom as do the more traditional theological concepts of God as the omnipotent sovereign who predestines all. For this we need understanding of the nature of freedom and deter-

minism and their relation, such as I have already outlined in the section "What Is Man's Freedom?" As we contemplate man's fate under such an omnipotent Lord of History, I wish to accent a point long known in religion. The religious, like the scientifically based solution of the freedom-determinism paradox, has required the recognition that *man is never separate from God.* In the scientific picture, man is a creature of nature, a phenomenon of dynamic flow completely dependent upon the boundary conditions set up by an ecosystem's evolution over billions of years of the natural dynamics of the earth. Apart from this all-embracing nature, which also is the substance within and flowing through him, man is nothing. This is tantamount to the religious concept that man is God's creature and in no sense independent.

In the sciences the information in the gene pool of a species has been referred to as a reflection or image of the ecosystem's history and the present ecological niche. This is quite parallel to the biblical concept that man was created in the image of God. Whether in an ancient religious view or the modern scientific one, the logic of man's freedom becomes clear. As a creature and agent of God or nature, incarnating in more advanced form than any other creature on earth the information on how to maintain and advance living systems, man is endowed with the freedom (as power) to maintain life under otherwise very improbable or adverse circumstances. But this power forever depends on man's continuing to embody the information which is the will of the Lord of History, the requirements of the total reality system of which he is a part, as its manifestations for man's life evolve in time or history. If by mistake man deviates from any present manifestation of the system of his boundary conditions, he ceases to exist. Man cannot be separate from nature or from God thus understood.

Under this same genesis or evolving system of boundary conditions, man is responsible for life in two major senses, simultaneously. In the first sense, he has already built into him, at genetic and cultural levels, the homeostatic programs and norms to do what is good for the life of his ecological niche, which includes himself, his fellowmen, and the larger ecosystem on which he is dependent. So long as it remains a program which is that of the Lord of History as well as his own, man's advanced program gives him a certain dominion over himself and other species and elements of nature. However, if in his cultural or private lapses and errors he begins to deviate from the norms set by the Lord of History, he only diminishes rather than succeeds in enhancing himself.

Narrow is the gate and straight is the path that leads to the realm of

lasting life. It is a path (complex set of boundary conditions) designed by nature and not by man. Man lives only by virtue of God's original and continuing grace and by man's continuing in his conscious and cultural patterns to embody the law or evolving requirements of the Lord of History. One could say that the success of selection by the "lower courts" of judgment or choice by human individual and social decisions forever depends on those decisions being in fact synonymous with the laws and preferences manifest in the "supreme court" of nature's judgments or selections—the Lord of History. To speak of freedom or separation from God or nature is a meaningless bit of language. Man's already realized freedom and responsibilities are engraved in his heart (genotype and culturetype) by the Lord of History.

In the second sense, man's freedom and responsibility, the freedom to differ from the norm, to explore and try out new and as yet uncertain or random ways, as we have seen, is also ordained by nature or the Lord of History. It is in the context of the conscious perception of this kind of freedom that the problem of evil arises, the problem of the obvious unadaptedness of present information or rules for life under the new and different circumstances into which a living system is moving or evolving. It is in this context of continuing evolutionary progress or adapting that death of present systems and birth of new and better ones necessarily arise. "Evil" is the name for what man's consciousness presents to him as an existing or potential pattern of the life system (self, fellow creatures, environment) that has or will become destructive of whatever it is that is good. As a first approximation, good is usually identified with what is conducive to life and evil with death. If the death of the body were recognized as the end of the true or real self, it would be regarded as evil. In this context, the great religions developed theodicies or ways of justifying the simultaneous goodness and power of the supreme being in spite of the obvious existence of evil.

The religious and theological solutions are the myths and doctrines of the human soul that arose to clearer formulation in the great axial period of religious reformation some two thousand years ago more or less. The particular imagery or formulation—such as the resurrection of the body, transition of a soul to another realm or world, or transmigration of soul to another body—is not important except for purposes of coherence and credibility within a particular culture. What is important is the basic notion that the true self is something much more than the present phenotype, whether of the individual body or of the "city," the sociocultural system. The distinction between body and soul or between the present world, city, or kingdom of man, and

the real, true, ultimate city or kingdom of God—to confine ourselves to Western culture—is what is important for resolving the problem of evil and of God's goodness as well as omnipotence.

In the logic of this hypothesis about the reality of God and man, a hypothesis or perception that has on countless occasions sent the imaginative mystics who first perceived it and many of their followers into ecstasy, it becomes clear how God is both just and sovereign since the significant or true reality of man's life is an inseparable element and agent of God, with dimensions that far transcend those of the present body or city of evil—incompletedness. The paradox of evil evaporates just as does the paradox of the direction of a star from the earth being in the west for one observer but at the same time in the east for another when it is explained that the observers are on opposite sides of the earth. In essence the doctrine of soul and man's inseparability from God is one with great scientific hypotheses that resolve what was hitherto a riddle or paradox. Since God is omnipotent and since man's true soul or being is one with God and since God's program of evolution is indeed the ultimate reality, then all is well.

