

EXPERIENCING AND INTERPRETING NATURE IN SCIENCE AND RELIGION

by Ian G. Barbour

Abstract. I trace three paths from nature to religious interpretation. The first starts from religious experience in the context of nature; examples are drawn from nature poets, reflective scientists, and exponents of creation spirituality. The second, "Natural Theology," uses scientific findings concerning cosmology or evolution to develop an argument from design—or alternatively to defend evolutionary naturalism. The third, "Theology of Nature," starts from traditional religious beliefs about God and human nature and reformulates them in the light of current science. I point to examples of each of these paths in papers by other participants in this symposium, and suggest that all three paths can contribute to the task of relating science and religion today.

Keywords: argument from design; cosmology; creation spirituality; environmental ethics; evolution; human nature; models of God; natural theology; naturalism; religious experience.

The title of this symposium makes reference to five concepts: experience, interpretation, nature, science, and religion. Using these concepts, I will explore three paths from nature to religious interpretation. The first path I call "Nature in Religious Experience." The second is "Science in Natural Theology," where theology is taken to be a form of religious interpretation. The third is "Science in a Theology of Nature," which involves the same concepts in a different configuration.

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I. NATURE IN RELIGIOUS EXPERIENCE

I start by asking some methodological questions concerning the interaction of experience and interpretation in both science and religion. Then I consider some types of religious experience and some personal religious responses to nature among both scientists and nonscientists. In this section, nature refers to the nonhuman world, though I will later insist that human beings are part of nature.

1. THE INTERACTION OF EXPERIENCE AND INTERPRETATION. What kinds of experience of nature are of interest to the scientist? As a first approximation, one might say that science deals with regularities and lawful processes in the natural world. Repeatable experiments and quantitative measurements and predictions are common in science. Yet science can be pursued even when some of these features are absent. No one claims that the history of evolution could have been predicted, and experiments can be conducted only on limited aspects of evolutionary theory. Lawfulness is accompanied by chance in several areas of science; but even when individual events are unpredictable, they often display statistical regularities.

Science relies on a particular kind of experience, namely publicly observable data, which are interpreted by scientific theories. Objectivity and universality are said to be the hallmarks of science. Yet the history of science shows that widely accepted theories have been replaced or modified, so there is no universal agreement across a span of time. And philosophers of science have pointed out that all data are theory-laden. A scientist's conceptual framework influences the selection of phenomena for study and the choice of variables taken to be significant. Thomas Kuhn argues that paradigms, which are clusters of conceptual and methodological assumptions, strongly affect scientific data. But the presence of historical and cultural assumptions in science does not mean that data are unimportant. Inconsistencies between a theory and current data can lead to modifications in the theory, and a prolonged accumulation of inconsistencies may even result in the search for an alternative paradigm. However, paradigm shifts are rare because most scientists work within a prevailing paradigm.

In the case of religion, paradigm shifts are even rarer, and the interaction of experience and interpretation is more problematic. Religious experience is expressed symbolically in myths and rituals, and it is interpreted conceptually in beliefs and doctrines. But religious experience is itself strongly shaped by cultural assumptions and prior expectations. Clearly there is less cross-cultural agreement

about interpretations in religion than in science, though there are some types of religious experience common to many cultures. Historical communities of interpretation strongly resist change. Yet critical reflection on experience can exercise some constraint on interpretation, and unexpected experiences can lead people to question their previous interpretations. Religious beliefs are brought to experience, but they are sometimes reformulated in the light of experience.

Religious experience does not have the publicly observable character of scientific data, but it occurs in the context of a religious community so it is not merely a private or individualistic phenomenon. It affects and is affected by the myths and rituals as well as by the conceptual interpretations of the community. The community as a whole goes through a kind of historical testing process that encourages some kinds of experience and interpretation and discourages others. While a religious community can be dogmatic and authoritarian, it can also be open to the diversity of human temperaments and experiences and can itself be open to change and reformation.

In science, imaginative models often play a crucial role in the formation of theories. Analogies with familiar systems are useful in formulating mathematical theories that can be tested against experimental data (for example, the billiard ball model of a gas, the Bohr model of the atom, or the drop model of the nucleus). Scientific models are more than temporary psychological aids, for they provide a continuing source of possible applications, extensions, and modifications of theories. Sometimes two complementary models, such as the wave and particle models in quantum physics, may be useful, even though they cannot be combined in a single model. I have argued that models play a similar role in religion in the formation of concepts. For example, personal and impersonal models of the divine may be considered complementary. In both science and religion, models are not literal descriptions of reality but attempts to imagine what cannot be directly observed (Barbour 1974; 1990, 31-65).

2. TYPES OF RELIGIOUS EXPERIENCE. Six types of religious experience have been described by scholars in the history of religions. The first three are often associated with nature, whereas in the last three nature usually plays a smaller role.

1. *Numinous Experience of the Holy.* Persons in many cultures have described a sense of awe and reverence, mystery and wonder, holiness and sacredness. Participants speak of otherness, confrontation, and encounter, or of being grasped and laid hold of. They are

aware of their dependence, finitude, limitation, and contingency. The overwhelming character of the experience suggests an exalted view of the divine and an emphasis on transcendence. The human responses include self-abasement, humility, worship, and obedience. The transcendent may be taken to be an impersonal power, but it is more often interpreted in personal models, and worshippers are likely to think of the holy as distinct and separate from themselves. This pattern is found in both Western and Eastern religions but is more prominent in the West.

Numinous experience often seems to have little to do with nature. Isaiah in his vision in the temple felt sinful in the presence of the holy, and he was empowered for a prophetic mission in his nation's historical life. On the other hand, the answer to Job's suffering came in an overwhelming experience of the greatness and mystery of nature. In the Bhagavad Gita, Arjuna's vision of Krishna is cosmic and awesome, involving life and death and the shattering of worlds. Of course, dramatic natural events such as earthquakes, storms, and plagues were once attributed to divine powers but are now explained by science. However, I will suggest shortly that nature as understood by science can still evoke numinous experience.

2. *Mystical Experience of Unity.* Mystics in many traditions refer to the unity of all things found in the depth of the individual soul. Unity is recognized through the discipline of meditation, and it is accompanied by joy, harmony, serenity, and peace. In its extreme form, the unity is described as selflessness and loss of individuality, and the joy is said to be bliss or rapture. Here the merging of the human and divine is emphasized rather than their separation. The experience is often interpreted by impersonal models of the divine, especially in Eastern traditions, though it occurs in the West with both personal and impersonal models. Divine immanence predominates over transcendence, and some versions are monistic or pantheistic. Contemplation rather than communal worship and ritual is a characteristic practice.

Though the unity of all things is found within, it may be associated with the experience of unity with nature. In Hinduism, the realization that the Atman within is identical with Brahman, the all-inclusive Absolute, may occur through meditation on the beauty of a flower. In Taoism, encounter with nature can lead to harmony, wholeness, and tranquillity, for every being is a manifestation of the Tao, the nameless unity that exists before differentiation into the multiplicity of the world. William James gives several examples of nature-mysticism in his classic study of the varieties of religious

experience. Some physicists, as we shall see, find in both religious mysticism and mathematical physics a unity and timelessness underlying the diverse and transient world.

