EVOLUTIONARY ASPECTS OF FREEDOM, DEATH, AND DIGNITY

by Alfred E. Emerson and Ralph Wendell Burhoe

Our aim, in response to the call of the Conference on the Humanizing and Dehumanizing of Man, is to explore some aspects of what is involved in our becoming human, to contribute something to the "scientific, philosophic, and religious criteria [that] enable us to distinguish the humane from the inhumane," and to respond to related questions, including our "hope for a more humane future."

Harlow Shapley, to the delight of an early conference of the Institute on Religion in an Age of Science, announced the discovery of the missing link between apes and humans—it is man! Shapley's story suggests the longer evolutionary perspective that defines our approach. We shall use recent scientific discoveries to examine the continuing evolution of human nature from its biological origins. We believe these can clarify the meaning of the humanity of man and guide us toward a more humane future.

We were asked to explain two highly esteemed human values—*freedom* and *dignity*—in relation to that seemingly inhumane indignity—*death*—from which we apparently have no freedom. We were intrigued by contemporary theories of evolution that can do much to clarify man's meaning, freedom, and dignity in the face of death.[1]

At the same time, we attempt to find some principles that relate natural science, social science, aesthetics, and religion within a common unity.[2] Early and recent thinkers have suggested that one can discover orderly relationships among diverse phenomena, indicating

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[*Zygon*, vol. 9, no. 2 (June 1974).]
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that all human experience can be arranged within an interrelated whole—a viewpoint that seems increasingly convincing.[3]

Freedom

The concept of freedom in its various forms is a product of human experience and thought. Precursors of freedom are found in biological systems.[4] If we limit the definition of freedom to *the liberty to vary that allows choices among alternatives,* biology provides many examples showing functional resemblances to advancing cultural evolution. The evolution of the human brain provides the integrating processes that join genetic and cultural heritages and enlarge man's capacity to make viable choices among alternatives.

Biological Variations and Cultural Analogues. Choices or selections among alternatives require variance. A degree of freedom to vary is necessary for progressive evolution in either biological or cultural patterns. It may give insight to compare some analogous characteristics of freedom in biological and cultural systems. While it is risky to assign human values, such as freedom, to prehuman biological or physical processes,[5] mankind did arise from preexisting species and shares many detailed and general attributes with earlier animals. Human individuals have anatomical, physiological, developmental, and psychological characteristics derived from ancestral animals. The novel and uniquely human traits emerge gradually, particularly with the evolution of the human brain, which is now shaped by cultural as well as genetic information. Convergent analogues in social organization evolved independently in both insect genotypes and human cultures.[6] We believe some basic principles for man may be derived from the homologous and analogous functions that are widespread in living systems.

Presented below (in italics) are ten important types of biological variation that provide freedom for choices or selection, each followed by discussion of an analogous type of cultural variation.

1. *Gene mutation.* Symbols are analogues of genes in their capacity to change and to repeat the modification.[7] Symbolic communication transmits cultural heredity. Selection of variants produces progressive social evolution.[8] Apparently, there is a similar balancing between conservative replication and novel change in both genetic and cultural evolution.

2. *Cytogenetic or chromosomal mutation.* Arrangements of interacting symbols in phrases, sentences, communications, customs, and rituals are analogous to arrangements of genes in chromosomes

and multiple associated genetic complexes. In cultural evolution, languages and moral and legal codes are changed and perpetuated over long periods of time.

3. *Change of the gene pool of a local population.* Population geneticists show that gene incidence in local populations is maintained along with individual genetic differences. Sewall Wright has postulated that integration of gene pools in local populations with considerable inbreeding, occasional outbreeding, and interpopulational competition allows populations to be selected as units.[9] The selection of fit populations may lead to more rapid adaptive evolution than the selection of individuals alone. Cultural evolution may be expected to progress more rapidly as local subcultures develop cooperative integration and then constructively compete as systems with other subcultures.[10] Fitness is measured by social and ecological homeostasis. If fitness is erroneously conceived as power and force with resultant selfish exploitation or mutually destructive warfare between individuals, or nations, or classes, improved homeostasis will not occur. Ignorance of this demonstrable principle in social decisions and choices is a major factor in the manifest deterioration, degeneration, and inviability of whole cultures, nations, and races around the world.[11]

4. *Reassortment by means of sexual recombination.* Rearrangement of words with emergent effects is similar to sexual reassortment of genes and chromosomes, each arrangement producing unique individuality. We commonly refer to the cross-fertilization of concepts and ideas, particularly through cross-disciplinary exchange.

5. *Somatic mutation.* Somatic mutation of genes or chromosomes during development of a single multicellullar individual is of minor importance in organic evolution. When it occurs, deleterious effects usually result. Cultural evolution of societal units with analogous organismic attributes is always accompanied by division into many subcultures represented by ethnic, regional, linguistic, institutional, political, scientific, and religious groups. Each originates new symbols to express new thoughts, emotions, aesthetics, and information. An important difference between genetic coding and cultural coding is the difference in the mode of transfer. Genes must be passed on by reproduction to new generations. Symbols are transferred vertically in a similar manner, but they are also communicated horizontally from one exist-

ing subculture to another, sometimes by means of single individuals who belong to several organizations at the same time.[12] Newly coined words such as "ecology" or "homeostasis" quickly pass across cultural borders and become functional concepts, whereas such horizontal exchange of genes is rare. However, integrated species invade different ecosystems by horizontal transfer.

6. *Epigenetic variation through physiological divergence and integration often genetically coded.* An unabridged English dictionary contains over five hundred thousand words. The number of genes in a single zygote is much less. In both types of coding, an infinite number of emergent effects is possible during internal development without modification of the coding genes or symbols.

7. *Change of habitat or ecological position.* Adaptation and adaptability should be differentiated. Internal and external adaptation of plants and animals results from the guidance by natural selection of genetic systems through evolutionary time. In contrast, adaptability is a capacity for pliable responses and adjustments to varying external conditions during the life of an individual or a population. A tree on the edge of a woods grows leaves and branches on the side exposed to sunlight and will self-prune its leaves and branches on the shaded side. Human red blood cells increase in numbers at high altitudes. The adaptability of individuals and cultures to new conditions is so apparent to anthropologists, ethnologists, psychologists, and sociologists that one may lose sight of genetic adaptation and the genetic basis of epigenetic development in social organizations.