In due course all wicked and evil (nonviable) ways will be selected out of the picture by the omnipotent God (nature's requirements for viability or being). The errors of the present phenotype (whether an individual person or a community in a sociocultural system) will be washed out, selected out. In the kingdom of God all error is cleansed and forgiven, and the true and corrected patterns of the true self or soul will forever flourish under the judgment and grace of the sovereign Lord of History.

I submit that the scientific pictures of cosmic evolution, including human evolution, essentially provide religion's picture. Moreover, they reveal new and concrete evidence for the credibility or reality of the significant or true elements of man's nature as transcending his present phenotype. A first phase of the immortal substance is already established as the core reality of a species and the individuals within it. It is known to have had a life of a billion years so far and to be a natural product and concomitant of earth's evolving ecosystem. I have been in this paper outlining a second phase of immortal substance underlying human nature, the cultural pool, with its life measured in terms of millions of years so far. The third major element in the human soul is what I have in other papers called the cosmotype, and this is the remainder of the total system of reality or nature or God, depending on what language one finds most useful. This remainder is not really separable from the first two phases that I have named and in long time spans actually is seen as their source.[100]

It is interesting to note that the problem of evil arises with eating of the fruit of the tree of knowledge when culturally engendered information presented a brain with information about future dangers to the body (including death) for which genetic information had not provided and cannot provide any proper responses. This kind of information about basic realities has to be provided to man through his culturetypes. It is the religions that have been doing this particular job, providing him with essential information evolved in the culturetype about his true nature or soul and its relation to the ultimate reality governing the world. The present moment of cultural evolution is, I repeat, the time for a basic religious revitalization, under a scientifically informed theology, of this sacred truth.

We may very properly say there is a plan or, more exactly so far as our knowledge is concerned, there is very probably a series of future stages of adaptation in which all those in the human community are privileged to participate. They are stages which are inherent in the scheme of things even though men may not yet perceive what they may be. The ecosystem of the earth may be said to be a useful new symbol of the Lord of History, especially if we include in the ecosystem its living components, including everything that is true about the human species, which good ecological language is careful to do. This incomplete religious and scientific vision of the scheme of things is not equivalent to the ultimate reality of God or of the ultimate nature of the system of the cosmos but is ultimate enough to guide man's conduct in large measure in his present stage of evolution.

It may be recalled that theologians have included in their images of God not only human nature but a "first person" which is the almighty creator of all that is, and this brings our attention to the immutables of the total ecosystem which is our current vision of the total system defining what shall be, including the sacred elements of our life. Too much emphasis on and pride in the human aspects of God, incarnate in man, and too little regard for man's continuing need to adapt to, or reverence, the ultimate requirements of the total reality system are what is bringing Christendom and Western civilization to their knees. Mircea Eliade has for years been pointing to our loss of sensing the sacrality of the world.[101]

However, the picture of the absolute sovereignty of a transcendent creator and sustainer of life which operates in every event of the world and whose requirements for life cannot be in the least altered or escaped by men—a fact which we can read from the determinist pictures from the sciences perhaps even better than we can today read it from the ancient revelations—does not in the least remove us from its grace. The revelation of the scientific story of creation, like that of

religion, is that, if we are interested in further adaptation to the requirements of the Lord of History, we have further opportunities for a larger realm of life.

Furthermore, this picture assures us that, even though we are constrained by the very nature of our inbred responsibility as God's agents within sociocultural systems to do whatever may be within our power and role to rectify and redeem the world, we do not have to fear that the failures of our fellowmen will utterly destroy the marvelous life system God hath wrought. The best, in fact in the end the only, way to redeem the world is by our continuing to act as God's agents to provide better information for our larger self, including our "brothers" in our society. Theologians may call this the bringing of light for life from the divine word. Attempts to force by superior "this-worldly" power (political, military, etc.) a superficial conformance to our particular view of God's truth is possible only for some short-term effects that may in fact delay long-term salvation.

Salvation is in the end man's continuing search and discovery of the next steps in the unending staircase of the "preferred configurations" in the "hidden strata of stability, one above another . . . in our universe [which] the evolutionary process climbs . . . one by one."[102] These are the realities of the system of nature, of the Lord of History. The evolutionary process of billions of years of discovering (by chance or design), internalizing (remembering), and acting out (expressing) this truth of nature's design for life is salvation or eternal life in God's kingdom.