3. *Wonder and Gratitude.* The beauty and order of nature sometimes evoke a response of reverence and appreciation somewhat similar to numinous experience but more affirmative and celebratory. In ancient times, the vitality and fertility of nature were celebrated, especially in the rituals of agricultural civilizations. People express gratitude for the gift of life to whatever they take to be the source of life. In modern times, some scientists have expressed awe at the creativity and complexity of nature and wonder that it has a rational order intelligible to our minds. The next section gives some recent examples of such religious responses to nature.

4. *Personal Transformation.* Experiences of renewal and regeneration are reported in many religious traditions, though in differing forms. Buddhists talk about liberation from bondage to desire and to the suffering produced by desire. Christians speak of being born again and the experience of forgiveness following the acknowledgment of guilt, or in more contemporary terms, the transition from brokenness and estrangement to wholeness, healing, and reconciliation. Such reorientation and renewal, whether sudden or gradual, may lead to greater self-acceptance, liberation from self-centeredness, openness to new possibilities in one's life, a greater sensitivity to other persons, or perhaps dedication to a style of life based on radical trust and love. It appears that nature is seldom central in such experiences of personal transformation.

5. *Moral Obligation.* Many people have felt moral demands overriding their own inclinations. Though the voice of conscience is in part the product of social conditioning, it may also lead persons to criticism of their culture, or moral outrage in the face of evil, even at the risk of death. Judgments of good and evil, right and wrong, are of course affected by one's view of ultimate reality. Moral demands may be taken as the will of a God of justice and love or as a requirement for harmony with the cosmic process. In the West, prophetic protest against social injustice has been viewed as obedience to God's purposes. Western religious traditions have unfortunately not given much attention to duties toward nature, but responsibilities to other creatures are important in Native American and other indigenous cultures and in some Asian traditions.

6. *Courage in Facing Suffering and Death.* Suffering, death, and transiency are universal human experiences, and responses to them are found in every religious tradition. Meaninglessness is overcome and greater serenity achieved when human existence is seen in a wider context of meaning beyond one's own life. The power of suffering and death is diminished when trust replaces anxiety (in the West), or when detachment replaces attachment (in the East). Views of suffering and death are influenced by beliefs about eternal life, reincarnation, and the historical or eschatological future of the world. They are also affected by our understanding of how human life is related to the natural world, so the interpretation of nature is relevant to existential attitudes concerning the significance of one's life.

3. RELIGIOUS RESPONSES TO NATURE. Some people who express a religious response to nature hold a negative view of science; others have a positive view or are themselves scientists.

1. *Nature Poets.* The Romantic poets combined a deep appreciation of nature with a critical stance toward science. Blake saw "a world in a grain of sand" and decried the "single vision" of Newton. Wordsworth held that nature is not an impersonal machine; it is pervaded by a beauty and spirit that elude the cold abstractions of science. Tennyson wrote that in fully understanding the flower in the crannied wall "I should know what God and man is." These poets said that science and technology have alienated us from nature and desacralized the world. The deeper spiritual reality and wholeness linking all things is known by imagination and participation and not by rational analysis or experimental manipulation.

Similar ideas were set forth by the American transcendentalists. Thoreau held that the sacred can be found in nature. If approached with reverence and humility, nature is a source of the healing, peace, and renewal that are lost in the materialism and hectic pace of the city. Emerson testified to a religious dimension in nature which goes beyond order and beauty. John Muir said that nature is a moral and spiritual teacher: in the sublime splendor of a pristine forest we can learn humility, receptivity, and reverence. Poets have also portrayed the sacredness of the natural world. Gerard Manley Hopkins wrote:

The world is charged with the grandeur of God.
It will flame out like shining from shook foil. . . .
And for all this nature is never spent;
There lives the dearest freshness deep down things.

—Gerard Manley Hopkins [1877] 1953

Theodore Roethke, Denise Levertov, and Wendell Berry are among the recent poets who have powerfully celebrated the bond between humanity and other creatures.

2. *Reflective Scientists.* Some scientists have recorded religious responses evoked by their work as scientists but going beyond science itself. Rachel Carson's *Silent Spring* and other writings drew heavily from her scientific knowledge, but she also had a sensitivity to the community of life and a sense of the sacredness of nature reminiscent of the transcendentalists. Loren Eiseley articulated his awe at the web of life and the ties that connect him to millions of years of evolutionary history. "For many of us the Biblical bush still burns and there is a deep mystery in the heart of a simple seed." Elsewhere he marvels at the amazing powers of matter which is "but one mask of many worn by the Great Face behind" (Eiseley 1946, 210). Aldo Leopold wrote with the knowledge of a scientist and naturalist but also with the imagination of a poet in portraying his holistic vision of the unity of life.

The writings of Teilhard de Chardin are diverse. Some are contributions to science itself, and others are theological in character. *The Divine Milieu* is a more mystical and personal meditation. Even *The Phenomenon of Man*, which seems to be a natural theology arguing from science to religious conclusions, sounds at times like an imaginative vision that owes as much to his intensity of religious experience as to his scientific expertise. David Bohm was a creative scientist who developed a new mathematical formalism for quantum physics, but his idea of an "implicate order" underlying the observable world assumes a holistic metaphysics which was influenced by his commitment to the meditative practices and monistic worldview of the Indian mystic Krishnamurti. Frijof Capra's enthusiasm for the holism of Bootstrap Theory in particle physics surely owes something to Eastern religions as well as to experimental data. All of these people saw a close relationship between their religious experience and their work as scientists.

Lyndon Eaves's paper "Science and Spirituality" in the present symposium makes reference to some of these forms of religious experience (Eaves 1993). He discusses mystical experience and cites Schleiermacher on the experience of absolute dependence. He mentions Einstein's writings about "the cosmic religious feeling." Eaves finds beauty and a sacramental quality in nature. He ends by defending the use of personal language in thinking of God as "the 'I' of nature."

3. *Creation Spirituality.* Matthew Fox finds awe, wonder, and mystery in the new scientific story of the universe which can inspire our gratitude. He urges us to celebrate the sacredness of nature in song, dance, ritual, and art. He is highly critical of most of the Christian tradition for emphasizing original sin and redemption and for neglecting the idea of creation as "original blessing." But he approves of those Christian mystics who were life-affirming and creation-centered, such as Meister Eckhart, Hildegard of Bingen, and Julian of Norwich. In meditation and in letting go, we too can realize the divinity within us and within nature. Fox also respects the concerns of liberation theology for the oppression of the poor and for the demands of social justice. A creation-centered spirituality can put us in touch with ourselves, with each other, and with nature (Fox 1991).

Thomas Berry and Brian Swimme say that we should set the Bible aside and take nature as our primary scripture. They advocate a new spirituality of the earth inspired by the story of the cosmos revealed by science, from the primeval fireball to human culture. They urge us to put our trust in this amazing cosmic process. The scientific narrative is presented, not to provide an intellectual argument for the existence of God, but to awaken our awe, reverence, and sense of community with all living things. They hold that a biocentric and ecological outlook in science has much in common with the celebration of the earth by religious mystics and in indigenous cultures (Berry 1988; Swimme and Berry 1992).