8. *Differential sensory perception.* Direct response to internal or external sensory stimuli is usual in prehuman animals and plants. Inherited direct automatic behavior of animals is called instinctive.[13] Before genetically coded behavior was separated from conditioned behavior, both were termed instinctive. Here *instinct* is confined to genetically induced behavior without learning or conditioning. Millions of examples of instinct are known among animals. The evolution of elaborate instinctive architecture and agriculture in some insect societies is analogous to the nongenetic cultural evolution of habitations and farming. Some human behavior is instinctive—for example, basic unlearned adjustments between mothers and babies, unlearned sexual activities, and defensive responses to internal and external danger.

Animated controversy occurs about the reality of human social instincts such as "territoriality," "aggression," and "love." We are inclined to think that some genetic basis of human social behavior exists. It is obvious, however, that instinctive behavior can be channeled toward epigenetic modifications, replacements, and substitutions in both higher animals and humans.[14]

9. *Different reactions after experiences, by means of learning and memory capacities in a central nervous system.* Learning and memory occur in animals but are enormously enhanced by the evolution of the human brain. Science has tended to concentrate on external sensory information, whereas religion has emphasized internal feelings and emotions, but such a dichotomy overlaps, intermeshes, and is not sharp. Sensory perception is both internal and external, and brain connections integrate both. External senses have been studied more thoroughly, but internal sensory perceptions and dreams are being actively investigated by neurophysiologists and psychologists. The internal integration or harmony that may be said to underlie dignity probably evolves in animals, with some precursors in plants without nervous systems. Subjective balance is difficult to ascertain in prehuman organisms, and the evidence is circumstantial.

10. *Variant internal neurological reactions involved in responses whose final selection of input and output is dependent upon the brain's dynamic homeostatic processes for optimizing relations of individuals with the environment.* It has been believed by millions, including religionists, philosophers, and some scientists, that internal awareness and contemplation, with concentration resulting in hypometabolic quiescence, provide integrated knowledge of the subjective and objective aspects of existence. As we understand this belief, inner contemplation produces wakeful rest with a feeling of unity with infinity, and is monistic, not dualistic, although some concepts, such as simplistic reincarnation, separate body from spirit and consciousness with unwarranted sharpness. Self-control with partial elimination of conflict—aspects of homeostasis—leads toward the idealistic goal that is never reached. Inner contemplation is individual awareness of and identification with human, biotic, and physical transcendent existence. Such inner contemplation, on the basis of present neurological understanding, operates as a dynamic homeostatic process whose structure involves a model of self, the world, and the cosmos, accumulated or learned from three distinct sources

and integrated into a single whole. The three sources of accumulated information are: (1) genetics, (2) enculturation, and (3) the other inputs to or experiences within an individual brain during its lifetime. The inner contemplation or neurological review is a phenomenon that seems to be a unique product of the human brain that for more than a million years has been evolving with strong cultural or symbolic information inputs. Such contemplation may be said to give freedom for the brain's processes to allow relevant information recorded in the past to be projected (sometimes consciously and logically, always partly unconsciously) into possible future outcomes on the basis of various explicit or implicit premises. All premises are dominated by the self's or organism's ultimate needs or goals as structured in the brain's homeostatic norms. The goals have been provided by previous integration of the three sources of information. The need to sort things out in the head is well known. The outcome or success depends upon the adequacy of the cultural as well as the other acquired information of the particular brain. The highest or most "sacred" needs or goals are usually considered to have their input from the religious sector of a culture. It should be noted that according to this model the culturally uninformed brain could not have much success in meditation. It would seem equally true that the more conflicts there are among genetic and cultural inputs, the more internal "sorting out" or reflection would be required.[15]

The analogous biological and cultural forms in each of the ten different levels above produce variations that provide for the possibility of selection or choice. The last five biological levels are essentially epigenetic or environmentally produced variations operating on given levels of genetic patterns. All cultural levels are strictly epigenetic, but with genetic grounds and bounds.

Some Notes on the Role of the Brain. In the tenth of our levels of analogous functions of genetic and cultural information, it becomes quite clear that in the human brain we are discovering the locus where the integration of both the genetic and cultural heritages of information takes place. Moreover, the brain integrates this complex collection of information into its processes for evaluating, selecting, and channeling the millions of bits of ever-varying inputs concerning the present state and needs of the organism in its environment. The brain operates to make selections or choices to optimize or enhance life. It is the seat not only of all the unconscious or tacit knowing and behavior

but also of the marvelous phenomenon of consciousness—of man's awareness, feelings, perceptions, and reasoning powers. Focal attention on some sensory stimuli with concomitant exclusion of others is observed in a variety of animals, including predatory wasps and flower-visiting bees. Catalepsy, alert immobility at times of danger, and trancelike death feigning are seen in insects and all classes of vertebrates. Hypnosis, as we understand it, is attention to the suggestions of the hypnotizer, with activation or inhibition of particular nerve pathways and memories. Pain can be cut off or enhanced by hypnotic suggestion. Detailed memories of early childhood that are vague or forgotten by the normally conscious adult may be uncovered. Self-hypnosis is well known. Partial separations of emotions and rational thinking often occur in both mentally normal and abnormal individuals.

Neurophysiological processes of attention and memory are known only fractionally.[16] Recent experiments, designed or by accident, provide considerable information about brain functions.[17] Areas of brain coordination and specialization are partially plotted by observations and experiments associated with small and large lesions resulting from strokes, brain damage, senility, oxygen and sugar deprivation, sleep, consciousness, unconsciousness, amnesia, connections between specialized abilities of right and left lobes, reduced learning ability, and excision of parts. The effects of drugs on illusions and hallucinations are being actively studied. Electric shock, insulin shock, and chemotherapy for psychiatric patients have been practiced. Side effects have been discovered that indicate functions of whole complexes rather than pinpointed spots.

Gradations between psychoses, neuroses, and prejudiced attitudes associated with specialized knowledge and ignorance are amenable to study. Order, cause and effect, feedback webs, specialization, abstraction, generalization, and scientific interpretations afford the beginning of an understanding of behavioral psychology and neurophysiology.[18] We may anticipate great future growth of these sciences and correction of present and past errors of fact and theory.