Since man's true nature is more than his body and extends on threads of unbroken "information chains" (genetic, cultural and other) in time indefinitely into the past and future and in space indefinitely into the total ecosystem of nature (God's realm) in which we live and move and have our being, we are given a fresh interpretation of man's being created in the image of the cosmic reality system itself. His genetic and other heritages directly reflect nature's conditions for the most complex patterns of life on earth. This is a new interpretation in the light of contemporary evolutionary theory of the ancient religious formulation that said man was created in the image of God.

The basic program of religion and religious reformation, then, is to continue in God's service as agents to maintain and to reform the information system on what is essential or ultimately necessary for life. It is a continuation, at a new level, of the project of building the various gene pools and other ecosystemic information that shape the viable patterns of life on earth. At the level of present human culture, the task or purpose of man is to transmit viable cultural patterns by

internalizing the proper information or truth for the sociocultural systems of man. This involves information for maintaining a proper balance in all the hierarchy of levels required for the earth's ecosystem. This information must be enculturated in all human societies.

For enculturation in human societies—with all their diverse levels of ages, education, and genetic endowments—it requires continuing reinforcement programs from the most elementary rituals through the most sophisticated scientific theology. It should be carefully noted that a scientific theology is no more and no less necessary for a population that would live in the "kingdom of heaven" (symbol for ultimate reality for life) than is the science of a medical technology for a population that would be healthy. Only a few persons in ten thousand need to be consciously aware of the full scientific details involved in certain medical inoculations; but without them health for millions would be impossible. The same is true for effective religion in the modern world.

I think that the scientific pictures of man's evolution are very close to some of the best wisdom of the great religious traditions and particularly close perhaps to the religious tradition out of which modern science blossomed. And it is my view that the omnipotent processes of the cosmos will continue and that men will be brought to their senses, will reform their ways and adapt themselves to the requirements for life and ever more advanced life to which the Lord of History on earth has destined them. What we have been selected for by the Lord of History during the past billion years is our adaptability to far wider ranges of habitat and ecological niche than those of any other species. Now that we are becoming conscious that this same program continues in our own cultural evolution as well as in our individual development, the only concern we need to have can be said very nicely in ancient theological language: Seek God's will and enjoy him forever.

A scientific theology seems to be as firm as any traditional one ever was in saying that there is a Lord of History which is not man, and that man's salvation comes in recognizing this fact and adapting to or bowing down before the majesty and glory of the magnificent program of evolving life in which we live and move and have our being. It is my view that today the sciences provide not only better evidence than previous theologies for the reality of a sovereign and omnipotent nature that determines human destiny but also far clearer evidence that the essential reality of evolving human life involves much more than the phenotype and something more "inner" to man than his "gut feelings." Phenotypes are only the visible, rippling wave crests of increasing complexity, a complexity shaped as the earth rolls around the sun millions of times, to do wondrous things by a continually

growing phylogenetic "soul" that shapes successive phenotypic ripples in time, increasingly reflecting nature's ultimate designs in the true and everlasting but hitherto more hidden, glorious realm of the Lord of History.

I cannot here more than hint at how a new wave of religious vision, shaped by a scientifically informed theology, will free man from the errors of an illusory vision which causes him to see a limited view of self as determiner of its own destiny and to fail to see this causes him to fashion and wield ever more powerful, iconoclastic maces to cut and crush the inner and outer sources of nourishment for his life's substance. A recapturing, with new scientific authenticity, of the great religious visions of man's true nature as a creature elevated by the creator to conscious agency in the creator's everlasting program of new creation can again bring his culturally shaped goals into line with the ancient wisdom of his genetically formulated goals and into line with the ultimate requirements of the sovereign Lord of History for life of all kinds.

Man's salvation or health springs from the transcendent source of his being.

Die Natur ist der Herr von Vergangenheit, gerade der Herr Gott, und auch ewig ist der heil Bronn, zwar der heilige Bronn, von Menschen.

NOTES

1. Robert L. Heilbroner, *An Inquiry into the Human Prospect* (New York: W. W. Norton & Co., 1974).
2. According to an interview by Nicholas Wade ("Robert L. Heilbroner: Portrait of a World without Science," *Science* [August 16, 1974], p. 599), Heilbroner says: "The things I see in the future are all personally abhorrent to me. I am against religion, for science, a liberal social democrat or whatever. I find myself very much like the king's messenger."
3. Heilbroner, p. 136.
4. Ibid., p. 138.
5. Ibid., pp. 140–41.
6. Ibid., p. 140.
7. Wade (n. 2 above).
8. Heilbroner, chap. 4, esp. p. 122.
9. Ibid., p. 115; original quote in italics.
10. Interview with Wade (n. 2 above); Robert L. Heilbroner, "What Has Posterity Ever Done for Me?" *New York Times Magazine* (January 19, 1975), pp. 14–15. On the problem of motivating altruistic behavior see the quotation from an unpublished manuscript by Donald T. Campbell, in Ralph Wendell Burhoe, ed., *Science and Human Values in the 21st Century* (Philadelphia: Westminster Press, 1971), p. 144.
11. Interview with Wade.
12. Ibid.
13. Heilbroner, *Inquiry*, p. 137.
14. Ibid., p. 124; italics mine.
15. Langdon Gilkey, "Robert L. Heilbroner's Vision of History," this issue.
16. Campbell (n. 10 above).