Ingrid Shafer's paper in this symposium shares the experiential emphasis of this first group of authors and develops it in a distinctive way (Shafer 1994). She urges us to draw from affective, intuitive, holistic, "right-hemisphere" forms of experience as well as analytic, rational, "left-hemisphere" understanding. She holds that it is love which connects us with other people, with nature, and with God. She describes her childhood experiences of compassion for an abused cat and an injured bird, and she recalls an experience of unity and pure consciousness which left her with "an overpowering, abiding sense of cosmic interconnectedness." In a fragmented world, she says, the grounds for hope lie in the experiences of loving action and mystic contemplation found in all cultures. In her concluding remarks she turns to what I will later call a "theology of nature." She explores there the distinctive grounds for an ecological ethic in the Christian tradition, and she suggests that the idea of incarnation implies a divine love for all creatures.

II. SCIENCE IN NATURAL THEOLOGY

The previous section traces a route from nature to religious interpretation through religious experience. In natural theology, by contrast, the scientific interpretation of nature provides the ground for a rational argument for a religious interpretation. I will consider the Big Bang, design in nature, and the claims of evolutionary naturalism.

1. THE BIG BANG AND THE COSMOLOGICAL ARGUMENT. According to the Big Bang theory, the universe expanded very rapidly from an incredibly small, hot, dense fireball 15 billion years ago. The theory postulates events to within a fraction of a second of the beginning, but the beginning itself—a point of infinite density and zero size at $t = 0$ —is a singularity inaccessible to science. Some authors see the Big Bang theory as vindication of the idea of creation *ex nihilo*. Some astrophysicists propose that the fireball originated in a gigantic fluctuation in a quantum field, but that would only push the question further back. What was the origin of the quantum field and the laws that describe its activity? Another alternative is an oscillating universe in which the fireball represents the end of a previous contraction before the present cycle of expansion. Perhaps there has been a series of cycles going back for an infinite time span. Or perhaps time is finite but unbounded, with no first instant at all, as Stephen Hawking maintains. The current evidence seems to favor an absolute beginning at $t = 0$, and the theist can look on it as a special moment of creation by God. A recent book by the physicist Paul Davies would be a good example of such a natural theology (Davies 1992). Other examples from Freeman Dyson and Frank Tipler were given in Robert Russell's paper earlier in this symposium (Russell 1994).

I submit, however, that the religious idea of creation does not require an absolute beginning of time. It is based rather on the human experience of finitude, contingency, dependence, and gratitude for life as a gift. The doctrine of creation is an acknowledgment of continued ontological dependence, not a historical statement about events in the distant past. It is also an affirmation that the world is meaningful, orderly, purposeful, and good. These affirmations could be maintained regardless of which scientific theory wins the day.

In one form of the cosmological argument, Aquinas said that every event must have a cause, so we can argue back to God as the First Cause at the beginning of time. But in another form of the argument,

he said that even an infinite chain of causes is contingent and not self-explanatory. Today we still ask the question: Why is there a universe at all, however it is structured? The universe did not have to have the particular laws it has, even if some of these laws are derivable from more basic laws. Einstein once said that the only thing incomprehensible about the world is that it is comprehensible. John Polkinghorne has argued that the rational and mathematical structure of the world, and its intelligibility to the human mind, suggest that the world must be the product of a rational mind. He holds that God is the common ground of rationality in our minds and the world. It is the rationality and contingency of the world, rather than any particular theory of the Big Bang, that supports the idea of an intelligent creator (Polkinghorne 1991).

The apparent fine-tuning of the physical constants in the early expansion of the cosmos has been used by some scientists as a new argument from design. Stephen Hawking writes: "If the rate of expansion had been smaller by even one part in a hundred thousand million million, it would have recollapsed before it reached its present size" (Hawking 1988, 121). On the other hand, if it had been greater by a part in a million, the universe would have expanded too rapidly for stars and planets to form. The expansion rate depends on many factors, such as the initial explosive energy, the inflationary process during the breaking of symmetry, the mass of the universe, and the strength of gravitational forces. Other scientists have pointed to a long list of unexplained "remarkable coincidences" that provided the conditions in which life and then human observers could occur. Freeman Dyson discusses this Anthropic Principle and concludes: "The more I examine the universe and the details of its architecture, the more I find that the universe in some sense must have known we were coming" (Dyson 1979, 250).

Other scientists propose that what appears to be design is simply a matter of chance. If there were billions of universes, and the physical constants varied among them, the right combination favorable to life and mind was bound to come up eventually, like the winning combination on a Las Vegas slot machine. The multiple universes might occur in successive cycles of an oscillating cosmos, or they might occur at the same time if myriad universes were born and broke apart like a cluster of expanding bubbles; but there is little theoretical support for multiple universes, and they could never be detected because all of them except our own are beyond the horizon of possible observations.

Another proposal is that the apparent fine tuning of independent constants and laws is the product of more basic laws, so that necessity

rather than chance explains the appearance of design. Astrophysicists are seeking an all-inclusive theory, the so-called Theory of Everything, from which the laws governing the four fundamental physical forces could be derived. But the question of design would recur on that level too, for it would be all the more remarkable if a law that unifies purely physical forces turned out to provide the conditions under which life and mind could occur. Even if chance enters at some points and necessity is present at others, the question of design in the early universe cannot be so easily dismissed.

2. EVOLUTION AND THE ARGUMENT FROM DESIGN. The classic form of the argument from design started from the observation that various parts of an organism work well together to serve its needs; for example, the various parts of the eye are marvelously coordinated to achieve vision. Darwin undercut the argument by proposing that the eye and other organs are the result of a long series of small random changes in earlier forms, in which the improvements were passed on because they contributed to the survival of the species. The design argument was then reformulated: God did not create creatures all at once in their present forms, but created them through a long process of evolution. God established the processes through which successive levels of matter, life, and consciousness could come into being. The overarching pattern of cosmic history is indeed impressive. We know that organic molecules are endowed with the capacity for self-organization and the development of higher levels of order and complexity. Matter had built-in potentialities that made possible the emergence of life and consciousness, and eventually intelligence and personal human life. Can we not see design in the laws and processes by which this amazing cosmic history could occur? As Holmes Rolston puts it, the dice seem to be loaded in favor of life and consciousness (Rolston 1987, 113).

But here we have to be cautious. The idea of design has traditionally been understood as a detailed blueprint or preordained plan in the mind of God. We know that evolution is characterized by waste, suffering, and chance, and by evolutionary dead ends that led millions of species to extinction. Chance as well as law contributes to evolutionary change and the appearance of higher levels of organization, and it makes the outcome unpredictable. In such a world we would have to think of design as a general direction and purpose rather than a detailed plan. We can be impressed by the pattern of cosmic history without assuming that everything in it represents a specific expression of divine wisdom.

In the present symposium, Langdon Gilkey presents what he

calls “a modest natural theology” (Gilkey 1994). He describes the presence of power, order, and novelty in nature. He also delineates the dialectical unity of life and death in both archaic religion and evolutionary biology. He says that these are all “traces” or “signs” of the sacred in nature. At times he speaks of wonder and “the intuition of the unity of order and value,” which might be considered forms of what I called religious experience above, but he also elaborates a more philosophical argument. And in the last chapter of his recent book (Gilkey 1993), he argues that nature as understood by science raises “limit questions” and “metaphysical questions” that are not answered by science itself. He holds that order and novelty in the world require a noncontingent ground. He also suggests that the scientific account leaves out our own experience as subjects of awareness, choice, and personal relationships. Gilkey grants that in nature we have only ambiguous hints of the sacred. He goes on to affirm that the God dimly known in nature is more clearly known in the existential dilemmas of personal and communal life, and especially in the covenant communities arising from historical events in ancient Israel and the life of Christ.