Conscious choice seems to be a product of the evolution of the brain. The human brain still contains earlier layers whose patterns were coded millions of years ago in our premammalian ancestors. These patterns in modified forms are retained in our own genotypes. MacLean describes three levels of brain involved in organizing and directing human life and awareness: the reptilian brain, the old mammalian brain, and the new human outside layer.[19]

According to Sperry, all consciousness is a product of brain action.[20] Young has called the brain a "homeostat," an organ for the

regulation of behavior so as to maintain certain norms or values necessary for the organism as a whole.[21] Many of these biochemical and biophysical regulations are coded by genetic information, such as the regulation of human body temperature close to the optimal for physiological activity. But many other norms are established by the culturetype supplied by the society in which a child is reared, such as morals and religion.

Freud and others have shown how a child learns many things through experiences of which he is at least partially conscious but which later on become partially unconscious. Everyone is familiar with the difficult conscious problem of learning to ride a bicycle, drive a car, or other complex behavioral repertoires which later become habitual, needing reduced conscious attention. Scientific inquiry is a largely conscious search for data and their relationships to interpretive abstractions, and these are consciously recorded in artifacts, words, and writings and are consciously learned as they are transmitted from brain to brain.

Our growing information strongly indicates that human consciousness, inner and outer awareness, depression, ecstasy, euphoria, mentality, organized and disorganized personality, responses, emotions, feelings, rationality, memory, logic, knowledge, abstraction, symbolization, intelligence, intuition, wisdom, soul, and spirit are the emergent results of neurophysiological variations impinged upon by internal and external stimuli and conditions.[22] They are correlated with development, deterioration, and modification of nerve and brain metabolism.

It follows that these emergents disappear individually with the disintegration or cessation of neurometabolism at the time of individual mortality. Immortality and continuity between generations depend upon coding by transmitted genes and cultural symbols.[23]

Cultural immortality through influence of the dead upon the living is magnificently expressed in the famous oration by Pericles in 430 B.C.: "The whole earth is the tomb of famous men; and their story is not graven only on stone over their native earth, but lives on far away, without visible symbol, woven into the stuff of other men's lives. . . . They gave their bodies to the commonwealth and received, each for his own memory, praise that will never die, and with it the grandest of all sepulchres, not that in which their mortal bones are laid, but a home in the minds of men, where their glory remains fresh to stir to speech or action as the occasion comes."[24]

In conclusion, when looking upon freedom as change followed by selection among alternatives, we find a degree of freedom in prehuman biological evolution and development. Freedom is necessary for

creative and progressive evolution. The role of freedom is efficient when the units of selection—genes and genetic systems—produce epigenetic neurophysiological capacities to learn and to associate effects and causes, enabling prediction of and adaptability to probable future events. Progressive cultural evolution is greatly facilitated when symbols and symbol systems are given a degree of freedom to vary, followed by selection of more fit and viable feelings, concepts, and expressions associated in society with internal integrity and external exchange.[25] Cultural evolution does not negate preceding and contemporary genetic selection.

Evolutionary Conservatism. Whether the selected unit is the result of genetic or symbolic change, only a small part of the total function of the whole system is due to immediate change. By far the greatest function of heredity is the faithful replication of integrated and adapted units and assemblages. Far more than 99 percent of the function of biological heredity is repetition without variation. To the extent that cultural innovation may be intelligently planned with less randomness, the balance between replication and variation may allow greater change without as great a danger of disintegration of attained adjustment. The more adapted a system has become either internally or externally, the more likely change is to be detrimental rather than beneficial. The greater the fitness, the more selection reduces or eliminates change. Freedom to vary, if uninhibited, may be lethal to the individual or group.[26] Yet no progress in the range of adaptation would occur without change resulting in emergent properties of new relationships. In other words, freedom is balanced and optimal, not maximal nor minimal, in surviving biological or cultural systems.

Restrictions on Freedom. There are several types of restraints on freedom, each with many ramifications.[27] The constitution of the unit, whether genetic or symbolic, changes only in part. Often an allele of a gene differs from the unmodified-type gene only by partial changes of its molecular structure. The resultant epigenetic effects may not be great. Side effects may be deleterious and outweigh a potential beneficial effect. The less drastic the effect, the greater is the probability of survival. Changes of symbols and ideas are far more rapid than genetic modifications, but again we find relatively slight variation more prevalent and more likely to survive than major innovations. Small changes in phonetics or spelling allow us to trace language evolution in time and space. Meanings of the same word may change slowly through expansion or contraction. If we invent a new word, such as "electron" or "cybernetics," to express a new discovery in science, we use roots of ancient languages.

If an organism has evolved a high degree of adjustment to a relatively unchanging environment, modifications may be eliminated —for example, the so-called primitive living fossils of plants and animals. There are many instances of relatively isolated primitive human societies, well adapted to their environment, that have changed little in thousands of years.

Yet an adapted species faced with rapid and drastic external ecological or internal physiological changes may become unadapted to new situations. If the capacity to change is too slow, or the complexities of interrelated function too intermeshed, species may become extinct, often to be replaced in the ecosystem by other species, initially poorly adapted, that slowly evolve better fitness. By hindsight, selection fitting organisms to a specialized environment which later changes radically may be considered overspecialized, but the processes of evolution usually cannot fully or adequately foretell rapid changes in the habitat. Exceptions include teleonomic end-directed functions and scientific predictability.[28]

In cultural evolution, an analogue is found in the intricate interdependence that makes urban or industrial communities more vulnerable to disruption than more generalized and self-sufficient rural communities. The breakdown of a single major parameter of a complex community can cause the collapse of the whole system.

Occasionally, preadaptation occurs.[29] Gene or chromosomal mutations at times produce a beneficial effect by chance before selection operates. On the other hand, more complex adaptations to a set of ecological factors may be preadapted to somewhat similar conditions in a new habitat. An example is the adjustment of the King Penguin to cold rocky nesting grounds in South Atlantic islands. Instead of laying eggs on the ground or in a nest, the female places the egg on her feet and incubates it within a warm, feathered pouch. This instinct and structure enabled the ancestral species to invade a new inhospitable habitat on the ice pack of the Antarctic continent. The derived Emperor Penguin nests exclusively on pack ice with no available nest material.

Cultural evolution provides many examples of preadaptation to new conditions and new locations. Europeans invaded North and South America occupied by Amerinds. With their more effective military weapons, armor, horses, social organization, and civilization, Europeans overwhelmed the native cultures by fair means and foul. The surviving Amerinds had to adopt many European methods and attitudes to avoid total annihilation. Other subcultures, such as the aboriginal Tasmanians and some tribes of American natives, succumbed. We have no doubt that the so-called superior invaders were actually inferior in portions of their culture and moral attitudes.

