

# PLEASURE AND REASON AS ADAPTATIONS TO NATURE'S REQUIREMENTS

by *Ralph Wendell Burhoe*

*Abstract.* The values which guide mental and physical behavior seem to be derived from evolutionary facts. In our brains, selection of genes has tied the experience of pleasure to motivating what nature requires us to do for the good of ourselves, our kinsmen, and our ecosystem. When our brains evolved to house also a cultural heritage (including religion, the motivation of sociocultural goals, and rational discourse), hellish tensions could arise to split brain function (minds) and societies. Salvation could and did come from natural selection's replacement of discordant elements in our heritages by better coadapted ones. In this replacement, human rational decisions participated. Selection also continued to adapt these symbiotic heritages to their common environment.

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This paper addresses the topic of "Private Interests, Public Good, and the Future of the Environment" by telling something about how we humans know what is good and how we are motivated to act to achieve it. In summary form our problem is: How do we know what is good for us, given our nature and that of our environment; and how does that knowledge activate behavior that is effective for accomplishing this goal?

This is the basic problem not only of humans but of all living systems. To resolve the problem we need answers to four major and baffling questions: (1) How do I know what is good for me, or, how do you know what is good for you—that is, how do we know what is good for each of us as a private individual? (2) What is good for the public and, if that is different from or conflicts with what is good for you or

Ralph Wendell Burhoe is research professor emeritus in theology and the sciences at Meadville/Lombard Theological School and *Zygon's* founding editor. His address is 1524 East 59 Street, Chicago, Illinois 60637. He presented this paper at a symposium on "Private Interests, Public Good, and the Future of the Environment," at Rollins College, Winter Park, Florida, March 19-21, 1981, which was sponsored by Rollins College and funded in part by the Florida Endowment for the Humanities.

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me, why should you or I bother with the public good? (3) How does the environment and our interaction with it enter into what is good for me or you, or for all of us as a community or public? (4) Even if I or you have correct answers to the previous three questions about what is good (for us individually, for the public, or for our environment) but find, as we often do, that either I or you or others just do not want to or just cannot do that good and thus we allow what is not good to come to pass, what then can effectively move us, and all the others who must be moved, to do what is good for ourselves, our community, or our environment?

These are questions with which the leaders of religions, philosophers, and the artists and scholars, who have helped to create and transmit the humane arts and wisdom of the world, have wrestled for thousands of years. The search for answers to these interconnected questions often gets us into a tangled and seemingly irresolvable logical mess. We are fortunate that most of this wisdom in the past has been transmitted by pre- or non-logical vehicles of information. But in an age of science there has risen a new problem. Can the relatively slower evolution of traditional cultural wisdom keep up with the rapid rate of change brought about by science and its technologies?

For this reason, in seeking answers to these questions about what is good for humans or humanity, I have taken a somewhat different approach from that used by most traditional theologians and philosophers. I have spent a good part of my lifetime seeking answers to questions of human values in a way that for a couple of centuries has been intellectually taboo: I have been seeking answers to human value questions through the sciences. Toward the end of the eighteenth century, David Hume, Immanuel Kant, and others formulated a philosophical conclusion that human values cannot be derived from facts, a conclusion that for various reasons, good and tragic, came to dominate our culture. In our century this view has continued to dominate the understanding of philosophers, theologians, and most scientists. In 1960 this chasm between the sciences and humanities was vividly illustrated and lamented by Sir Charles P. Snow's book on *The Two Cultures*.<sup>1</sup>

I suppose I represent a sort of intellectual "counterculture," for even before 1930 I began to pick up from various scientists and scientific literature that even the physical and chemical sciences were capable of revealing significant information about what was going on inside human nature and that *physical* events inside and outside our skin were indeed shaping our structure and behavior. It became clear that knowledge of such physical events would be helpful if not necessary, if we were to explain to ourselves the full story of the phenomena of human feeling, willing, believing, thinking, behavior, and indeed, even our "intrinsic" values.

Gradually there has been an increase in the power of molecular biology, evolutionary theory, information theory, thermodynamics, and related sciences to explain the generation of values as a part of the natural panorama. Working with the ideas and some of the leading investigators in many of these sciences and the related humanistic disciplines, I have come up with a scientifically informed set of answers to the problem of what is good for each of us, our society, and our environment. These answers may have some advantage of objectivity and credibility that today is accorded to statements from the sciences. But these answers have the disadvantage that they fly in the face of the widely accepted philosophical conviction that values cannot be derived from facts.

Although it would be good if I could, I shall not seek in this presentation fully to document or “prove” every statement, for pieces of the information come from diverse scientific disciplines, with which few are familiar enough to make possible a ready comprehension. Also, some of the findings are so new that they are not widely known or accepted even among colleagues in the field. Moreover, some of the details in my formulation might turn out not to be quite the final truth about the matter—I am enough of a scientist and realist to know that even our best answers today are only tentative visions of what will later become a fuller truth. But perhaps you, the readers, can tentatively trust my statements as representing a fairly competent investigation of some important new views the sciences offer for our understanding of the nature of the good or values, and you may be stimulated to seek further details and proofs or disproofs later.