These various forms of natural theology have been extensively discussed by many recent authors. Though none of them provides a conclusive argument for the existence of a creator or a designer, they do show that at least some forms of theism are compatible with the scientific evidence. They have an important role in removing obstacles to belief, even though few people seem to have reached belief in a personal God by relying exclusively on this approach.

3. EVOLUTIONARY NATURALISM. Some exponents of evolutionary naturalism show a great sensitivity to the kinds of religious experience discussed above, though they interpret such experience naturalistically. Perhaps they belong with the nature poets and reflective scientists mentioned earlier; but because of their greater reliance on science to justify their views, I see a closer affinity to the formal structure of natural theology, though their arguments lead them to naturalism rather than theism.

Some scientists hold that the scientific evidence is incompatible with any kind of theistic belief. Jacques Monod maintains that nature is exhaustively explained by law and chance, excluding any role for design or for God. Monod embraces a thoroughgoing reductionism in which “man is a machine” and consciousness is an epiphenomenon that will eventually be explained biochemically (Monod 1972). On the other hand, Carl Sagan expresses great awe at the beauty, vastness, and interrelatedness of the cosmos, and he has been an

active spokesman for global environmental preservation. But he is very critical of religion and of any beliefs that are beyond the scope of the scientific method, which he says is “universally applicable” (Sagan 1980).

E. O. Wilson advocates “scientific materialism” and gives evolutionary explanations of both morality and religion. “The only demonstrated function of morality is to keep the genes intact.” In evolutionary history, he says, religious beliefs and practices were a strong social bond contributing to a group’s cohesion, cooperation, and self-defense. Religious beliefs were thus a survival mechanism conferring a selective advantage on those who held them. He concludes: “If religion, including the dogmatic secular ideologies, can be systematically analyzed and explained as a product of the brain’s evolution, its power as an external source of morality will be gone forever” (Wilson 1978, 201). I find this argument dubious, for by the same reasoning one could discredit science, since it too is “a product of the brain’s evolution.” Surely in neither science nor religion can the validity of our beliefs be established by looking at the evolutionary origins and functions of our diverse human capacities. We can, of course, turn to anthropology, sociology, and psychology for further analysis of the functions of religious beliefs and practices in human life, but none of the social sciences addresses the question of the plausibility of religious beliefs.

Ralph Burhoe’s evolutionary naturalism resembles Wilson’s in some respects but not others. Like Wilson, he holds that, in the competition among early human tribes, religion conferred a selective advantage by fostering loyalty to one’s own group and hostility to outsiders. The circle of loyalty expanded as more universal religions arose. Now, he says, science has shown us that the power that determines all things is not God but natural selection. Nature itself is our creator and judge, omnipotent and sovereign. “Man’s salvation comes in recognizing this fact and adapting to it or bowing down before the majesty and glory of the magnificent program of evolving life in which we live and move and have our being” (Burhoe 1975, 367). According to Burhoe, the system of Nature as a whole (with a capital N) should now be the object of our worship and obedience. Compared to Wilson, Burhoe sees a more important place for religious traditions today, provided they are reformulated in keeping with the scientific evidence. Moreover, he says that Nature has some of the characteristics of transcendence and beneficence traditionally associated with God. He also acknowledges the continuing importance of myth and ritual in religious life, and he wants to preserve the “well-winnowed” practical wisdom of religious traditions.

In the present symposium, Ursula Goodenough bases her “new naturalism” on the common features of human life and other forms of life. She holds that meaning and valuation are present whenever signals are communicated and responses elicited, even at the level of protein assembly by DNA, the changing shape of receptor proteins, or the action of enzymes and neurotransmitters in organisms. An elementary perception and intentionality is present already in the approach and avoidance responses of bacteria. Evolution occurs not only by the environment’s selection of organisms, but also by the organism’s active and purposeful selection of niches in the environment. Goodenough holds that ultimate meaning can be asserted as “a statement of faith” by the extension of these biological principles. The continuation of life is, for her, the ultimate value and source of moral obligation because all forms of life are so intimately interrelated.

While Goodenough recognizes an element of faith in her final assertions, Sagan, Wilson, and Burhoe claim that they derive their naturalistic conclusions from science alone (including sociobiology and anthropology). I believe that each of these authors, while making extensive use of science, presents a metaphysical position which goes beyond science itself. They offer us a new vision, an alternative philosophy of life, to replace traditional religion—not a scientific theory to replace other scientific theories. Moreover, if science is selective in the kinds of experience with which it deals, science cannot itself say whether its interpretation of reality is complete and all-encompassing. I take metaphysics to be the attempt to develop a coherent set of concepts that can be used to interpret all types of experience. As a metaphysical system, evolutionary naturalism has much to commend it, but we must still ask whether nature is a worthy object of worship and unqualified devotion. If not, how do we decide to which aspects of nature we will look for guidance for human life?

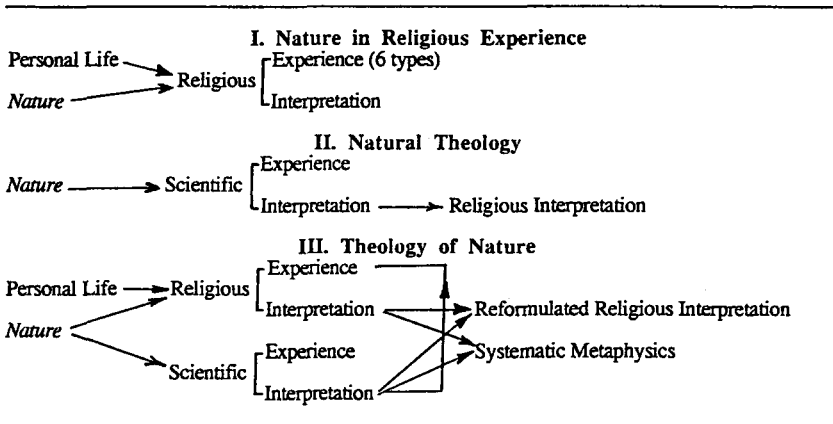
In summary, it seems to me that both theistic and naturalistic exponents of natural theology are carrying out a significant task, that of building bridges from science to religion, to use Robert Russell’s metaphor. The value of their contribution is not diminished if they do assume a metaphysics that goes beyond science itself, nor is it diminished if they are motivated partly by personal religious responses to nature as understood by science, like some of the people discussed earlier. They may even have a loyalty to a particular religious or philosophical tradition for reasons unrelated to science, like persons in the next group I will consider. In any case, we are all indebted to people writing in the tradition of natural theology, which understandably has a strong appeal to some scientists.

III. SCIENCE IN A THEOLOGY OF NATURE

In addition to bridges from science to religion, we need bridges from religion to science, and these are central concerns in a theology of nature. After describing the general approach, I will give some examples from ideas about God, human nature, and attitudes toward nature.