In both biological and cultural preadaptation, successful traits are associated with deleterious characteristics. A species that becomes extinct may carry into oblivion some advantageous adaptations. Lateral mixing of cultural heritages ultimately may blend in a new and viable composite with reinforcement of separately evolved beneficial customs, whereas only vertical continuity of genetic units allows biological characteristics to become incorporated in numerous derived races or species. Hybrid vigor (heterosis) occurs in both biological and cultural systems. Hybrids, however, also may be unintegrated or sterile.

Diversity within Unity. The incompatibilities between freedom and restrictions are partially resolved by incorporation into more inclusive units that order both the cooperating and antagonistic aspects of any system. Some have conceived a highest unit, God, as perfect. Perfection is the *omega* of Teilhard de Chardin, implying complete harmony. *That* which is behind *this* is the Brahman or the absolute of basic Hindu philosophy.[30] Perfection, however, does not allow for any dysfunction, disequilibrium, differentials, variation, struggle, competition, pain, suffering, disease, sacrifice, death, or evil in any sort of biological or human existence.

We believe not only that perfection of any form of life is quite impossible, but that it is a dangerous illusion without valid justification in either the external biological world or our minds and inner consciousness. Striving toward an ideal can be constructive, but failure to attain it may be destructive frustration. Diversity within unity is possible, but both are necessary aspects of life and cannot be fundamentally or sharply separated. Diversity and change produce the energy and matter that may later find ordered relations. The most basic scientific constants of which we are aware are formulae of relationships among differences. Relations are just as important as are the perceptions that are related. Unity is a relationship, but is inconceivable to us without diversity to unite. Various inclusive levels of organization each have holistic emergent qualities not found in the parts that may be relatively separate units at lower levels. Diversity provides the dynamics of unity and organization in both the physical and living world. Organic unity is not synonymous with complete uniformity.

Integration—which may be basic for a sense of dignity—may decrease both internal and external conflicts, but in living beings integration always involves dynamic relations. Remove the dynamic aspects, and integration is also removed. An internal quiet joined with an all-pervading quiet is beyond time and space, beyond energy and matter, beyond life, beyond consciousness, beyond comprehension, beyond existence—in other words, totally empty and void.

Emotional and intelligent awareness of possible order among variations inspires the religionist, artist, and scientist, and provides the motivation leading to creative religion, art, and science. In the attempt to bring our deeply felt religious emotions and inspirations into relation with our intelligence, we often find individuals and groups polarizing these parts of human nature. Either they discount science as mechanistic, analytic, and reductionist without recognizing the emergent qualities of synthetic wholes eliciting wonder, inspiration, and religious experience; or they discount religion as faith in a supernatural, mystical, anthropomorphic god based upon myths and superstitions. By eliminating the errors of fact and interpretation, we hope that the order between contrasting phases of human experience in relation to the ecosystem and to the cosmos will evolve toward optimal adjustments that will avoid looming disruption, deterioration, depravity, and extinction.[31] In the long run, selection chooses among free variables with guidance toward more viable optimal maintenance, perpetuation, and progress. Both biological and cultural progress involves replacements, eliminations, death, and extinction of unfit individuals, populations, and ideas, together with the emergence of improved holistic systems and homeostatic regulation of variables.

To sum up on human freedom, we have found from the sciences a picture of freedom as the capacity to change so that selections can be made among alternatives. This is essential for the selective guidance that eliminates the unfit and establishes forms that fit the environment. We have seen that there are restrictions on such freedom imposed by nature, which decrees that most random choices are self-destructive. Hence, for living systems to evolve above rather primitive or unstable levels, freedom also comes to mean the *capacity* to make choices that are partially preadapted to the conditions which nature imposes. We have briefly touched upon some aspects of the evolution of new levels of choice-making systems that are less fully random and more homeostatic—from recombination of genes to association in brains. We have found that in biological evolution from primitive cells to men there is an increase in the range of adaptation and adaptability by making choices. This increase is based on accumulated genetic information about what is viable. We have also seen that in the evolution of the human brain, which makes possible greatly enhanced conscious selection, the patterns of choosing are guided by cultural as well as genetic information about self and surroundings. In human brains there has evolved the largest capacity of freedom to make viable choices that we know about. The evolution of religious and other cultural wisdom provides human brains with grounds for ever

more advanced choices. The more detailed scientific information about what freedom means provides guidance for the further conscious enlargement of human freedom.

However, although we may now at least have a little clearer view of freedom and its connection with both the variability and the stability or viability of living systems, we may remain perplexed. With all our freedom and viability as a species, our inevitable death as individuals presents us with logical problems that our natural feelings of hope, worth, and dignity are not able wholly to overcome. Before we can talk about human dignity, we must confront the problem of death.

Death

Death has been considered incompatible with life, but can now be shown as necessary for life. Religion is commonly associated with man's facing the puzzle of life and death. The consciousness of self and of the threat of death is considered a unique quality of man. Ritualistic burial of the dead originated with Neanderthal man and indicates a conscious self-awareness.[32]

It cannot be overstated that division of labor separates some functions from others in the integrated unity of the whole individual or population system. Nor can it be overemphasized that the relations between the parts are as important as the parts that are related. For example, a personal individuality with obvious continuity in time remains relatively intact as the various atoms and molecules are replaced through continuing ingestion and excretion. It is a great error to exclude the "spirit" from physical and chemical relations of the human individual, or humanity from those of the whole cosmic unity.[33] The extreme mechanists and rigid determinists, together with certain extreme religious dogmas, exclude aspects of a larger inclusive whole. Dogmatic interpretations by both religionists and scientists often become incredible and disproved by later facts and rational constructs. The aim of both science and religion is to discover relative truth and to penetrate as deeply as possible into fundamental truth. The goal of both science and philosophy should be critically to evaluate evidence, both internal and external, together with alternative explanatory hypotheses, to correct errors, and to improve both rational and emotional responses.

It is inspiring that some early philosophies of Asian and Mediterranean civilizations conceived of infinite, transcendental unity. Some religious beliefs, often superficially drawing upon anecdote and pseudoscientific concepts of spiritualism, extrasensory perception, fatalism, astrology, precognition, and dualism, indicate a great human concern to transcend personal death by continuity. Our indi-

vidual role in the more inclusive organizations of which we form a small and transient part may be uncomprehended. The human personality is so anxious to attain harmony between itself and the social system, ecosystem, and cosmic order that it often turns to irrational faith or even patently false or absurd beliefs, particularly if wishful thinking provides short-term comfort and tranquillity. Some of the basic beliefs of the early Vedanta philosophy, Buddhist concepts, Chinese ethics, Judeo-Christian morals, and even pagan and ancient Near East and Mediterranean religious philosophies have inspiring ideas compatible with early and recent scientific truth. We should continue to examine the processes of persistent truth and error. Absolute truth, absolute good, and absolute evil are beyond our knowledge at present or in the future.