I think you will be intrigued that the answers to these questions coming from the scientific perspective, somewhat surprisingly to many, will demonstrate the very necessary role and wisdom of traditional religions in providing essentially correct answers to these problems about the good. In fact, evolutionary theory is providing a new view of how religions effectively guided our ancestors in their development from the primitive tribal life of ape-like kin groups, living by hunting-and-gathering technologies, to the highest levels of human civilization. Still more surprising is the indication, which we get from the scientific pictures of human nature in relation to its environment, that a revival of religion will be required if mankind in an age of science is to advance, properly adapted to its own nature and to the nature of its environment. Of course, to communicate with and to persuade the scientific and sophisticated members of the community, any traditional religion would have to be properly interpreted and, as the case may require, somewhat reformed in the light of contemporary scientific knowledge, at least at the level of the religion’s intellectual formulation. But we should have no more trouble

with such interpretations than we have had with our scientific interpretations of the prescientific wisdom inherent in the Eskimo's kayak, Egyptian sailboats, or the still earlier genetic "wisdom of the body."

Hence from a scientific perspective I introduce back into twentieth-century politics and technology the need for the revitalization of sound religion to induce people to behave properly for the commonweal. This is a view that Thomas Jefferson (who made important contributions to our religious and technological as well as political philosophy) recognized as essential. But for various reasons this understanding has been lost during the past two centuries.<sup>2</sup>

#### HOW DOES THE INDIVIDUAL KNOW WHAT IS GOOD?

Here is a brief sketch of the answers I have found. As I hinted, answers to any one of the four questions involve answers to the other three. Let us start by looking at a scientific picture of an individual living system, a model of a me or a thee, as the sciences portray us, not dressed in all our present particularities, but in an analysis of our basic structures that have existed for millions of years and on which successive layers of newer structures have been built. From this perspective, it has become quite clear that recent science has given some basic answers to all four of the questions and illuminated their interconnections.

In answer to the first question, how does each individual know what is good for it, it has been amply shown that at a basic level each individual has been endowed with genetic knowledge or information which tells it what is good for it. At its fundamental level the living being does not need to read or go to school to get this wisdom. The blade of grass in the field or the bird of the air already has it. The knowledge came as a heritage, prepackaged in a DNA strip of spiral tape, a strip of molecules which constitute a small fraction of the millions of millions of molecules in each microscopic cell of our bodies. This molecular strip contains information, equivalent in volume to an encyclopedia, on how to generate and operate a large organism such as you or me.

For everyone who is alive, this information is necessary for guiding correctly the billions of tasks to maintain a local dissipative flow of cosmic energy into miraculous patterns of activities among billions of trillions of molecules, each of which does what is necessary to result in what you are, do, feel, or think. It is the basic package of information that, in interacting with its environment, in our embryonic beginnings began to structure your or my brain and its basic information content, to give us our capacity to extract from our environment and properly utilize the molecular building blocks and energy to carry

on the essential business of life. This gift of an encyclopedic genetic handbook of information shaped the development of organs that later enabled us to feel, taste, smell, hear, see, talk, and to know, remember, and reflect or reason. Furthermore, that basic package of information, again by interacting with its environment (which also always contains information essential to our lives), generated our capacities to discern, desire, delight in, and acquire certain things that are good for us and avoid or eliminate those which are bad. At this level of knowing there is no serious gap between know-how and the action to accomplish the goals prescribed to maintain life.

The picture I have just sketched is supported by recent scientific discoveries about information and its relation to living systems. There has developed, largely in the past thirty years, a mathematical and physical breakthrough in information theory; with this has been associated the development of computers and the computer technology and industry. This same new information about information has become important for our understanding the nature of genes as information carriers, about which most of us are aware. However, not so many are aware of the information content of the environment. I shall give just a couple of statements exemplifying this. Gregory Bateson in his *Steps to an Ecology of Mind* gives a crisp but science-related definition: Information is "any difference which makes a difference in some later event."<sup>3</sup> That the environment is full of information should be clear from this. Nobel Laureate Herbert Simon has noted that "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."<sup>4</sup>

I wish to emphasize that in this scientific picture of our development, the environment is always a part of the information that makes us what we are and determines our likes and goals. It is actively engaged in shaping our values from the time of our conception in the form of a zygote or union of a half set of the chromosomes from each of our parents to the end of our days as a phenotype or observable organism. Today we can see better than ever how marvelously and fully our nature reflects or "images" the total environment that created us. The information that shapes our nature and behavior is, and on the average always must be, beautifully adapted to the opportunities and requirements provided by our environment.

If we trace our history back in time far enough, the scientific picture shows that the environment, in its provisions and selective actions throughout that history of the development of our genes during several billions of years, is totally responsible for all our life and its values. Our environment provided and refined this precious "book" of information that is the dynamic center and shaper of the basic structure

of our natures. Without it we would not exist as the special body and mind, which can contemplate our origins, destiny, and duty with respect to our environment. This is part of the evolutionary picture of our beginnings and history to the present moment.