17. See n. 10 above.
18. Ibid., p. 15.
19. Victor Ferkiss, "Christianity and the Fear of the Future," this issue.
20. Ibid.; italics mine.
21. Edgar S. Dunn, Jr., "Heilbroner's Historicism versus Evolutionary Possibilities," this issue.
22. Hudson Hoagland, transcript of his commentaries at the Institute on Religion in an Age of Science symposium, "The Human Prospect: Heilbroner's Challenge to Religion and Science" (Washington, D.C., October 23–24, 1974).
23. Gods-as-explanations-of-the-unknown is a common hypothesis, but the hypothesis is given a new illumination by recent hypotheses on necessary characteristics of the brain such as the "initial causal termini of strips of observed reality" discussed by Eugene G. d'Aquili and Charles Laughlin, Jr., in "The Biopsychological Determinants of Religious Ritual Behavior," *Zygon* 10 (1975): 32–58, esp. p. 55.
24. The way in which the meaning of "nature" in modern physics has come to cover the domain denoted by the term "supernatural" in earlier times is given some elaboration in my "The Concepts of God and Soul in a Scientific View of Human Purpose," *Zygon* 8 (1973): 412–42, esp. pp. 423–24.
25. For "initial casual termini" see d'Aquili and Laughlin (n. 23 above), esp. p. 47. The intertwined character of facts (what is actually perceived or observed) and hypotheses (or theoretical and conceptual systems) is widely recognized in the literature of and about the sciences (see Thomas S. Kuhn, *The Structure of Scientific Revolutions* [Chicago: University of Chicago Press, 1962]). A clear source for nonscientists would be Henry Margenau, *The Nature of Physical Reality* (New York: McGraw-Hill Book Co., 1950), or Richard von Mises, *Positivism: A Study in Human Understanding* (Cambridge, Mass.: Harvard University Press, 1951), or Karl R. Popper, *The Logic of Scientific Discovery* (New York: Basic Books, 1959). Popper says: "We may distinguish within a theoretical system, statements belonging to various levels of universality. The statements on the highest level of universality are the axioms; statements on the lower levels can be deduced from them. Higher level empirical statements have always the character of hypotheses relative to the lower level statements deducible from them" (p. 75).
26. In this account of brain functions I have perhaps gone beyond that given by Paul D. MacLean in his "The Brain's Generation Gap: Some Human Implications," *Zygon* 8 (1973): 113–27. I draw on a number of other researchers and admit that *all* details for such a picture as I have presented here may not be in the literature as fully established yet, although I believe there are sufficient areas of evidence to make it quite probable. It is also necessarily an oversimplified and popularized picture.
27. R. W. Sperry, "Science and the Problem of Values," *Zygon* 9 (1974): 17.
28. Ibid.
29. Ibid., p. 9.
30. MacLean, p. 115.
31. George C. Williams, *Adaptation and Natural Selection* (Princeton, N.J.: Princeton University Press, 1966), p. 95.
32. Ibid., p. 96.
33. Ibid., p. 93.
34. Ibid., pp. 93–95.
35. Ibid., pp. 120–21; italics mine.
36. Theodosius Dobzhansky, "Ethics and Values in Biological and Cultural Evolution," *Zygon* 8 (1973): 261–81, esp. p. 276.
37. Alfred E. Emerson, "Dynamic Homeostasis: A Unifying Principle in Organic, Social, and Ethical Evolution," *Scientific Monthly* 78 (1954): 67–85 (reprinted with some changes in *Zygon* 3 [1968]: 129–68). A committee of the American Academy of Arts and Sciences in 1960 brought together a few dozen pioneers to assess the relation of theories involved in biological, social, and personal development, some of whose papers were published in the Summer 1961 issue of *Daedalus* and in 1962 by the Columbia University Press as *Evolution and Man's Progress,* ed. Hudson Hoagland and Ralph Wendell Burhoe. *Zygon* contains numerous papers by many authors on this topic.

Theodosius Dobzhansky in *Mankind Evolving* (New Haven, Conn.: Yale University Press, 1962) provides a good summary in his first chapter on cultural and biological evolution.

38. Konrad Lorenz, *On Aggression* (New York: Harcourt, Brace & World, 1966). The original title in German is a better characterization: *Das sogenannte Böse,* which might be translated "The So-called Evil."

39. d'Aquili and Laughlin (n. 23 above).