Dreams probably provide some basis for notions of flight or freedom of the spirit from the body. Through dreams we seem to see and hear persons who have died or are separated from us in space or time. If memories emerge from the neurophysiological process of the brain and are thereby projected in new combinations into consciousness, then dreams may be interpreted without recourse to a dualistic separation of mind and emotions from the body.

Biological Death. A consideration of the biological aspects of death may help bridge some of the gaps between religion and science.

All organisms belong to population systems by means of asexual and sexual reproduction. Before the advent of sexual reproduction, division of the cell occurred under conditions of differentiation, growth, and environmental stimuli. Asexually dividing cells do not necessarily die, but limitations of increasing numbers are soon imposed, inevitably leading to mortality of the great majority. In multicellular organisms growth results from cell development and division. In our own bodies, billions of cells originating from the fertilized egg form tissues with division of labor benefiting the whole organism. Some tissues, such as the red blood cells, have a limited life cycle of their own. After a few weeks, they are literally eaten by the liver cells and other phagocytes that recycle their ingredients.

The detailed processes of growth and differentiation are incompletely known, although much research is devoted to this subject. Once attaining a functional balance within the body, the kidney may not grow in size; but if one kidney is removed by surgery, the opposite kidney grows twice as large. It is then inhibited from further growth. The controls that activate or inhibit growth under such circumstances are often largely unknown.

Growth and reorganization are activated in lower organisms when

parts are lost or injured. A branch of some plants may regenerate a whole plant with roots, stems, leaves, and flowers. A flat worm cut in half will regenerate two whole worms. The worm first may reorganize by division of some "embryonic" cells, followed by growth when it has developed a functional mouth connected with a digestive system. As one ascends the evolutionary tree, regeneration of the whole organism or of major portions may be limited. Man, for example, heals wounds and may regenerate some parts, such as the ear drum, but cannot regenerate whole limbs. Nerve dendrites may regenerate, but nucleated nerve cells soon after birth do not. Regeneration of whole bodies may occur early in embryonic life to form identical twins, but not in later stages of development. Polyembryony in some insects results in one hundred fifty or more individuals from a single egg, all genetically identical.

Sexual reproduction appeared early in the evolution of plants, antedating the origin of animals. Some sexual fusion (DNA-RNA transfer) is found in bacteria and viruses, but eggs and sperms with division of labor between nutrition and motility originated with green algae. Sexual fertilization produces unique genetic reassortment from two parents. The later reproductive functions of sex are derivative.

After the attainment of sexual reproduction, many evolutionary branches secondarily evolved asexual reproduction. A great many gradations between meiosis with haploid gametes with one set of chromosomes and mitosis of diploid reproductive cells with two sets of paired chromosomes are known. Permanently parthenogenetic asexual reproduction has convergently evolved in many phyla (including fishes) with gradations connecting to sexual ancestral types.

The price of most functional epigenetic specialization is later deterioration, mortality, and replacement. Mortality may result from external or ecological events, or it may occur through irreversible degeneration, aging, and senility.[34] Mortality produced externally by accident or disease, competition in a finite environment, predation and parasitism between species, and relations within ecosystems are too obvious to need elaboration here. Internally induced death of individual cells or organisms has received less scientific study. It may surprise some to learn that predation of some cells and tissues by others is a normal and beneficial occurrence within the human body. Deterioration and death are genetically coded for the somatic individual organism,[35] but are not inevitable at population levels.

Evolution of functional division of labor often leads to the regressive evolution of maintenance.[36] The tumbleweed is adapted to break the stem of the dead plant, roll with winds, and distribute its seeds over steppes and prairies. Mouth parts, digestive tissues, and defen-

sive adaptations are vestigial in many adult insects. Loss of reproductive capacity has evolved among the sterile castes of social insects. Pacific salmon hatched in fresh water migrate to the sea and return to fresh water, where they cease to eat well before spawning. They are innately and genetically adapted to die at the end of their individual lives of several years. That this physiological death is genetically coded is proved by the similarities in the life cycle of related species of the same genus and between related genera.

With millions of examples of genetic limitation of individual range of life in plants and animals, we are forced to conclude that death is normal and innate in most organisms.[37] Mortality is selected because of its benefit to the life of the group. Genetically induced senescence serves to eliminate aged and deteriorating individuals no longer of benefit to the inclusive population or society. We can imagine no greater catastrophe for the human species than the discovery of an elixir of life that would perpetuate old individuals at the price of new births and associated physical and mental vitality. Humane consideration for the sick and elderly is characteristic of a healthy society, but hope for immortality of complex organisms appears to be looking in a wrong direction.

Genetic immortality does occur. Primary or secondary asexual organisms that divide and bud do not necessarily die. Surviving individuals may never have had an ancestor that died, but maturity and size may have optimal functions that initiate asexual reproduction and duplication with consequent reestablishment of more homeostatic populations. Processes leading to perpetuation, replication, birth, maturity, and death are genetic and epigenetic with feedback webs from effects to causes.

Many have thought that there is no meaning in personal life if mind and consciousness cease at death. Of course there is meaning, the more so if one plays a constructive social and ecological role during life. We serve a better function and are better able to face death to the extent that we identify *our basic nature* with an ongoing community of the living:

> For there is nothing lives but something dies,
> And there is nothing dies but something lives.
> Till skies be fugitives,
> Till Time, the hidden root of change, updries,
> Are Birth and Death inseparable on earth;
> For they are twain yet one, and Death is Birth.[38]

Death of Populations. In contrast to individuals, instances of genetically coded death of populations are difficult to find. In general we

find no evidence that populations have innate senility or death.[39] However, it is true that lemmings and locusts react to crowding by migrating with resultant ecological death of the migrating portions of their populations. Populations of flour beetles and social insects may control overpopulation in a finite habitat by cannibalism or slaughter.