In view of this, some of you may find it easy to join me in translating the scientific term "nature" (which denotes the complex set of systems and subsystems of information that constitute our total environment and which the scientific story tells us is the source and determiner of our nature, values, and destiny—indeed, our creator, judge, and sustainer) into the more traditional religious term for that only partly known system of mostly hidden forces that accomplishes all this—"God." Thus, in answer to our first question we can say that, at the basic genetic level of our being, the source of our knowledge of what is good for us as individuals is properly symbolized by such terms as "that which has shaped our total evolutionary history in our natural environment," or "God."

As a brief thrust at the main topic of this issue—our responsibilities for the future of the environment—you might well conclude from what I have just said that this is a laughable topic. We should not be worrying about how we shall treat the environment but about how the environment will treat us. If the environment in reality operates as the almighty God, Lord of all history in the universe, and creator and judge of us, then we should recognize this and pray that we can discern and carry out its will or requirements that it presents to us as conditions to be met if we would have continued life. In fact, this is a first glimpse of the primary point of what I have to say.

In the above paragraph I have also given a first installment on my answer to the third question: how does the environment and our interaction with it enter into what is good for us? The environment clearly enters into what is good for us through selecting our genetic know-how or genotypes, which endow us with a vast amount of information about what is good for us and with the faculties to discern, desire, acquire, and do what is good for us.

#### PLEASURE AS GUIDE AND MOTIVATOR TO WHAT IS GOOD

The basis of our willingness to do what is good for us is pleasure, as indicated in my title: "Pleasure and Reason as Adaptations to Nature's Requirements." While Charles Darwin already had some evidence and wrote about it, much more has been learned in recent years about how the genes not only give us arms, legs, eyes, and ears but also provide inside our heads the distilled information of the ages which comes to us essentially in the form of "what I love is good for me," or, "I want to do that which is good for me because it is pleasant so to do." The other great category of information, which I did not put in my

title but which is closely paired in the brain wiring with the pleasure-producing mechanisms, is the opposite of pleasure—the painful, or fearful, or otherwise distasteful. Our genetic and other acquired information tells us what is evil or bad for us as well as what is good, what we should avoid as well as what we should seek.

All nature's creatures are genetically endowed with information of this kind about their basic values. The genes spell this out just as they spell out how long our legs should be and what part of the visual spectrum our eyes can see. As our ancestors were advanced by the environment's selection up the ladder of life to ever more complex and more widely adapted levels, the mechanisms for being attracted to what was good and avoiding what was bad were always present as a bit of internalized information selected to shape our behavior so that we would flourish.

Of course, sometimes the adaptations that told our ancestors that eating a certain thing was good might not suit us today. Indeed, various particular adaptations which told them then that something was good, on many occasions became bad, even lethal, information as circumstances changed in their long history. However, note how lucky we are that, through the grace of the system of powers that be, whether you call it God or environment, the design for the wiring in our nerves as well as the design for the structures of our various organs from which they receive and to which they give information, were and are being revised constantly, with some inevitable lags and compromises, but tending to insure that we enjoy what is good for us and avoid or dislike what is bad.

The creation story according to natural selection tells us that our genetic design was altered in small step after small step to adapt not only our gross structures but also the inner desires produced in our brains, so that our desires and consciously directed behavior nicely fitted (at least to a statistically significant degree) the circumstances of our environment, so that we eagerly sought after that which was good for us and avoided that which was bad for us.<sup>5</sup> This is true not only for how we respond to the environment outside our skins, but also to our internal environment, where what we desire and do is usually good for us and what we avoid, brush off, reject, or eject is evil for us.<sup>6</sup>

This motivation to do what is good for the individual self by the pursuit of its own pleasure or happiness also appears to operate in motivating its doing good to its species and ecosystem, since, as this century's studies of biological and ecosystems show, the individual is selected as a dependent unit within a viable species and ecosystem. Selection has been profuse in providing pleasure for the usually costly and sometimes self-sacrificial tasks of generating and raising children for another generation. Thus selection tends to insure that the moti-

vation of the average individual tends to provide behavior that preserves the viability of the larger system of which it is a part.

At least since Jean Jacques Rousseau, enlightened men have contemplated the beauty of natural systems with great admiration. And the recent popular spread of intimations from scientific ecology, as well as our genetically programmed delight in order and beauty, have brought most thoughtful people to appreciate the gracious wisdom and balance of the natural order and to tend to dislike that others should pollute our part of it.

Moreover, the careful scientific study of some of the smaller and more tightly knit ecological communities have revealed how the genes and their epigenetic pleasure mechanisms have been selected to motivate mutually beneficial services among the various coadapted species whose cooperative function is necessary to a well-run ecosystem. Hence the pleasure mechanisms not only motivate us to serve the self but the larger ecological community and, as we are beginning to recognize, to serve all nature, the environment, or the kingdom of the Lord of History. The basic laws of physical attraction and repulsion have evolved into a complex hierarchy of information or energy constraints that shape the phenomena of both nonliving and living systems in nature (including conscious experience).