40. The phenotypic diversity of genetically homologous (identical) cells in an organism has to be accounted for by information supplied by the environment and is thus analogous to a primitive level of "culture." Williams (n. 31 above), pp. 223–34, discusses cellular societies of possibly diverse genotypes where "cells that cooperated in the formation of these 'somatic' structures sacrificed themselves." But he indicates that either close genetic relationship or proportional representation in the spores must be and probably is the explanation. Brian C. R. Bertram ("The Social System of Lions," *Scientific American* [May 1975], pp. 54–65) describes a similar problem in the organization of prides of lions.

41. I have long relied on the writings of Emerson (n. 37 above) and general biological texts for this area, but, as I write this, I am informed about a publication by E. O. Wilson, *Sociobiology: The New Synthesis* (Cambridge, Mass: Belknap Press, 1975), which I believe will be of central importance for this field. Williams (n. 31 above) deals with genetics in insect societies in his chap. 7.

42. Williams, esp. on pp. 96–97, calls nongenic changes "biotic evolution." In my descriptions of the non-DNA mechanisms of changes in time I use "information" as a term to describe *any* set of forces or "boundary conditions" which shape or form and thus explain the interactions. The notion of "information" as a "boundary condition" is derived from recent physical analysis of information and is used by Michael Polanyi in "Do Life Processes Transcend Physics and Chemistry?" *Zygon* 3 (1968): 445. More than Williams and other geneticists, a more general science like physics will be concerned to understand the outcome or selection in terms not only of the information in the DNA molecules but of the information or conditions in the total interacting system being studied. In Williams there is a hint of this in his reference to primitive man's interaction with other men in which the other men are the first man's "ecological environment." My development of culturetypes also will be to show other men as embodying information in an ecological environment. But I would go further and deny Williams's denial that there is any biotic adaptation. I would agree with him that this information may not be collected by competition in a gene pool; but, if one looks at the total ecosystemic boundary conditions or sets of information, one may properly say that the total change (genic and biotic) is naturally selected or determined. As Polanyi points out in his writings, biologists have taken too restricted a view—see his *Personal Knowledge* (Chicago: University of Chicago Press, 1958), especially the last chapter, "The Rise of Man."

43. Lorenz (n. 38 above), p. 256.

44. Ibid., p. 251.

45. Anthony F. C. Wallace, *Religion: An Anthropological View* (New York: Random House, 1966), p. 102.

46. Ibid., pp. 243–44.

47. Ibid., p. 239.

48. Anthony F. C. Wallace, "Religious Revitalization" (an occasional paper of the Institute on Religion in an Age of Science, 1961), p. 4.

49. Wallace, *Religion: An Anthropological View,* pp. 29–30, 38.

50. See n. 37 above. I would also suggest that my "Civilization of the Future" (*Philosophy Forum* 13 [1973]: 149–77) provides a useful review of some of the story.

51. G. G. Simpson's commentary in a conference. It may have been published, but I have it only on tape.

52. Burhoe, "Civilization of the Future," p. 163.

53. Julian Huxley, *Evolution in Action* (New York: Harper Bros., 1953), esp. p. 8.

54. Williams (n. 31 above, chap. 5) reflects some of the marvel of origin of the

genetic system. See also Francis Crick, *Of Molecules and Men* (Seattle: University of Washington Press, 1966), pp. 63–71, on the necessary conjunction of amino and nucleic acids for the beginning of natural selection in biology.

55. My "Civilization of the Future" (pp. 159–64) gives other details.

56. Solomon H. Katz, "Evolutionary Perspectives on Purpose and Man," *Zygon* 8 (1973): 325–40. Many of the other papers in the same *Zygon* issue (September–December 1973) are also contributions to this same theme of the emergence of cultural evolution and man's sense of meaning and purpose in the scheme of things. Dr. Abaya, *Zygon's* editorial assistant, in reading my manuscript commented that it appeared to be presenting the whole *Zygon* story.

57. That scientific beliefs are a special case of "myths" is a matter that I and many other scholars have pointed out. The conference of the American Academy of Arts and Sciences that gave rise to the *Daedalus* issue for Spring 1959 on "Myth and Mythmaking" was generated by a committee several of whom wanted to show the relation between scientific and other hypothetical structures (see the introduction, esp. pp. 218–19). My own efforts to translate religious beliefs into scientific language began when I was a preacher in 1935. Because of the lack of any audience ready to hear of such notions until I began to work with some first-rate scientists on problems of science and human values in the American Academy after World War II, I did little and published nothing until the mid 1950s. The first volume of the papers of the Institute on Religion in an Age of Science, *Science Ponders Religion,* ed. Harlow Shapley (New York: Appleton-Century-Crofts, 1961), contains my earlier paper on "Salvation in the Twentieth Century" seeking to integrate religion and science. In 1960, Hudson Hoagland and I sought to evoke some new thinking on the relation of cultural to biological evolution which had been an academically taboo area for a half-century. The American Academy held three symposia, some of the papers of which we published in *Daedalus,* and later these were issued as *Evolution and Man's Progress* (n. 37 above). These symposia were influential in a renaissance of thought and research concerning sociocultural evolution in relation to biological evolution and provided me with much critical information.