Tissues of individuals of one species may be sacrificed for another species in ecosystems. Flowers and fruits attract pollinators and distributors benefiting cooperating plants and animals. Pollinating and nectar-seeking worker bees feed the young and other members of the colony with genetic sacrifice of their individual reproductive capacity. In such cases, only a part of the organism or population dies, whereas division of labor sustains and perpetuates the species or ecosystem as a whole.

However, species do become extinct. Species may evolve to fit changing conditions, or they may be unable to change rapidly enough to adjust to either physical or biological conditions.[40] Tertiary predaceous marsupials of South America were replaced by predaceous placental mammals when the Isthmus of Panama connected North and South America in the Pliocene. The superior placental families and species were more efficient in their reproductive physiology and care of the young—an example of improved internal homeostasis associated with improved ecological homeostasis. Survival of the fit is concomitant with the elimination of the unfit at every organismic level. However, we must be careful not to extrapolate the specific mechanisms of adaptation from one level to the other, even though the general principles involved may be the same. For instance, adaptation to the cold by insulating the organism or its habitat in the arctic regions is clearly the same principle but carried out by utterly different mechanisms in the various animal species and the various cultural groups. All attributes of one system are not found in new emergent systems, although improved homeostasis at all levels with intricate webs of interaction is the general trend of organic evolution.[41]

Maintenance and Death. Temporary maintenance of individuals evolves along with death, but death maintains more inclusive organizations. Organisms heal injuries, evolve immunities to infections and parasites and defenses against predatism and disease. Also, toleration and cooperation for mutual benefit in holistic systems evolve. In many instances a part of an individual or an individual in a population is sacrificed for the maintenance and perpetuation of the whole.

Reproduction itself is hazardous at the individual level, although necessary at the species level. Males may compete for mates, nesting sites, and courtship territories, although losers seldom are directly

killed. At the ecological level elimination of individual prey by predators is common, but it is against the interests of the predator or a parasite to destroy the prey population, and hence both populations tend to adapt to each other. Population size within the species and in different species has an optimal value under selection pressure. If population size is above the optimum, lethal elimination or prevention of reproduction of excess individuals evolves. If it is below the optimum, processes that increase the population are selected.

Consequently, the evolution of the ecosystem results in a balanced relationship between the exploiter and the exploited within a food chain, and all links are important and beneficial for recycling within the whole system. Competitive spacing, timing, adjusted compromise, and toleration increase the balanced integrity of holistic organizations at every level. Evolving cooperation enhances integrity of inclusive entities. This biological principle is pertinent to the competitive and ethical[42] relations of human individuals within social groups interdependent with their physical and living environment.

Dignity Transcending Death

Can we come to terms with innate personal senescence, tragedy, and death, both for ourselves and for those whom we love? A disturbing conclusion expressed by many scientists and religionists is that few persons are sufficiently mature to accept death and to control their emotions with integrity and dignity. Some religious writers say that high attainment of self-awareness and unselfish moral attitudes cannot be achieved by more than a small percentage of humanity. The psychiatrist Fromm contends that love of humanity and God can be attained only by the mature few.[43] Intellectual understanding of the bases of freedom, death, and integrity requires considerable knowledge and interpretive thought that few have the opportunity or inclination to achieve. However, humans have evolved combined genetic and cultural bases to generate the desires to serve even sacrificially and with dignity the larger life of humanity. These are the foundations of social evolution since the origin of man.

In the face of death, many of us experience helplessness and inability to cope with our emotions. Our rational and conscious understanding becomes confused. The meaning of life and our faith in justice elude us. Some become angry, frustrated, and bitter. We may lose hope and a sense of purpose. Psychologists and psychiatrists[44] are continuing to study these reactions that are of deep concern in all religions.[45]

When our understanding is limited and overwhelmed, we can follow the "wisdom" of our culture and turn to traditional expressions of

love, compassion, empathy, sympathy, hope, courage, and meaning that have evolved under the aegis of various religions. We can recognize the "wisdom of a culture" that may have evolved without too much conscious, logical, or scientific knowledge, but nevertheless is sound and wise with some resemblances to the "wisdom of the body."

However, we know that during the last twenty-five centuries, more or less, and especially during the last two centuries, the religious elements of human cultures have not evolved fast enough to keep up with new philosophical and scientific criticism. Many of us find some traditional beliefs incredible and hence inadequate, although they evolved to help us face the problem of death. But new concepts of the meaning of life and death can integrate with traditional expressions if we search for the deeper values behind the symbols.

If the humane perspectives of religion and science can join forces to generate inspiration, high motivation, moral values, integration, and dignity, we may hope to attain an ever higher culture and civilization serving humanity as a whole in balance with ecological realities. It is high time for religious feelings and scientific intelligence to join together in a greater comprehension of evolving life and death.

Biologists respect and marvel at what nature has wrought, or, in an earlier language, what God hath wrought. Biological progress encompasses activities which involve pain, suffering, and death that have formerly been considered evil but may now be seen to be parts of selective processes guiding toward the good. The new understandings of cultural evolution even allow us to see some psychosocial value and "wisdom" underlying the presently incredible beliefs and practices of ancient religions that were essential to the successful life of societies at early stages of advancement. We can surely find scientific evidence for both the "wisdom" of evolving cultures and the genetic wisdom of bodies, and extend our comprehension of the place of humanity within temporal and spatial cosmic order.

We have begun to glimpse the total system that guides human cultural as well as genetic evolution toward viable adaptations within the total ecosystem in which we have our being. We are becoming conscious of the larger picture of time and space in which our lives are set. We can begin to identify our self-awareness with the transcendent meaning of evolving life. We can even begin to understand not only how our consciousness itself is a product of our cultural heritage going back to the authors of the Upanishads, classical Greek philosophy, and the Bible, but also how both ancient and contemporary cultural heritage is a product of the evolution of ecosystems since the origin of life.

Human societies within an ecosystem are flow patterns of transient

and necessarily dying parts. They evolve boundary conditions that increase the order, homeostasis, structure, and meaning of human life. Corrections, refinements, and expansions of mental and religious concepts of spirituality and immortality emerge.

The human gene pool and symbol pool are not composed of identical parts. All of us are highly different units in highly unique situations in the grand onward flow of life. We require different personalities with different approaches to religious, philosophical, scientific, or psychological belief for the healths of our souls individually and collectively. United complexity is essential to higher comprehension and awareness. A mature individual, society, or ecosystem develops and evolves with heterogeneity. Emergent characteristics are richer, better adapted, and more adaptable if based upon orderly differences. We unconsciously inherit different aspects of wisdom from our genotype and our culturetype. No one can be all-knowing or all-wise, but we can partake of higher knowledge and wisdom as we integrate with many others in time and space. Not even the greatest minds can comprehend more than a tiny fraction of genetic or cultural wisdom. Individual awareness is limited, but our heritage of the wisdom of life transcends us. Also, we have learned that we are part of a larger, longer program of creation of life by adaptation through death when necessary.