In general, we can say that it is quite clearly known to be true for most of our ancestors that pleasure has been the green light leading to what is good, even for a self-sacrificial death for the good of the public or even for the broader ecosystem. And pleasure or a warranted hope for future satisfaction is still the basic guide to the good for us today.

#### THE PROBLEM WITH PLEASURE AS A GUIDE TO THE GOOD

Now I am well aware that in recent millennia among humans there has arisen a flaw in this nice adaptation whereby pleasure almost universally told our ancestors what was good for them and strongly inclined them to do whatever was necessary to attain that pleasure and good. We have eloquent written records of trouble from more than a couple of thousand years ago. The Book of Job reported that all was not well with this rule. And Saint Paul, who lived a few centuries later, is still widely remembered among us for describing how good intentions and the rule of pleasure get so wretchedly contrary in more complex societies: "I know that nothing good dwells within me, that is, in my flesh. I can will what is right, but I cannot do it."<sup>7</sup> Many others, earlier and later, have given eloquent testimony to the fact that the traditional rule of pleasure as the way to the good no longer seems to work so well. What has happened to spoil the lovely life of our erstwhile Garden of Eden? What has caused the failure of the pleasure principle to be a satisfactory guide to the good?



I have space only for a brief sketch of the answers. The recently evolving pictures coming from sociobiology and from our dawning understanding of the emergence of humanity as a radically novel, more-than-animal creature will tell us a lot.

To begin, we should note that humans are almost as pleased to grub for food, eat, and procreate as some of our genetic "cousins" such as the apes in the primate groups or the dogs and cats in the mammalian world. We are well programmed genetically to find it pleasant to eat and drink and to procreate, feed and fondle babies. If we were able to go back to our earlier ape-man environment and survive, we perhaps have nearly enough of our ancestral genetic information left so that, after a relatively brief period of adaptation, we might live quite comfortably in small, kin-related hunting-and-gathering tribes or troops. In a suitable environment, we might be able to follow the lead of our pleasure instincts and a prelinguistic level of cultural-information transfer as our guides. We would be pleasure-motivated to find our food, generate our babies, and raise them until some of them were able to continue the viability of our tribe and others to fan out to join neighboring tribes for the same purposes. As a matter of fact, in the twentieth century A.D. there are some in our species that are still pretty close to this kind of life. It is well for us to know that as a species we are separated genetically from the gorilla and the chimp by only about a one percent difference in the DNA code.

However, some biologists have speculated that our brains have become genetically so preprogrammed for mutual symbiotic dependency upon elements of cultural information that we would not survive if we tried to go back to the Garden of Eden. We might learn that we are not even internally fit to survive under such conditions again. It would be an interesting experiment; however, it might have to be set up on another planet, since the tendency of the rest of us whose ape-man nature has been wedded to a new level of non-DNA information called culture (including language, religion, technology, art, and science) would be to do things that would eliminate those who returned to "paradise."

It has been visible in our history that more advanced cultures tend to eliminate the less advanced, perhaps mostly by taking away the habitat they need for their livelihood. This results from our felt need to have that habitat for ourselves, and our advanced technologies have made it so easy for us to take it away. Tens of thousands of years of such a history reduce the frequency of genes that are expressed in the more primitive, less culturible, primates among us. Thus nature has selected for those genes that favor certain kinds of enculturation and at the same time for the most suitable sociocultural systems as symbionts to evoke the optimal expression of the selected genes. In

this process we tend to lose our capacity to live by our genetically evolved information alone, and we become more and more dependent upon symbiosis with some kind of sociocultural organism and upon having its culture inseminated into our growing brains.<sup>8</sup>

The sciences have been amassing evidence recently that what makes the nature of humanity unique and different from the nature of animals, is a phenomenon that was created on earth under the same general processes that have been operating in evolution everywhere in the world and presumably in every spot in the universe—wherever there are suitable dissipative energy flows—beginning with the evolution of primitive matter and continuing through to the emergence of the most complex forms of information and life that we know on earth. This picture of the evolution of energy and matter is a new development in evolutionary theory in which the astronomers, physicists, mathematicians, and others have been extending our understanding of the dynamics of successive new stages and levels of the patterns in the cosmos. Papers, such as that by the late Jacob Bronowski entitled “New Concepts in the Evolution of Complexity: Stratified Stability and Unbounded Plans,” are showing that biological evolution, with its neo-Darwinian picture of the natural selection of genes, is a special case of our universe’s evolution of hierarchical stages of stratified stability.<sup>9</sup>

I wish to stress that we humans are creatures of two natures: two very closely coadapted mutual symbionts, one programmed by “ape-man” genes and the other by a culture, both of which have been produced and selected by the nature of our environment.<sup>10</sup> We have been produced because the environment itself is of such a nature that among other things it produces the conditions for life and selects the patterns of information which guide life so that the information and the consequent flow patterns of a particular form of life are adapted to or stable in its local environment or ecosystem. This rule of the ultimate sovereignty of the nature around us applies just as much when that life-producing information is transmitted by culture as when it is transmitted by the genes.