58. Among significant developers of various stages in religious development are Erik Erikson, Lawrence Kohlberg, and Wallace. Two papers by Kohlberg are found in *Zygon* ("Indoctrination versus Relativity in Value Education," *Zygon* 6 [1971]: 285–310; with Dwight Boyd, "The Is-Ought Problem: A Developmental Perspective," *Zygon* 8 [1973]: 358–72). Wallace treats of evolutionary stages of religion that are successive hierarchical levels (n. 45 above, esp. pp. 88, 256). It would seem significant that ontogenetic stages of development described by Erikson and Kohlberg roughly parallel the long-term history or phylogeny of religion of the kind which Wallace presented or which I am presenting in this paper. In biology the notion that "ontogeny recapitulates phylogeny" was under severe criticism in the middle of this century. Alfred E. Emerson in his "Vestigial Characters, Regressive Evolution and Recapitulation among Termites" (in *Termites in the Humid Tropics,* Proceedings of the New Delhi Symposium ["Humid Tropics Research"], UNESCO, 1962) suggested quite properly, I think, that a good deal of the debate on this was semantic. Recent research on all kinds of systems suggests that the organization of complexity in adapting to ever wider ranges of an environment actually requires, whether in phylogeny or ontogeny, such hierarchical or pyramidal building of these systems or structures. In order to build the nth level there must be available entities of the $(n - 1)$ level and so on. An early and excellent paper on this is Herbert A. Simon's "The Architecture of Complexity," first published in the *Proceedings of the American Philosophical Society* 106 (1962): 467–82, and later included as the final chapter in his *The Sciences of the Artificial* (Cambridge, Mass.: M.I.T. Press, 1969). In it Simon has a section specifically on "Ontogeny Recapitulates Phylogeny" (pp. 114–17). Another pioneer in this area is Paul A. Weiss, who wrote "The Basic Concept of Hierarchic Systems" as the introduction to his 1941 text, *Principles of Development,* and recently republished with other newer papers by several authors in *Hierarchically Organized Systems in Theory and Practice,* ed. Paul A. Weiss (New York: Hafner Publishing Co., 1971). The International Library of Systems Theory and Philosophy, ed. Ervin

Laszlo, has published *Hierarchy Theory: The Challenge of Complex Systems,* ed. Howard H. Pattee (New York: George Braziller, Inc., 1973). Perhaps the matter is summed up by Simon in his paper, "The Organization of Complex Systems," in *Hierarchy Theory:* "One can show on quite simple and general grounds that the time required for a complex system, containing k elementary components, say, to evolve by processes of natural selection from those components is very much shorter if the system is itself comprised of one or more layers of stable component subsystems than if its elementary parts are its only stable components. . . . Our whole discussion . . . underscores the crucial significance of hierarchic organization to the synthesis and survival of large, complex systems" (pp. 7, 23).

59. Wallace, *Religion: An Anthropological View,* p. 3. Among others dating religion back for more than 100,000 years is Theodosius Dobzhansky. See his *The Biology of Ultimate Concern* (New York: New American Library, 1967), esp. pp. 70–74.

60. In biological evolution this is well known. In the history of civilizations much was made of it by Arnold Toynbee under the term "challenge and response." It is perhaps an example of a basic law of physics, Newton's Third. Even the history of scientific advance in its revolutions is noted as a response to crisis—"the scientist in *crisis* will constantly try to generate speculative theories that, if successful, may disclose the road to a new paradigm . . ." (Kuhn [n. 25 above], p. 87).

61. Alfred E. Emerson, "Vestigial Characters of Termites and Processes of Regressive Evolution," *Evolution* 15 (1961): 125–26: "Adaptive mechanisms of recombination certainly evolve. Whether mechanisms of mutation adaptively evolve is a more controversial question, but an affirmative answer is credible. . . . Genetic variability probably has different optimal values in different organisms under different conditions. Both mechanisms of change and mechanisms of stability are selected and evolve."

62. Karl Jaspers, *The Origin and Goal of History* (London: Routledge & K. Paul, 1953). The whole Spring 1975 issue of *Daedalus* was given over to an analytical review of the thesis of Jaspers's "axial age."