1. A THEOLOGY OF NATURE. The diagram below presents the three paths from nature to religious interpretation that I am exploring. The first path runs from nature to religious interpretation through religious experience. ("Personal life" here refers to the types of experience outlined earlier which do not seem to be evoked by the natural world around us, though, of course, human beings are always part of nature.) The second pattern, Natural Theology, is the derivation of religious interpretations from scientific interpretations, though I have suggested that it also reflects personal responses and metaphysical assumptions. My third configuration, Theology of Nature, includes an arrow running from scientific interpretation to religious experience, in order to acknowledge personal responses to nature as it is understood by science. I have also drawn arrows to show the integration of scientific and religious concepts in a systematic metaphysics. In addition, I have indicated that religious interpretations can be reformulated in the light of science in a less abstract way within the life of particular religious communities.

In this third configuration, theology is critical reflection on the beliefs of a particular religious community. This requires examination of the relationship of its beliefs to its history and its current



myths, rituals, scriptures, and the religious experience of its members. This view takes the historical and experiential sources of particular traditions seriously, but it accepts the need to reformulate religious beliefs as scientific knowledge changes. I will be speaking of the reformulation of Christian beliefs, but members of other traditions face a similar task in relating their beliefs to contemporary science. A pragmatic justification for this approach is that such a reformulation could affect millions of people who belong to these traditions today. Religious traditions resist change, but change does occur, especially in situations of crisis.

If the evidence from science seems to challenge even the basic affirmations of one's religious community, one may be driven to abandon the latter in favor of another religious tradition or naturalism. But if the evidence does not undermine what one takes to be its central message, one can try to reform the tradition rather than abandoning it. In the course of historical development, judgments will change as to what is considered the central core of a tradition and what can be treated as a revisable auxiliary hypothesis (Murphy 1990).

In the Christian community, the experience of personal renewal and the healing of brokenness have been found primarily in response to the person of Christ. In repentance and forgiveness, people have known the power of reconciliation overcoming estrangement. Such personal and communal experiences are at the center of Christian life and theological reflection. But in the Bible itself, God is always Creator and Sustainer as well as Redeemer. Our personal and social lives are intimately tied to the rest of the created order. Nature is not just the impersonal stage for the drama of personal life. According to the Bible, we are part of a cosmic drama in which all of nature participates.

However, subsequent Christian thought downplayed the importance of nature. It emphasized the transcendence of God and the contrast between God and the world. Theology, preaching, liturgy, and ritual all focused on the doctrine of personal redemption rather than the doctrine of creation. Moreover, Christian thought drew a sharp line between humanity and all other creatures. I would argue that the separation of redemption from creation and the separation of humanity from other creatures were responsible for the neglect of both nature and science in the life of the Church.

Our view of how God is related to nature will be affected by our understanding of nature. In particular, scientific knowledge is relevant to the reformulation of our beliefs concerning God, creation, and human nature. I am not suggesting that theologians should

consider every new scientific theory, since many theories are short-lived and of limited scope, but I submit that they must be familiar with well-established theories of broad scope, such as evolution, and should be aware of the general characteristics of contemporary science.

Newtonian science was deterministic, atomistic, and reductionistic. In the Newtonian view, all changes are to be explained by the rearrangement of atoms—except in the case of human beings, who were described in terms of a mind/body dualism. But several fields of science have cast doubt on these assumptions. In many fields, determinism has been replaced by a combination of law and chance. Orderly structure together with unpredictability are found in quantum physics, nonlinear thermodynamics, chaos theory, and evolutionary mutations. The evolution of nature at all levels must be described by a historical narrative, for its path cannot be deduced from predictive laws. Radically new types of phenomena have appeared at successive levels in matter, life, mind, and culture. Ecology has shown us that diverse living forms, including human beings, are interconnected and interdependent. We are kin to all creatures and our welfare depends on the welfare of the ecosystems of which we are a part.

The power of molecular biology and the crucial role of DNA in all forms of life might seem to lend support to reductionism, but many biologists point to the evolutionary role of the organism's own behavior as it interacts with the environment, and ecologists look at the activities of systems and larger wholes. Concepts used to describe higher levels are distinctive and cannot be reduced to lower-level concepts. Causality operates in both directions, from higher to lower level as well as from the bottom upward. Patterns at a higher level set constraints or boundary conditions on activities at lower levels without violating lower-level laws. Nature seems to be more open, multileveled, holistic, and interdependent than can be represented by deterministic and reductionistic accounts (Barbour 1990, 165–72; Peacocke 1986).

In the present symposium, Philip Hefner's paper seems to be an example of a theology of nature (Hefner 1994). He calls for "the reformation of theology" and its "constructive integration" with the new science. He gives a helpful historical survey starting with the Neoplatonic view of nature as an imperfect embodiment of the perfect world of eternal ideas. He shows that the legacy of this low view of nature, carried into the medieval synthesis, was in tension with the basic Christian conviction that nature is a fitting vehicle for God's presence and action in the Incarnation and sacraments. The

Newtonian mechanistic worldview went even further in excluding God's continuing presence and action. Hefner suggests that the interrelatedness and unpredictable novelty of nature in contemporary science make it more amenable to interpretation as an instrument of grace and an expression of love (see also Hefner 1993, 213-79). He concludes that "nature rooted in love is our friend." I greatly appreciated Hefner's analysis. However, in order to distinguish God from nature and to make clear my indebtedness to the Christian tradition, I would want to go on to say that the God expressed in both Christ and nature is our friend and not simply that nature is our friend.

2. SCIENCE AND MODELS OF GOD. What metaphors and models can we use to think about God's relation to nature as understood by science today? In the Bible itself, God is sometimes pictured as a powerful king ruling over nature. God is also said to be like an architect or a potter, designing or producing an artifact, though today we would have to add that nature is not a static or completed product like human artifacts. In Gen. 2:8, God is the gardener who plants the garden, which seems to fit better with an evolutionary world.

In the opening of the Gospel of John, God is said to have created through the Word, a term which combines the Hebrew idea of God's active wisdom and the Greek idea of *logos* or rational principle. John says that the purpose of creation was made known in Christ, the Word made flesh. In the past decade, the importance of information in many fields of science (from thermodynamics and DNA to cognitive science and computers) has led some theologians to interpret the Word as God's communication of information in both creation and redemption. God is the great communicator expressing meaning and rational structure through the divine Word.

The biblical idea of Spirit seems to me particularly helpful in thinking about God's relation to the world. In the opening verses of Genesis, "the Spirit of God was moving over the face of the waters." Several of the psalms speak of the presence of the Spirit in nature. In Psalm 104 the Spirit is the agent of continuing creation in the present: "Thou dost cause the grass to grow for cattle and the plants for man to cultivate. . . . When thou sendest forth thy Spirit, they are created." The Spirit also represents God's activity in the inspiration of the prophets and in the worshipping community. The psalmist prays: "Take not thy Holy Spirit from us" (Ps. 51:11). Jesus received the Spirit at his baptism and according to Luke was "full of the Holy Spirit" as he started his ministry. The activity of the Spirit marked

the birth of the church at Pentecost. Within the Bible, reference to the Spirit thus ties together God's work as Creator and as Redeemer (Lampe 1977).