A grave danger for us is that so many have not yet been educated to see the powerful, transcending forces that supervise the course of our lives. In the past these have been called the gods. Now they are more clearly than ever revealed in the scientific picture of the world. Ignoring these transcending forces, we too often jump at what looks like a good temporary technological fix to meet our needs, but we find that the long-term ecosystemic consequences may turn out to ruin us. We exercise our freedom of choice only with respect to near-term and very finite technological fixes. Of course, the more we adapt to the range of conditions of the universe, the greater is the horizon of our

freedom. Nevertheless, no matter how extensive and detailed the adaptation to the requirements of ultimate reality that we may cram into the finite information packages that guide our behavior, we never escape the fact that we can act only in accordance with that larger reality. The reverse is impossible, for any private desires that carry us beyond reality's limits carry us only to our destruction. Recently we have been learning how narrow is each specific ecological niche.

The new natural-history views of the creative environment at times resemble the Old Testament pictures of the omnipotent and stern God of judgment that will not tolerate sinners against its will. If our niche is the multidimensional sets of boundaries within which every element of our being must stay for the whole being to remain viable, then indeed we cannot separate ourselves from the supreme system of power that defines our niche. This sounds as if the scientific world view were confirming some aspects of ancient religious beliefs, and that is exactly my interpretation.

#### THE CREATION OF A DUAL NATURE

According to my reading of the scientific picture, it has been the operations of the larger nature in which we live and move and have our being that have selected our ancestors and us to be part of a radical new experiment in life—a living experiment that transcends the hitherto dominant role of information encoded primarily in the DNA packets that produced the wonders of prehuman life. This new experiment simultaneously selected, a small step at a time, a looser coupling between environmental stimuli and genetically programmed response patterns for life, giving a larger role to intermediate variations of routes by a brain capable of receiving various categories of environmental information, especially the co-evolving socially transmitted cultural information, and of projecting and selecting an optimum path to the basic goals implicit in or prescribed by its genotype. This involved a large expansion of the outer layers of the brain for information processing, including making tentative decisions and using internal models to test their consequences before choosing an action. Such decisions, of course, always had to be constrained by the basic genetic requirements, which always remained specified in and enforced by the basic, inner, lower, or reptilian parts of our brain.<sup>11</sup>

Thus, with ultimate control by the genetic information in the lower brain, but with increased tolerance of suitably coadapted cultural information added to the outer brain, the evolutionary scene was readied for the emergence of a new creature, transcendently different from any hitherto on earth: humanity. The new brains could gradually adapt to receive, store, and transmit a pool of greatly en-

riched animal-ritual communication, thus becoming generators of and heirs to a paragenetic or supragenetic information pool, which vastly enhanced and accelerated their adaptation. Rituals of technology and social behavior rapidly evolved, culminating in tools, languages, religions, and the emergence of a partially private and partially cultural world, represented in symbol patterns shaped by brains: human conscious awareness or mind. Since the sociocultural reservoirs of this information could be selected independently of the much more slowly evolving genetic reservoirs, they evolved independently and much more rapidly. Insofar as these hominid groups carried cultural information that gave one of them an advantage over competing hominid groups, its sociocultural reservoirs of information were selected, just as is genetic information, but by a very different mechanism.

As Julian Huxley noted, sociocultural evolution is many times more rapid than genetic evolution and it has become the important feature of human evolution.<sup>12</sup> Insofar as different patterns of cultural information (culturetypes) were used by competing tribal societies and insofar as some culturetype gave greater viability to the group possessing it, that culturetype could and would be selected, provided that the genetic differences between the groups did not offset that viability. But, of course, the genetic and cultural systems of information necessarily had to evolve in close coadaptation, since no culturetypes could exist without a receptive, genetically programmed population of brains as hosts and since no tribe of ape-men could survive competition with neighbors or invaders possessing a more viable culturetype. A most telling piece of evidence for the latter is that *sapiens* is the only species left in the whole genus of *Homo*.

Stated in another way, during the past few million years the genes of our line of ape-men became increasingly coadapted with an emerging new system of life—the sociocultural organism with its information patterned not in DNA but in a culturetype. It has been estimated and to some degree measured that in this time our genetic information has been changed by selection less than one percent away from our ape-man relatives, and that, perhaps, mostly to generate greater brain capacities to operate with culturally as well as with genetically transmitted information. New genetic programs included greater capacities to learn; to review in memory (to rearrange memory's symbols) and make new associations there; to synthesize new patterns of memory symbols; to fit current experiences with memory symbols forged from different sensory modalities; to communicate increasing amounts of meaning through genetically programmed animal ritual, including the more ready imitation (with variations) of the behaviors of others, especially manual behaviors in various technologies; to

communicate complex symbols through language; and the related capacity, to give forethought or imaginative projection of future states and to prepare for them; and so on, up to handling complex, modern sociocultural communication.

At the same time the packets of cultural information, which would be transmitted from brain to brain (not merely once in a generation through the genes but immediately with the speed of light or sound through the air, and repeatedly as often as need be), were likewise being selected to be closely coadapted or fitted to the requirements of the genetic information expressed in the same brain; and hence they were eagerly accepted as a part of the working program of that brain.