Nevertheless, we must face and help to resolve the problems created by the advancement of science and religion. There must be a new scientifically grounded theology that helps to unite life's basic and ultimate concerns. We suggest that human feelings, mind, and consciousness are emergent products of human brains. The brain is a product of a common gene pool and a common pool of cultural heritage. Hence it participates in the programs, purposes, and meanings of evolving life from the beginning and continuing far into the future. There is re-created in every generation the consciousness of life triumphant in the midst of tragedy, injustice, and death. Our consciousness is not limited to the transient phenomena of a particular configuration in the flow pattern of cosmic evolution, but we may and do increasingly become aware of our true selves serving the cause of a great evolving ecosystem. As men increasingly become aware of the wider dimensions of their reality, their insight into their own transcendence increases. By such an illumination of one's self, its continuity, and its unity with the whole of existence, one can find greater freedom, meaning, purpose, dignity, and hope in the face of pain, suffering, and death. One can remain courageous and confident through the days of struggle, frustration, loss of loved ones, and awareness of inevitable personal death.

Discussion

Insofar as we mean by freedom the act of choice or selection between various alternatives, there are many levels in the hierarchy of living systems that can vary and be selected. With the emergence of learning and improved memory of the human brain resulting in symbolic communication, we find a model of the self and the world which is capable of computing its own choices and enhancing its capacity to make wise decisions. Insofar as the models in the brain come to correspond to the real world, then conscious choosing can rapidly extend natural selection, with resulting evolutionary progress toward higher patterns of life, greater integration among complex parts, and more effective maintenance and perpetuation of life at all levels of organization.

We have crossed the boundary from biological to cultural evolution.[46] In so doing we find a whole new set of variations which vastly expand the freedom for selection of better and faster adjustments. Because of the change of thought, and because of a total population of millions of communicating brains, we find cultural evolution of improved life patterns to be the greatest enhancer of freedom yet evolved. It is, of course, accompanied by new cultural restrictions of freedom by corresponding duties and responsibilities.

Although freedoms of individuals[47] and groups in human society emerge from the biological freedoms with common related principles, semantic ambiguities and confusions occur as we move from one level of organization to another. Unknown side effects and fluctuations in rate and intensity of selection occur. Choices may result in temporary deterioration, although a general trend of improvement is manifest through millions and billions of years and probably will continue on earth as long as the sun continues to radiate suitable energy.

Freedom has many meanings. We have thus far emphasized the freedom to change that is followed by selection of some changes resulting in new adaptations to larger and more complex environments—the kind of change that leads to biological and cultural progress. Another important meaning of freedom leads to "rights" or "privileges" of individuals, families, institutions, classes, or societies to do or to have certain things they want. These "rights" may have biological antecedents as in the independence and rights of a separate organism, or the territorial or "property rights" in various vertebrates that are established by combat and threat. Dominance hierarchies in birds and mammals may be beneficial to the species by spacing or timing important activities more efficiently. However, the

generation of certain desires and goals may be destructive, particularly if moral and ethical values are not based upon decisions leading toward higher patterns of viability.

While it may be a natural human desire to expand human consumption of food and energy, ecologists and others have pointed out that we may ultimately harm ourselves and society by overconsuming. Overpopulation is a major part of the general problem of overconsumption of limited and sometimes irreplaceable resources.

The rights or privileges to live and reproduce for both biological or cultural organization at every level entail a role in the optimal maintenance and perpetuation of the whole system. These powers, capacities, and channels are products of the relatively stable pattern of evolved adaptation or the "wisdom" of genetic and cultural heritage.

Living systems are open, complex, coordinated, and cooperating organizations that evolve toward ever higher control and expansion of improved conditions of existence under emerging conditions specified by a total ecosystem. In the nonliving environment, organization moves toward disorganization and decay ending in randomness in a dissipating flow of energy. The miracle of the increasing organization of living systems as a part of the energy dispersion systems is something that scientists have only recently begun to understand.[48] This new understanding provides important new insights into man as a natural part of the cosmic program—including man's culture, society, and mind.

For historical reasons in the evolution of language, the term "freedom" has become attached to realities that are opposed in their actual processes—the freedom to vary being initially grounded in randomness and chance, and the freedom of rights and privileges being grounded in a selected, guided, and established order of life.

In human societies, guided freedom involves the social order as well as the order attained within the individual organism or the habitat. For every privilege or right there is a cost or requirement that must be fulfilled in any complex system. When the rights of one unit or individual within a living system are infringed upon by another, then delicate spatial separation, periodic phasing, or compromise have to be worked out within strict limits, or else the system will blow up, disintegrate, or die. Perfection with complete harmonious cooperation within or between organisms without competition and opposition is impossible in biological or human organizations. Ecology has in this century become a primary science in showing the complex interdependence and exchange of energy and supplies of many different species in the same ecosystem, and the utter dependence of the total

flora and fauna on the energy and material supplies provided by the prebiological habitat.

The intricate arrangements of duties, responsibilities, and privileges in human societies cater to the biologically and culturally inherited human wants within a complex ecosystem. The internal and external patterns of our social interactions are a complicated adjustment to the biological and social needs of individuals and populations. When the complex social integration either is as yet incomplete or breaks down, we say our rights or freedoms have been infringed, and we are aroused to restore due justice.

Malfunctioning of human societies arises from the loss of effective memory of necessary moral obligations and of the significant privileges or requirements of the various subunits of the total system. This is a cultural equivalent of the failure of genotypes to reproduce faithfully. Malfunctioning of particular societies may also arise from changed outside circumstances in the ecosystem, such as drought, flood, or invasion of territory by a more powerful society. For a society to adapt to a new situation about which it has little information, it will have to acquire new information and resort to the freedom to change its ways or to vary and adjust to the newly imposed conditions. This is a cultural equivalent of the adjustment of genotypes to new conditions.

Malfunction of the various processes that integrate ordered societies may be caused by loss of effective motivation for maintaining duties, responsibilities, and privileges. Here again, the rights of subunits may be recovered by a renewal of effective memory and motivation of responsibilities that once worked. Or, if the loss of rights and privileges is a product of changed circumstances, then a new order with new duties must be discovered and motivated. This latter is more difficult than reliance on a tested and established adaptation. Not more than one change in a hundred, sometimes only one in a million, is successful.