63. C. F. von Weizsäcker, *The Relevance of Science* (New York: Harper & Row, 1954).

64. Arnold Toynbee, *An Historian's Approach to Religion* (London: Oxford University Press, 1956), see esp. chap. 13.

65. Heilbroner, *Inquiry,* pp. 132, 136.

66. Jay W. Forrester, "Churches at the Transition between Growth and World Equilibrium," *Zygon* 7 (1972): 145–67. Heilbroner's views are given in n. 2 above and elsewhere in this issue.

67. J. Bronowski, "New Concepts in the Evolution of Complexity: Stratified Stability and Unbounded Plans," *Zygon* 5 (1970): 18–35.

68. Ibid., pp. 32–34.

69. Jacques Monod, *Chance and Necessity,* trans. Austryn Wainhouse (New York: Alfred Knopf, Inc., 1971).

70. Bronowski (from the title of his paper).

71. Jonathan Edwards, *Freedom of the Will,* ed. Paul Ramsey (1754; New Haven, Conn.: Yale University Press, 1957), p. 183.

72. In spite of a number of more recent and excellent studies of the nature or philosophy of scientific statements and scientific inquiry, I find von Mises's *Positivism: A Study in Human Understanding* (n. 25 above) to be one of the clearest and best statements. The "causality statement" referred to is found on p. 161, but the whole book provides it with a sophisticated and sound context of understanding, showing its usefulness and limits.

73. As quoted in Sydney E. Ahlstrom, *Theology in America* (Indianapolis: Bobbs-Merrill Co., 1967), p. 168.

74. For living systems as open-ended flow patterns of dissipative energy, see A. Katchalsky, "Thermodynamics of Flow and Biological Organization," *Zygon* 6 (1971): 99–125. I have given related pictures, involving the phenomena of culture and mind as well as basic biology in my "Control of Behavior: Human and Environmental," *Journal of Environmental Health* 35 (1972): 247–58, cf. esp. pp. 249–50, and in my "Civilization of

the Future" (n. 50 above, esp. pp. 154–55). For the significance of "dynamic homeostasis" see n. 37 above.

75. From pp. 20–29 of the transcript of the general discussion, in this symposium, following the presentation of the Ferkiss paper.

76. For the weaknesses of psychotherapy as a religion see my "Bridging the Gap between Psychiatry and Theology," *Journal of Religion and Health* 7 (1968): 215–26. Various weaknesses of the Marxist ideology relative to long-selected religions have been indicated in a number of my papers, but one of my prime resources for understanding this matter comes from the late Clyde Kluckhohn, an anthropologist who carefully studied Soviet society after World War II. His "Scientific Study of Values and Contemporary Civilization," *Proceedings of the American Philosophical Society* 102 (October 1958) (reprinted in *Zygon* 1 [1966]: 230–43), provides a critical analysis that is consonant with that of mine and others who more recently have come to understand how the selective processes of long-evolved sociocultural systems produce a deep and essential wisdom that Marx and his followers failed to include in their system. Various of my papers have also pointed out the fact that the Marxist program for salvation leaves out the sensitivities of individual human feelings, and the Freudian program leaves out the larger sociocultural system—hence either of them is at best a half religion.

77. I have already, at the end of the previous section on "scientific theology" and the beginning of this section on "freedom," given grounds for understanding the expansion of the term "nature" in contemporary science to indicate what the older philosophers could mean by "being." *The Way Things Are* is the title of a book by a physicist, P. W. Bridgman (Cambridge, Mass.: Harvard University Press, 1959), which I commend as one of the basic texts of the new "metaphysics" of the natural scientists. But the "conceptual systems" of Margenau (see his *Nature of Physical Reality* [n. 25 above]), or the "paradigms" of Kuhn (see his *Structure of Scientific Revolutions* [n. 25 above]), or the "systems of hypotheses or theories" of Popper (see his *Logic of Scientific Discovery* [n. 25 above]) are all indicative of the fact that the "nature" studied by the sciences may readily be translated as equivalent to what philosophers and theologians have meant by ultimate being, so far as men can know anything about it.

78. The "Kingdom of God" or the realm of ultimate being, I suggest, is essentially a symbol for the realm of reality that modern scientists call "nature." This is the realm filled with a network of invisible forces and entities which actually produce the world that we perceive, along with its dynamic changes in history or evolution. Theologians, of course, have customarily used the term "nature" to refer to only the visible, tangible phenomena—not the invisible network. What scientific literature lacks (and what religious and theological literature has possessed) is the meaning of what is going on in this invisible network for man or human destiny. What is to happen in the future, in the eschaton, in this hidden but real world is of the essence for proper human motivation and hope.

79. For an analysis of the "higher and lower courts" in the selection process see my "Civilization of the Future" (n. 50 above), esp. p. 163; this is similar to the "first and second sources of selectivity" in Simon's "Architecture of Complexity," in *Sciences of the Artificial* (n. 58 above), p. 97.