The production, transmission, and reception of packets of cultural information by their nature always involved the interactions not simply of a father and mother with children, but they were products of larger communities generating a language, technology, and religion, that I have called a sociocultural organism. The sociocultural organism's common information packet inevitably imposed upon its ape-man population certain statistically common behavioral characteristics, regardless of the different genotypes constituting the population. For instance, regardless of the voice pitch and timbre of different speakers, we can easily tell whether someone is speaking our language or a different one.

By their very nature, the individual ape-men members of a sociocultural organism inevitably tend to be shaped to form a coherent entity by the common cultural information they share and by their genetic selection as viable units in such a cooperating community, just as the cells of an organism are constrained to constitute a coherent unity by their common information.

But what is most important for us here is to note that sociocultural organisms have a life of their own independent of the individual ape-men who have been embraced and utilized by them. The sociocultural organisms, or the culturetypic information that reproduces them, are selected by mechanisms and circumstances different from the selection of the genes in a population of ape-men, even though they are parasitically dependent upon such populations, for without someone with genotypically produced ears to hear there would be no language.

In biology we have learned to understand how two genetically very different species can become symbiotic, so symbiotic that the one species cannot live apart from the other. Also we have learned that we often cannot even discern that there are two species together instead of one creature. Symbiotic species, such as the termites and their protozoan flagellates, can flourish in an environment far beyond the means of one of them alone. As a matter of fact, we have learned that

so-called species of animals, including ape-men, even before their symbioses with sociocultural organisms, are not really a single species, but are already such mutually beneficent symbionts of eukaryotic and prokaryotic information all operating in each cell of their bodies.

What we are witnessing in the formation of humanity is one of nature's greatest advances since its first merger of two or more species into a cooperative enterprise, into a division of labor to generate activities so organized among individuals from several participating species within an ecosystem that there resulted what a pioneer ecologist, Alfred Emerson, called a supraorganism, an organic structure made up out of the interaction of individuals from several different species.<sup>13</sup>

I call the emergence of the human supraorganism a great advance because this is the device by which nature for the first time seems to have been able to overcome the genetically forbidden possibility of generating the habit of life-risking cooperation among non-kin members of a species. I have seen no well-established reports that any but humans significantly do this. I believe my theory explains how this is accomplished in humans by the symbiotic mutualism operating within the brain of each individual. Each brain is programmed not only by its unique, ape-man genotype but at the same time by a common culture-type, which is shared by each ape-man in a population and may be sufficiently coadapted with the genotypes so as to serve them better than they could, alone, serve themselves. This can bind the various individuals (even non-kin) in a super-familial concern for one another.

This kind of dual character (dual programming) of the individual human phenotype is one of the most dangerous as well as most marvelous innovations of nature in its evolution on earth. The dual drive of the culturetype and the genotype in the same brain, while it can produce cultural or spiritual kinship among individuals who are not genetically close, is a potentially unstable mechanism. For it may produce a divided will at war with itself—a living hell—in those brains when and where culturetype and genotype are not suitably coadapted, that is, where the self's two separate "organisms" may not be suitably fitted to function in single-minded harmony. This picture of human nature's dual character helps explain many psychological, religious, social, and historical phenomena. But here I aim only to show roots of private and public responses, of their tensions, and possible methods of reducing those tensions. It will explain the loss of the pleasure principle which operated in the Garden of Eden before man got his enlarged brain cortex and his culturetype. For, when the culturetype is not well coadapted with his genotype a human tends to experience hellish tensions that our innocent ancestors knew not.

In my scientifically based theory of religion, it is from such tensions between an emerging culturetype and the genotypes of its gene pool, as well as the necessary joint adaptation of the two to their common segment of the ecosystem, that religions emerged, as an expression jointly of genotypes and culturetypes, to provide coadaptation and unity, that is, salvation from the tensions, conflicts, and splits both within brains and within societies. Modern secular culture is as yet painfully and tragically unaware of any corresponding or adequate program of coadaptation and salvation. Hence it and we are in serious danger.

#### PRIVATE INTEREST, PUBLIC GOOD, AND THE ENVIRONMENT

We come now to a point where my scientific theory of human nature can begin to be useful for analyzing the problems of private interest, public good, and the future of the environment. I believe you may recognize a primary source of *private interest* as that aspect of the individual that is dominated by its ape-man genotype, which largely structures the basic values or desires of the lower levels of the brain but which also, through its coadaptation to the sociocultural organism, provides the general structures of the outer cortex of the brain with so little detailed programming that it requires ten to thirty years of experience under the influence of a sociocultural organism for its maturation. You probably also recognize the *public realm* as related to that aspect of each individual's outer brain which is largely devoted to storing the input from the culturetype and in most cases is infused with the values of the sociocultural organism.

If the culturetype is well coadapted with the average genotype in a population, and that obviously has been the case most of the time so far in human evolution, the individual ape-man is adequately satisfied or motivated to his carrying out the duties imposed upon him by the sociocultural organism. In general, he finds that statistically his sociocultural organism gives him greater security, comfort, and potentiality for himself and his offspring than does a lone tepee for him and his family in the wilderness.