However, the early church tended to identify the work of the Spirit more exclusively with Christ. As the doctrine of the Trinity was developed in the Western church, the Holy Spirit was subordinate to the Eternal Son and was said to come from the Son. In the Middle Ages, God's grace was held to be accessible mainly through the sacraments and the institutional church. Protestantism saw the work of the Spirit primarily in the life of individual believers. The Spirit was said to witness within us to the truth of scripture, or to bring us to conversion to Christ. Pentecostal and charismatic groups saw the work of the Spirit in prophecy, speaking in tongues, and other unusual powers. In all of these cases, the biblical understanding of God's indwelling presence in nature as the life-giving Spirit was ignored.

In the Middle Ages, the model of God as king assumed greater prominence. God was the omnipotent, omniscient ruler controlling a completed and hierarchical cosmic order. Under the influence of Neoplatonic thought, God was said to be unchanging and unaffected by a world that only imperfectly embodies the realm of eternal ideas. In later centuries, Newtonian assumptions led to the deistic model of God the cosmic clock-maker, who designed the world as a law-abiding mechanism and left it to run by itself. Both monarchical and deistic models seem to me inconsistent with human freedom and the presence of suffering, waste, change, and chance in an evolutionary world. How do contemporary models of God deal with these problems?

1. Primary and Secondary Causality. Some theologians have developed the thesis of Thomas Aquinas that God as primary cause works through the matrix of secondary causes in the natural world. God endows each creature with intrinsic properties and empowers it to express them. This differs from deism by asserting that the world does not stand on its own but needs God's continual concurrence to maintain and uphold it. It also differs from deism in acknowledging the emergence of radically new forms of life and mind in evolutionary history. There are no gaps in the scientific account on its own level; God's action is on a totally different plane from all secondary causes. Yet divine sovereignty is maintained if all events are foreseen and predetermined in the divine plan. God does not have to intervene or interfere with the laws of nature. But we still have to ask: Are omnipotence and predestination compatible with human freedom and the presence of chance, evil, and suffering in the world?

2. *God as Determiner of Indeterminacies.* Some authors argue that quantum events are not completely determined by the laws of physics, so the final determination can be made by God. The equations for predicting future events in atoms and subatomic particles yield a range of possible outcomes of varying probability, as expressed in the Heisenberg uncertainty principle. God doesn't have to intervene as a physical force pushing atoms around. Instead, God actualizes one of the many potentialities present in each atomic system, as William Klink suggests in this symposium (Klink 1994). One might think that the indeterminacies at the microlevel of individual atoms would average out according to the statistical laws governing large groups of atoms in everyday objects. But we know that in some cases the effects of very small differences at the microlevel are greatly amplified by the time they reach the macrolevel. For example, in chaos theory and nonlinear thermodynamics, an infinitesimal change in one of the initial conditions can produce major changes in the whole system. David Oxtoby in the present symposium describes the sudden phase-change transitions that can occur in systems far from equilibrium (Oxtoby 1994). Similar trigger effects occur in biological organisms. God could influence events moment by moment because the historical chain of natural causes is not deterministic as Newton had assumed. Scientific research finds only law and chance, but in God's knowledge all things are foreseen and predetermined. This view makes room for what appears to us as chance. However, if God is really in control, the problems of natural evil and human freedom remain.

3. *God's Self-Limitation.* Some theologians hold that God voluntarily set omnipotence aside in creating. They suggest that we can see in the person of Christ that God's power is the power of a suffering love that participates in the world's suffering. Like the teacher or parent of a growing child, God respects the integrity of the created world and the freedom of human beings, but does not abandon them. The monarchical emphasis on transcendence, eternity, and impassibility are here balanced by ideas of immanence, temporality, and vulnerability in God's interaction with the world. Predestination is rejected because of the unpredictability of creative change (Vanstone 1977; Fiddes 1988). Feminist authors have urged that patriarchal images of power as coercive "power over" be replaced by the images of "power sharing," empowerment, nurturing, and cooperation that are associated with women in our culture. We need the image of God as Mother to balance the traditional image of God as Father. Empowerment and the nurturing of growth are

also appropriate features of a model of God in an evolutionary world.

4. *The World as God's Body.* Another proposal is to look on the world as God's body, and God as the world's mind or soul (McFague 1993; see also Tracy 1984). We can use the analogy of human beings, with due allowance for the human limitations that would not apply to God. We have direct awareness of our thoughts and feelings, but only limited awareness of many other events in our bodies, whereas God is said to be directly aware of all events. If omnipresent, God does not need the equivalent of a nervous system. We did not choose our bodies and we can affect only a limited range of events in them, whereas God's actions would affect all events universally. From the pattern of behavior of other people, we infer their intentions, which cannot be directly observed. Similarly, the cosmic drama can be interpreted as the expression of God's intentions. However, I will maintain below that we should not think of ourselves as a dualism of mind and body, but as holistic embodied persons. In that case, the analogy would lead us to think of God as an embodied person rather than as an embodied mind. But the world as a whole does not seem to have the systematic integration at the physical level so characteristic of human beings and other organisms. The analogy also seems to identify God too closely with the world and to allow little scope for either divine or human freedom.

5. *God as Communicator.* In earlier writings, Arthur Peacocke uses a variety of analogies for God's activity in cosmic history. God is like the composer of a still unfinished symphony, experimenting, improvising, and expanding on a theme and variations. Chance is God's radar sweeping the diverse potentialities present in the world. God has endowed matter with a range of creative potentialities which can be explored and successively realized under suitable conditions (Peacocke 1979). In the present symposium, he says that God exerts a kind of top-down causality, similar to the way upper levels of a system alter the boundary conditions within which lower-level laws operate. God communicates meaning through the pattern of events. We can look on evolutionary history as the action of an agent who expresses intentions but does not follow an exact predetermined plan. We can see Christ as a God-informed person who could be an effective vehicle for God's self-expression (Peacocke 1994).

6. *Process Theology.* Process theologians go further in stressing God's immanence and participation in the ongoing world, but they

do not give up transcendence. In process thought, God is eternal and unchanging in character and purpose but is temporal in being affected by interaction with the world. God is present in the unfolding of every event, but never exclusively determines the outcome. God is the ultimate source of both order and novelty, though at lower levels order predominates and novelty is minimal. God builds on what is already there, for each successive level of reality requires the structure of lower levels. This is a God of persuasion rather than coercion. Process theologians see God not as an omnipotent ruler but as the leader and inspirer of an interdependent community of beings. Of course, no model is literal or exhaustive, and we can use several of these models to portray different features of God's relation to the world, as long as they are not inconsistent with each other (Barbour 1990, 218-70).

3. SCIENCE AND HUMAN NATURE. How might science affect the Christian view of human nature? In the Bible itself, body, mind, and spirit are looked on as aspects of a personal unity. The self is a unified bodily agent who thinks, feels, wills, and acts. The body is not considered the source of evil or something to be denigrated or escaped. Persons in their wholeness are the object of God's saving purposes. In the biblical view, selfhood is always social, for we are constituted by our relationships and the covenants we enter. We are always persons-in-community, not isolated individuals.

But under the influence of late Greek thought, the early Church increasingly viewed a human being as a separate soul temporarily inhabiting a body. In the Middle Ages the central goal of human life was the salvation of one's immortal soul. This dualism was continued in the modern period in Descartes's distinction between mind and matter as radically different substances with no properties in common. An absolute line was drawn between humanity and all other creatures, for only humans were said to have souls or the capacity for rational thought. In the eighteenth and nineteenth centuries, many authors found such a dualism untenable and kept only one-half of it, the material side. For them, human beings as well as the rest of nature were to be explained in materialistic and reductionistic terms.