The invention of ready change, transmission, and exchange of symbol systems among a population of brains that can inherit the successful adaptations of any one of them, within an instant in some cases and within a few years in others, has provided a shortcut that makes cultural evolution many times faster than genetic evolution. The selection of a well-adapted idea at the expense of many wrong ideas is much more rapid than the selection of one viable group from a population of ten thousand who died because they were wrong. The evolution of brains that can reverse themselves and go back to earlier more viable views mistakenly abandoned is an achievement that

genetic evolution can hardly equal. As a result, the cumulative adaptations and capabilities of human civilizations today have given mankind capacities never equaled by any other species or by previous human societies. The discoveries of science, the evolution of religious morality, and the inventions of technologies applied to the extraction of energy from atoms, movement in interplanetary space, and the beginning of the integration of compassionate humanity are high points in progressive adaptation of life to hitherto unrealized conditions.

But we face new dangers too if we fail to recognize that our freedoms to accomplish our goals are powers that have been won at great cost of life and suffering, and that freedom to vary and change must be kept within limits. Otherwise we may destroy the delicate complex of life. One of the realities that the scientific pictures of human life and its evolution demonstrate is that the total system of life and nonlife which makes up an ecosystem is an interdependent network wherein the most advanced patterns are dependent on the less advanced organizations.

SUMMARY

Man is dependent on the cumulative adaptations of plant, animal, and cultural evolution for the genetic and cultural information that has brought him up from the primitive plants, animals, and societies to his emergence toward increasing social cooperation and high civilization. Contemporary humanity has risen from earlier cultures by means of qualitative and quantitative advancement of emotional and intellectual brain capacities resulting in ever increasing symbolic communication among integrated social subcultures. A complex interdependent system (with cause and effect, and feedback to cause, in both biological and cultural levels of organization) has evolved under selective processes to improved maintenance and reproduction, all dependent upon the sun and the cosmos for energy and materials. Within this total system, the sciences have added to the earlier religious discoveries of basic conditions and laws of behavior which cannot be violated without self-destruction.

We hope we have shown how science can help religions by providing fuller understandings of man's freedom, death, and dignity. Scientific information seems to reinforce certain elements of religious tradition and may help provide enlightenment for a more rapid advance in religion's further evolution. Science itself could not survive in a society in which viable motivations for living were not enculturated. It behooves the sciences to take a hint from the evolution of the

brain of man not only to provide abstract or incidental information but also to serve humanity's ultimate concerns. Systematic motivation of the necessary goals and commitments for man's continuing and advancing life in his earthly and cosmic habitat has survival value.

NOTES

1. By contemporary theories of evolution, we mean the increasingly broad and systemic theories that encompass physical, biological, and cultural evolution. An important view of evolutionary theory that covers human and computer learning as well as genetic and cultural accumulations of information patterns is found in Herbert A. Simon's *The Sciences of the Artificial* (Cambridge, Mass.: M.I.T. Press, 1969), esp. chap. 4, "The Architecture of Complexity." But we also include the neo-Darwinian views of biological and the new physical-chemical views of prebiological evolution.

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4. R. R. Grinker, ed., *Toward a Unified Theory of Human Behavior* (New York: Basic Books, 1956).

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7. Emerson, p. 144.

8. Donald T. Campbell, "Variation and Selective Retention in Socio-cultural Evolution," *General Systems* 14 (1969): 69–85; Monod (n. 5 above), pp. 160–80.

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10. Simon (n. 1 above), p. 98.

11. Alfred E. Emerson, "Some Biological Antecedents of Human Purpose," *Zygon* 8 (1973): 294–309.

12. R. A. Rappaport, "The Sacred in Human Evolution," *Annual Review of Ecology and Systematics* 2 (1971): 23–44.

13. Anne Roe and G. G. Simpson, eds., *Behavior and Evolution* (New Haven, Conn.: Yale University Press, 1958), esp. p. 457.

14. Ibid., p. 330.

15. For an introduction to understanding the brain's integrative function, see J. Z. Young, *A Model of the Brain* (Oxford: Clarendon Press, 1964), esp. chap. 2, "The Brain as the Computer of a Homeostat"; see also Simon (n. 1 above). Scientific grounds for the ancient art of contemplation or meditation have been suggested by recent brain science, e.g., the role of the prefrontal cortex in imaginative projections and the role of the limbic system in producing "eureka-type feelings" (see Paul D. MacLean's "The Brain's Generation Gap: Some Human Implications," *Zygon* 8 (1973): 113–27, esp. pp. 123–24). The uses of contemplation and imagination as essential elements of the scientific method have been given new focus by Michael Polanyi (see his *Personal Knowledge: Towards a Post-critical Philosophy* [Chicago: University of Chicago Press, 1958], and *The Tacit Dimension* [Garden City, N.Y.: Doubleday & Co., 1966]).

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17. A. R. Luria, "Neurophysiological Studies in the USSR: A Review [pts. 1 and 2]," *Proceedings of the National Academy of Sciences* 70 (1973): 959–64, 1278–83.
18. A. G. Karczmar and J. C. Eccles, eds., *Brain and Human Behavior* (New York: Springer-Verlag, 1972).
19. MacLean (n. 15 above).
20. R. W. Sperry, "Science and the Problem of Values," *Zygon* 9 (1974): 7–21.
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31. Garrett Hardin, *Nature and Man's Fate* (New York: Rinehart, 1959).
32. Anthony F. C. Wallace says that "the essential theme of the religious event is the dialectic of disorganization and organization" and that religion characteristically "offers a solution that assures the believer that life and organization will win, that death and disorganization will lose" (*Religion: An Anthropological View* [New York: Random House, 1966], p. 38).
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39. Allee et al. (n. 29 above); Alfred E. Emerson, "The Impact of Darwin on Biology," *Acta Biotheoretica* 15 (1962): 175–216.
40. Wright (n. 9 above).
41. Emerson, "Impact of Darwin" (n. 39 above).
42. Emerson, "Dynamic Homeostasis" (n. 6 above).
43. Erich Fromm, *The Art of Loving* (New York: Harper & Bros., 1956).
44. Ibid.; Elisabeth Kübler-Ross, *On Death and Dying* (New York: Macmillan Co., 1969).

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