Moreover, this tension between his genotypically and culturetypically programmed needs has been reduced by the fact that most of the time in our evolution, and still today for much of what goes on in the world, we have lived in the intermediate level of a population that is essentially an extended family, in which genetic kinship has been an important mediating agency for the tensions between the individual and the larger population of non-kin ape-men in our larger towns and cities. Genetics has readily explained the possibility of social cooperation with close kin. The societal power of the kin group is profusely illustrated in our common experience, and the existence of nepotism

and family loyalties is widely celebrated in our literature from Romeo and Juliet to newspaper accounts of the Mafia families.

When the two natures of the individual human are well coadapted, we reach heights of power, perception, intellect, and joy that no other creature can begin to approach. The upper brain, filled with riches and powers to serve a high sociocultural organism, may also be finely tuned to its essential ape-man roots and thus operate harmoniously with both of its natures. Indeed it can, and sometimes does, fulfil both our private and public hopes. Then we say life is heavenly. We should note that in this situation there is no breakdown of the rule of pleasure as defining the good. Under such conditions good culturetypes statistically insure saints, soldiers, and others that their risks in aiding non-kin members of the sociocultural organism would not likely lead to their own genetic deaths. Farmers, craftsmen, and scholars gladly will work long hours for the public good because it is simultaneously the most rewarding kind of life personally.

But evolutionary history is characterized by changing circumstances and opportunities or requirements for new adaptations. Formerly well-suited patterns or systems no longer may be adequate under new conditions and some changes then are needed. The rise of modern science and scientific technology is one of the most drastic changes, if not the most drastic change, in a culturetype in human history thus far. Most of our value-shaping cultural institutions, which in our past evolution have been able to keep a workable coadaptation between the genetic and the culturetypic shapers of our nature, recently have failed to be effective in producing the proper transformations of our value system to fit both with the radical changes resulting from the sciences and scientific technology and with our genetic information. The failure of religion, poetry, drama, philosophy, law, and other cultural institutions to produce a credible and effective conceptual scheme of our values in the context of ancient genetic and radically new cultural patterns leaves them relatively impotent to illuminate or to motivate proper ethical relations of individual to individual, or nation to nation, or our duties with respect to *the environment*. Many leading scholars have asked: Can the value-shaping institutions become rationally coherent with, or operationally effective within, modern science and scientific technology?

I believe they can. But the humanities and the religions of man have thus far failed to adapt to the new science, and thus they fail to produce a suitable coadaptation of our genotypic needs with our sociocultural needs, to harmonize the two natures within each individual. As a result we may witness increasing mental breakdown and social disruption as long as this incoherence between genotypically and culturetypically generated goals and needs persists. If it does



persist, the private interest will confront and oppose the public good and vice versa, instead of their finding mutual satisfaction. This will lead to the crumbling of the social structure and its potential benefits to the individual. These are the sources of the decline and fall of civilizations.

Moreover, with this disharmony and impotence for motivation spoiling the fine tuning of earlier adaptations to values in our relations with one another, we shall be less capable of dealing with new problems that arise with respect to our environment because of the new powers and applications of scientific technology. Thus we find all three major elements contemplated in this *Zygon* issue to be in potentially unstable and possibly dangerous states. The three elements—private interest, public good, and the environment—which ordinarily have been harmonious, recently have become sadly out of tune.

What becomes clear is that the highest powers of our scientific reason must be applied to understanding and adapting our sociocultural patterns of life to our underlying genetic and ecological realities. It is an error to suppose that reason has nothing to do with emotion, feeling, religion. The brain that our genes have given us is a brain which profusely interconnects our rational faculties with our deep genetic motivations. We do not even have the power to think unless it is perceived as a pleasure and ultimately a good for us individually as well as for us as members of a sociocultural organism. Our politicians as well as our psychotherapists and clergy are going to need to grasp this deeper nature of man and how its good is involved in both the sociocultural organism and the environment.

A first thing to keep in mind is that nature, the environing reality, or the total ecosystem in which we live and move and have our being, calls the tune, sets the requirements to which we must adapt. We cannot simply seek to carry out our present feelings or will until we have tested the validity of our intent with what the total ecosystem requires of us.

You will see now from this, as I hinted earlier, that the meaning many people attach to the term “environment,” the clean air and water, the conservation of energy, and tidy villages, is a part of the more inclusive perspective of the ecosystem that I am presenting. I am saying we cannot offend this larger totality of nature that the scientists are revealing, the seemingly invariant network of laws by which the totality of events in the universe operates. If we ignorantly or spitefully offend that nature, we only spite ourselves, because the nature that the sciences portray is not just the wood or pond beyond our yards and domestic economy; it is the very ground and source of our being.

Many people in our society, including many in business and government, are trying to solve particular important economic, social,

and environmental problems. But the larger picture I have presented now gives us a very tangible view of what we must do if we are to motivate gracious service in the public realm from among our fellow citizens who may not be as persuaded as we are that we must respect the requirements of the environment and be careful about our potentialities within it in the future.