80. Simon, *Sciences of the Artificial,* p. 25.

81. The stages of ontogeny or development of the individual have been known in embryology and biological sciences for some time. Corresponding stages in psychological ontogeny have recently been pointed up by such students as Jean Piaget, Erikson, and Kohlberg. A significant view of the shaping of cognitive and emotive processes by the joint action of genetic and cultural information is present in Konrad Lorenz, "Knowledge, Belief, and Freedom," in *Hierarchically Organized Systems* (n. 58 above), pp. 231–61.

82. Williams (n. 31 above, p. 97) defines "biotic evolution" but in the course of the book correctly refuses to allow meaning to the term "biotic adaptation" on the grounds of genetic selection by elimination of less adapted individuals or groups in an ecosystem. However, he, as we, would recognize that there are *natural* circumstances or forces

that do in fact cause biotic evolution to take place and for persisting ecosystems to be formed.

83. See n. 10 above.

84. Alfred E. Emerson and Ralph Wendell Burhoe, "Evolutionary Aspects of Freedom, Death, and Dignity," *Zygon* 9 (1974): 156–82. I am also indebted to a paper, "The Origin of Death," by George Wald, at a Star Island conference of the Institute on Religion in an Age of Science, following his earlier paper, "The Origin of Life." The latter was published in *Scientific American* (August 1954). I do not know if the former was published.

85. Ibid.

86. Many anthropologists and evolutionists have noted the origin of burial ceremonies in archaeological sites more than a hundred thousand years old and have concluded from this as well as from the context of other facts about human brains and psyches that religious rituals and myths were already evolving then to protect the human psyche against the increasing knowledge of death of the body. See, for instance, Theodosius Dobzhansky, "An Essay on Religion, Death, and Evolutionary Adaptation," *Zygon* 1 (1966): 317–31.

87. I give further detail on this in "Concepts of God and Soul" (n. 24 above).

88. Wallace (n. 45 above), p. 52.

89. Ibid., p. 107.

90. As quoted in Robert N. Bellah, *Beyond Belief* (New York: Harper & Row, 1970), p. 12.

91. Wallace (n. 45 above), pp. 264–65.

92. In looking now at the position of life and human life beyond biological conditions and in the framework of the totality of nature, the evolving universe—most of whose realities are as yet and probably forever will be unknown to us—I am drawing our attention to such recent formulations as those mentioned earlier by Bronowski (n. 67 above) and Katchalsky (n. 74 above), which provide important insights for this purpose.

93. I have defended on scientific grounds the necessity for and genuineness of religion in my "The Phenomenon of Religion Seen Scientifically," in *Changing Perspectives in the Scientific Study of Religion,* ed. Allan W. Eister (New York: Wiley-Interscience, 1974), pp. 15–39. This also contains further details that supplement my efforts here to show how the biophysical as well as the psychosocial sciences are essential for a scientific understanding of religion.

94. "Civil Religion in America," *Daedalus* (Winter 1967), pp. 1–21, was Robert N. Bellah's first paper on this theme.

95. Sydney E. Ahlstrom, *A Religious History of the American People* (New Haven, Conn.: Yale University Press, 1972).

96. Any of the writers on the philosophy of science to which I have already referred bear this out. See, for instance, the writers listed in n. 25 above. Not only does the scientific community recognize the finiteness of its knowledge, in Gödel's theorem it has proved the impossibility of ultimate knowledge even at the level of the internal or logical consistency of arithmetic.

97. See, for instance, B. F. Skinner, *Beyond Freedom and Dignity* (New York: Alfred A. Knopf, 1971). In many of my papers I have used certain of Skinner's hypotheses and data to support my efforts at scientific theology. I was interested to see "B. F. Skinner and Religious Education" in *Religious Education* 69 (1974): 558–67 by John L. Elias, who also sees the importance of Skinner's "insights into the nature of religious behavior and . . . institutions." Skinner, however, has not faced up with what I have called the higher courts of nature's selections and has rested largely within the lower courts of human preferences, which, like all humanistic self-worship and pride, could be lethal in natural selection's last judgment.

98. By the "preferred configurations" of our universe, I mean those stable or metastable states described in such papers as those by Bronowski and Katchalsky quoted earlier and cited in nn. 67 and 74.

99. Ralph Wendell Burhoe, "Natural Selection and God," *Zygon* 7 (1972): 30–63; "Concepts of God and Soul" (n. 24 above); "What Specifies the Values of the Man-Made Man?" *Zygon* 6 (1971): 224–46; and many others.

100. My development of the "cosmotype" as the primary and inclusive set of boundary conditions of the soul has not been published, although presented in a number of papers beginning with one to the Society for the Scientific Study of Religion in 1951.

101. See, for instance, Mircea Eliade's *The Sacred and the Profane* (New York: Harcourt, Brace & Co., 1959).

102. Bronowski (n. 67 above), p. 34.