Three challenges to the status of human beings have arisen from science.

1. *Evolutionary Origins.* Since Darwin, the evolution of humankind from nonhuman forms has seemed to challenge human dignity. Biologists treat human beings as part of an interdependent natural order. However, most biologists today acknowledge the distinctive-

ness of human language, self-consciousness, and culture. While changes in life forms over evolutionary history have been gradual and continuous, they have added up to dramatic differences in ability and behavior. There are, of course, significant parallels between biological and cultural evolution, and some philosophers interpret culture and even the history of science as the survival of the fittest ideas. But new and imaginative ideas do not resemble random mutations, and their transmission through language and education has little in common with transmission through genes. Selection and change in cultural forms are more rapid and more deliberate than natural selection in biological populations. Human beings are part of nature, but an amazing and distinctive part.

2. *Genetic Determinism.* A more recent challenge to human freedom and responsibility comes from evidence concerning the influence of genes on human personality and behavior. For example, genetic and biochemical factors evidently play a major role in schizophrenia, depression, alcoholism, obesity, and homosexuality. Studies comparing pairs of identical twins, fraternal twins, siblings, and adopted children brought up together in the same family, show that roughly half of the observed variations in personality and behavior can be accounted for by genes, though the methodology of some of these studies is a subject of continuing dispute. We are clearly constrained by our genes and by conditioning from our family and culture, but within these limits we have some degree of freedom to reflect on our goals and to assume responsibility for our decisions. We are influenced by our social environments, but we also have some opportunities to choose our environments and life-styles. Genetic tendencies cannot be equated with genetic determinism (Eaves and Gross 1992).

3. *Artificial Intelligence.* Human dignity also seems to be threatened by the possibility that computers and robots might equal or surpass us in intelligence. They have already surpassed us in their speed in carrying out complex calculations. Some computer experts claim that all human thought and language consists of information processing and the manipulation of abstract symbols—which can in principle be carried out by computer circuits. It is said that “mind is to brain as computer software is to computer hardware.” Critics reply that human language is not just a formal symbol system because it is context-dependent. In understanding words we draw from an immense background of nonlinguistic experience. Language aims not at abstract representation but at communication for

particular purposes in the context of interaction with other people and with the world around us.

The frog's eye and visual system is a product of its evolutionary history; it doesn't give an exact representation of the world, but extracts the kind of information that is relevant to a frog's needs. So, too, human neurophysiology evolved in parallel with distinctive human needs and interests. Moreover, the growing child today learns by interaction with the world and with other people. Robots with sensor and motor capacities will also be able to interact with the world, but their mechanical bodies will be very different from our biological bodies. What they will learn from experience will therefore differ from what we learn from our experience. Human experience has many dimensions that are hard even to imagine in computers, such as emotions that are unlike the logical relationships of a computer program. Some authors have argued that self-consciousness is simply the ability of a system to form a symbolic representation of itself, which might be achieved by a suitably programmed computer; but such symbolic self-reference does not seem to capture the essential subjectivity of self-consciousness. We can be grateful for all that present and future computers can do, without ignoring the distinctions between computers and persons (Barbour 1993, 168-75).

In sum, we can reject reductionistic materialism and acknowledge human beings as responsible persons without reverting to classical dualism. As in the biblical view, we can accept the holistic character of persons as integrated centers of thinking, feeling, willing, and acting. We can affirm the social and bodily character of selfhood. Taking science into account, we can think of ourselves as many-leveled psychosomatic beings. We have strong evidence of the biological basis of human life and of our kinship with all creatures in evolutionary history and in the ecological interdependence of diverse forms of life today. We know that human culture is firmly rooted in the biological world, but it flowers in intellectual and artistic creativity and human relationships far beyond anything found among other creatures. Above all, it is in the personal character of their capacity to respond to God that human beings differ from other creatures.

4. ATTITUDES TOWARD NATURE. Both science and religion affect our attitudes toward nature. Science can tell the dramatic story of a cosmos in which all creatures are related to each other. Science reveals the present interdependence of all forms of life and the role of diversity in sustaining ecosystems. Only science can provide

reliable information concerning the consequences of our actions and their impacts on the environment. Scientific studies have explored the destructive consequences of soil erosion, deforestation, water pollution, atmospheric change, and population growth.

But the value judgments that enter policy decisions about the environment and natural resources cannot be made on the basis of science alone. Social goals affect priorities even in the allocation of funds for scientific research. Public support of environmental legislation and regulation is influenced by attitudes toward nature and by prevailing visions of the good life. Science is essential in bringing about new perceptions of reality, but it is seldom adequate to provide the motivation for radical change in our habits or life-styles. Religion strongly affects the way people treat nature, both for better and worse.

Some environmentalists have claimed that Western exploitative attitudes toward nature can be traced back to the verses in Genesis in which humanity is instructed to "fill the earth and subdue it; and have dominion over the fish of the sea and over the birds of the air and over every living thing that moves upon the earth" (1:28). Biblical scholars have replied that in the Bible itself humanity does not have absolute dominion because we are always responsible to God. The alienation of humanity from nature in Western history seems to be attributable primarily to other factors, including the body/soul dualism and the concentration on redemption mentioned earlier.

With the rise of capitalism, nature was increasingly viewed as simply a resource for human use and private profit. With the growth of technology, human power over nature rose dramatically, and it was assumed that there were no limits to our ability to manipulate it for our own purposes. One can also point to the parallels between the domination of human beings over nature and the domination of men over women. Both forms of domination assume the superiority of reason over emotion, objectivity over subjectivity, and control over nurture and cooperation. In our culture, the first of each of these pairs of terms (reason, objectivity, control) has been associated with men and also with science and technology, which until recently were almost exclusively male occupations.

But after recognizing that many forces have contributed to the degradation of the environment, we still have to confess that historical Christianity bears significant responsibility. After repentance for the past, we can find new directions both from the Bible and from more recent sources (Barbour 1993, 72-80).

1. *Stewardship of Nature.* Many recent theological writings give prominence to the biblical injunction of stewardship. According to Deuteronomy, "The earth is the Lord's." The land belongs ultimately to the God who created it; we are only trustees or stewards, responsible for its welfare and accountable for our treatment of it. The Sabbath is a day of rest for the earth and other living things as well as for people. Every seventh year the fields are to lie fallow; the land deserves respect and it will cry out if mistreated. But stewardship is often interpreted as assigning only utilitarian value to nature, and it can easily get distorted into dominion unless other themes are brought out.

2. *Celebration of Nature.* Genesis 1 ends with an affirmation of the goodness of the created order. Hosea pictures God making a new covenant that includes all living things: "I will make for you a covenant on that day with the beasts of the field, the birds of the air, and the creeping things of the ground" (2: 18). Many of the Psalms refer to the value of nature apart from its usefulness to us:

Mountains and all hills,
fruit trees and all cedars,
Beasts and all cattle,
creeping things and flying birds . . .
Praise the Lord!

— Ps. 148:9-10

Psalm 104 celebrates the rich diversity of nature. Other images affirming the value of nature in God's eyes are presented in Isaiah, Job, and the parables and teachings of Jesus.