The whole gamut of the humanities, including philosophy, literature, arts, and religion, insofar as they may have any role whatsoever in shaping human values and in motivating behavior in accord with these values, must become relevant and attuned to the human condition as seen in the light of the new scientific pictures of man's nature and the nature of the total system of reality, which ultimately sets our values. People in the humanities may indeed resonate with the new "two-in-one" understanding of man's private and public nature, and how those two natures have been successfully made one in the past, and how that can be better done in the future. People in these broad realms of the humanities must also take seriously the new scientific understandings of man's essential union with and utter dependence upon his essential environment. They must see that scientific information is beginning to reveal how genes and cultures in the past both have been coadapted successfully to unite into a harmonious whole these three—genetic, sociocultural, and environmental—aspects of our nature. This information could be important for understanding how best to choose new goals in the context of our ecosystem.

If I understand correctly the historic role of the humanities in education and the humanistic institutions or professions in their presentations to the public, I would say the humanistic scholars and creative artists should be very assiduously examining the new revelations and transformations brought about by the sciences and scientific technology concerning the place of man in the scheme of things, be describing the major opportunities among which we can choose, and be illuminating the consequences of such choices for our ultimate good. This task should include the following purposes: (1) to examine whether the new scientific pictures may be (as I believe they are) a reasonably close, modern translation of what the religions and the traditions of literature, arts, and philosophy in general have been saying; (2) to determine whether the translation needs to be presented through the arts, humanities, and religion to orient the public (as I believe it does), and how and by whom; or (3) to ascertain whether there are new and different patterns of what ultimately should be our concerns, and if different (as is very likely to be the case at least to a small degree), how best to convey these to the public. And, after such a research into whether new scientific-technological conditions reinforce traditional values or warrant a change, the scholars

and agents of the humanities should be teaching the whole population how its values must be revitalized or reoriented for a good life in an age of science and technology, especially to achieve an optimal degree of harmonious coadaptation among private, public, and environmental good.

NOTES

1. Charles Percy Snow, *The Two Cultures and the Scientific Revolution* (New York: Cambridge University Press, 1960).
2. Sidney Mead, *The Lively Experiment: The Shaping of Christianity in America* (New York: Harper & Row, 1963), pp. 55-71.
3. Gregory Bateson, *Step to an Ecology of Mind* (New York: Random House, Ballantine Books, 1975), p. 381.
4. Herbert A. Simon, *The Sciences of the Artificial*, (Cambridge, Mass.: MIT Press, 1969), p. 25.
5. For a comprehensive and readable account of related matters, see George Edgin Pugh, *The Biological Origin of Human Values* (New York: Basic Books, 1977).
6. This interpretation of genetic selection of the motivational mechanisms in the brain is widespread in the sciences, with diverse routes to it. See for instance Michel Cabanac, "Physiological Role of Pleasure," *Science* 173 (September 17, 1971): 1103-7. See also Charles J. Lumsden and Edward O. Wilson, *Genes, Mind, and Culture: The Coevolutionary Process* (Cambridge, Mass.: Harvard University Press, 1981), who have posited the operation of environmental reinforcers of epigenetic development that establish regularities or rules whereby genetic information is translated through a series of behavioral consequences in the central nervous system to establish preferences of various kinds, from which follow individual response patterns and hence certain cultural patterns. The relation of selection in genes to selection of epigenetic structures is newly elaborated and stressed in Lumsden and Wilson but was also noted earlier by such investigators as Pugh (see n. 5). See also B. F. Skinner's somewhat different emphasis on a similar process in his "Selection by Consequences," *Science* 213 (July 31, 1981): 501-4, which is a recent follow-up of an interpretation he has been developing for a long time; see his "The Phylogeny and Ontogeny of Behavior," *Science* 93 (September 9, 1966): 1205-13.
7. Romans 7:19.
8. For a discussion of the symbiotic relationship between two kinds of organism that constitute a human being, one based on genetic information and one based on cultural information, see Ralph Wendell Burhoe, "Religion's Role in Human Evolution: The Missing Link between Ape-Man's Selfish Genes and Civilized Altruism," *Zygon* 14 (June 1979): 139-48; reprinted in Ralph Wendell Burhoe, *Toward a Scientific Theology* (Belfast: Christian Journals Limited, 1981—in the United States, available through the *Zygon* editorial office), pp. 206-17.
9. J. Bronowski, "New Concepts in the Evolution of Complexity: Stratified Stability and Unbounded Plans," *Zygon* 5 (March 1970): 18-25.
10. Burhoe, "Religion's Role," in *Zygon*, p. 143, in *Scientific Theology*, pp. 210-11.
11. For a scientifically up-to-date analysis of three levels of the brain—reptilian, old mammalian, and neocortex—see Paul D. MacLean, "Evolution of the Psychencephalon," in this issue.
12. Julian Huxley, "The Uniqueness of Man," in *Man in the Modern World* (New York: New American Library, Mentor Book, 1948).
13. Alfred E. Emerson, "Dynamic Homeostasis: A Unifying Principle in Organic, Social, and Ethical Evolution," *Zygon* 3 (June 1968): 129-68, esp. 140-43.