3. *A Sacramental View of Nature.* Even greater value is attributed to nature when it is believed that the sacred is present in and under it. Eastern Orthodoxy celebrates the goodness and beauty of creation and finds God's presence in it, holding that the infinite is manifest in the finite. Celtic Christianity, influenced by pre-Christian nature-worship in Britain and Ireland, expresses a deep love of the natural world and a conviction that God is immanent in it. Several Anglican authors suggest that all of nature, and not just the bread, wine, and water of the sacraments, can be a vehicle of God's grace. Here the Holy Spirit is understood to be at work throughout creation and not simply in the life of the Christian believer.

4. *Kinship with All Creatures.* Because so much of Christian thought has been anthropocentric, we turn primarily to science and to other religious traditions for recognition that human beings are

part of the wider community of life, but there are some examples from biblical sources. The story of Noah is myth rather than history, but at least it seems to defend biodiversity. The Psalms acknowledge our companionship with other creatures. The prophetic vision of the future kingdom included the renewal and redemption of the whole creation, not simply humanity alone. For Saint Francis, a spiritual bond connects us with all creatures, while Saint Benedict promoted agricultural and resource practices that treated nature with respect. Contemporary theologians see us as partners, companions, and participants in the community of life. They seek action in solidarity with the victims of abuse, human and nonhuman.

5. *Process Theology.* Process theologians reject the sharp separation of nature and human history in most of twentieth-century theology (especially in neo-orthodox, existentialist, and evangelical thought). Traditional theology emphasized divine transcendence and the gap between God and nature. At the opposite extreme, Romanticism, pantheism, nature mysticism, and some of the New Age movements have emphasized immanence, which usually leads to an impersonal God or identifies God with nature. According to process thought, God transcends nature but is also immanent in the temporal process. This implies that nature is not to be exploited, on the one hand, or worshipped, on the other, but is to be respected and appreciated, for it is the scene of God's continuing activity. According to process thought, all creatures have value to God and to each other, and all have intrinsic value as centers of experience. But creatures vary widely in their richness of experience and in their contribution to the experience of other living beings, so they are not equally valuable. This provides a basis of concern for the welfare of all forms of life while offering grounds for establishing priorities when the needs of human and nonhuman life conflict. A biocentric view that advocates equal respect for all forms of life provides no grounds for such judgments when hard choices are forced upon us. I suggest that we can draw from all of these themes (stewardship, celebration, sacramentalism, kinship, and process), since they are not mutually exclusive.

In closing let me indicate three other points at which the Christian tradition has a distinctive contribution to make to environmental ethics.

1. *Social Justice.* The effects of environmental damage fall very unevenly on different groups in society. The urban poor are exposed to higher levels of air pollution, water pollution, noise, and lead

poisoning than citizens with higher incomes, and they have little economic or political power to defend themselves from such risks. Consumption by industrial nations is responsible for a grossly disproportionate share of global pollution and resource use. On average, a U.S. citizen consumes as much of the world's resources as forty citizens of India. Environmentalists often neglect social justice, and social activists often neglect the environment, but the religious community can join these goals together. The National Council of Churches combined them when it created a task force on Eco-justice. The World Council of Churches at its last assembly adopted the theme: "Justice, Peace, and the Integrity of Creation." The exploitation of nature and the exploitation of people are often products of the same economic and political forces. The attempt to choose between jobs and the environment is short-sighted, for jobs that entail the rapid destruction of the environment cannot long be sustained.

2. *A Long-term View.* Many of the impacts of our activities will be felt by future generations. Degraded land, eroded soil, and decimated fisheries and forests will take decades to recover. Radioactive wastes from today's nuclear power plants will endanger anyone exposed to them ten thousand years from now. The world of politics, however, tends to take a very short-term view. Political leaders find it difficult to look beyond the next election. The main concern of business and industry is this year's bottom line. Economic calculations give little weight to long-term consequences because a time discount is applied to future costs and benefits. The biblical tradition, by contrast, takes a long-term view. Stewardship requires consideration of the future because God's purposes include the future. We are told that the land, in particular, is to be held as a trust for future generations. This long-range perspective derives from a sense of history and ongoing family and social life, as well as accountability to a God who spans the generations.

This view would indeed lead one to conclude that the preservation of the human species against threats to its continued existence would be in keeping with God's purposes, as Mary Gerhart and Allan Russell maintain in this symposium (Gerhart and Russell 1994). But I am dubious about Russell's thesis that we should colonize space because our species is threatened by overpopulation and by the possibility of collision with an asteroid. He uses Noah's ark as an analogy. In the story of Noah, however, all the known species were saved, whereas Russell's proposal is anthropocentric; it ignores the theological and ecological lessons of our interdependence with other forms of life. Once population growth is stabilized, the earth's

resources, if equitably distributed, are adequate for the needs of both human and nonhuman life. If we are unable to deal with our social problems on earth, we will just take them with us into space. While duties to the human species in the future would take priority over duties to needy individuals in the present, it seems questionable to invest heavily in the research, equipment, and fuel required to put a small human colony into an uncertain future in space while there are threats to human survival more urgent than asteroids. We are unlikely to find a long-term home elsewhere more hospitable to human fulfillment than the earth which gave us birth.

3. *A Vision of the Good Life.* Conservation measures in industrial nations would contribute significantly to a more just and sustainable world. Greater efficiency and improved technologies can cut down on both pollution and resource use, but I believe we must go beyond efficiency and look at our patterns of consumption. In our society there are powerful pressures toward the escalation of consumption. By the age of twenty, the average American has already seen 350,000 television commercials. The mass media hold before us the images of a high-consumption life-style. We are encouraged to try to fill all our psychological needs through commercial products. By contrast, the Christian tradition offers a vision of the good life that is less resource consumptive. It holds that, once basic needs are met, true fulfillment is found in spiritual growth, personal relationships, and community life. This path is life-affirming, not life-denying. Religious faith speaks to the crisis of meaning that underlies compulsive consumerism. A vision of positive possibilities and an alternative image of the good life are likely to be more effective than moral exhortation in helping people to turn in new directions. If a quarter of the trillion dollars the world spends on arms each year were spent on sustainable agriculture, reforestation, energy conservation, renewable energy sources, and family planning, the prospects for the whole planet would be dramatically altered.

CONCLUSION

I have outlined three paths from nature to religious interpretation. They represent personal responses to nature, bridges from science to religion, and bridges from religion to science. I suspect that in differing contexts all of us use each of these paths. Whichever path we are most accustomed to follow, we can be grateful for people who help us to see new possibilities for exploring the other two. We need all of them to be whole persons.

The flyer that announced the 1993 Templeton Symposium shows a picture of the earth taken by an astronaut on the moon. It is a stunningly beautiful and marvelous planet. Following the first path, we respond to it in awe, wonder, and gratitude. On the second path, science shows us that it is the product of a long cosmic and evolutionary history and may lead us to infer a creativity within nature or a source beyond nature. Following the third path, we can work within our own religious traditions to encourage greater appreciation of the natural world, greater openness to scientific knowledge, and a greater dedication to the preservation of the planet. The earth has adequate resources for humankind and all other forms of life, if we learn to use those resources carefully and share them equitably. Both science and religion can help us to look on the earth in a new way and to respect and cherish it.

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