

# EMPIRICAL THEOLOGY IN THE LIGHT OF SCIENCE

by Karl E. Peters

*Abstract.* Empirical theology stands in contrast to science insofar as it seeks to understand the nature and source of human fulfillment and insofar as science seeks to understand the world and human beings regardless of the implications of that knowledge for human welfare. However, empirical theology is like science insofar as it affirms a dynamic, relational naturalism; accepts limitations of the human knower, thereby making all knowledge including religious knowledge tentative; seeks causal explanations as well as religious meaning; and argues that a key criterion for justifying ideas is their ability to explain experience already had and to predict new experiences in Lakatosian-type progressive research programs.

*Keywords:* empirical theology; experience; facts and values; Lakatos; naturalism; scientific method.

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Empirical theology is a twentieth-century movement, largely in the United States, that argues that religious ideas must be tested and thereby justified against human experience. Influenced by American pragmatism, empirical theology flourished at the University of Chicago in the first half of the twentieth century, and it continues to have an impact through the Religion and Empiricism Group of the American Academy of Religion, the Highlands Institute for American Religious Thought, and *The American Journal of Theology and Philosophy* (1980– ). An excellent historical and topical survey of this kind of theology can be found in *Empirical Theology: A Handbook*, edited by Randolph Crump Miller (1992).

The work of empirical theology has usually been done in relation to the social and life sciences; many empirical theologians have used resources from the fields of psychology and sociology, and many also

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are cognizant of the importance of evolutionary theory for philosophy and theology. Since relating theology to the natural and social sciences in the context of evolutionary theory has been one of the primary tasks occupying the pages of *Zygon* since its inception in 1966, it is appropriate to examine some general relationships between empirical theology and the sciences.

Much has been written on the relationship between religion or theology and science, mostly within the framework of Western thought. However, almost nothing has been done to explore the relationship of *empirical* theology and science. Major works such as Ian Barbour's pioneering *Issues in Science and Religion* (1966) and his most recent Gifford Lectures, the first course published as *Religion in an Age of Science* (1990), have little to say about the "Chicago School" and related thinkers. The same is true of Holmes Rolston, III's excellent *Science and Religion: A Critical Survey* (1987), as well as the most recent work by Arthur Peacocke, *Theology for a Scientific Age* (1990).<sup>1</sup> So this essay will work out its own comparisons between empirical theology and science; however, as far as space allows, it will do this in the context of more general discussions of the relationship between science and religion. First, I will compare the "spirit" of empirical theology and of scientific inquiry; then I will compare the methods of each. As I do this I will also discuss some specific findings of science insofar as they have a bearing on the spirit and methods of inquiry.<sup>2</sup>

#### ON THE SPIRIT OF SCIENCE AND EMPIRICAL THEOLOGY

In explaining why the spirit or spirituality of science is just as important as the methods and content of science and faith, human geneticist Lindon Eaves writes that "*spirituality* is nothing less than that orientation of the human spirit toward reality which motivates, directs, and sustains our encounter with the unknown. It embodies our assumptions about the nature of reality, the state of mind normative for the pursuit of truth, the appreciation of the barriers of knowledge, and the sacrifices which must be made on the journey" (Eaves 1989, 197). In discussing the sacrifices science makes, Eaves points out that the primary sacrifice is that of subjectivity in favor of scientific "objectivity": "The sacrifice of subjectivity . . . is itself the spirituality of scholarship" (Eaves 1989, 197). In this section of the essay I will suggest that the sacrifice of subjectivity is related to both a fundamental difference and a fundamental similarity between science and empirical theology. Then I will show how science and empirical theology generally agree in their assumptions about the

nature of reality, the state of mind normative for the pursuit of truth, and the appreciation for the barriers of knowledge.

THE OBJECTIVITY OF SCIENCE AND THE TASK OF EMPIRICAL THEOLOGY. Both the basic difference and similarity between science and empirical theology on the issue of "objectivity" can be brought to light by exploring the more general relationship between religion and science in terms of the following working definition of *religion*: a religion is a system of ideas, actions, and experiences that offers a path toward human fulfillment by relating individuals and societies to what is thought to be ultimate.<sup>3</sup>

The basic similarity can be seen by looking at the first part of the definition: "system of ideas, actions, and experiences." In general, science consists of a body of theories that are tested by experiments or controlled observations (the actions of science) against a particular domain of experience. Religions have the same general structure: poetic stories called myths and rational doctrines constitute the ideas; rituals and codes of conduct specify behavior; and both of these lead to as well as respond to a variety of experiences. In science, as in religion, the relation between ideas, actions, and experiences is not one way but interactive: theories influence the kinds of actions undertaken and the character of the resulting experiences; yet experiences can lead to a modification of theories.

The basic difference between science and religion can be seen in the second part of the definition: "offers a path toward human fulfillment by relating individuals and societies to what is thought to be ultimate." What is meant by *fulfillment*, the nature of the path, and the understanding of what is ultimate vary considerably when one examines what has been called religion (cf. Streng et al. 1973). For example, fulfillment may occur in the context of nature—maintaining small-scale societies in harmony with nature, or developing a variety of individual human potentials in a manner integrated with the rest of society and the environment. Or human fulfillment may be realized independently of nature as we know it—merging individuality into an originating cosmic self, or gathering the righteous at the end of history into a peaceable kingdom in a new heaven and earth. Paths to this completion may be primarily ritualistic, devotional, or meditational and experiential. They may involve only human effort, a complete reliance on a reality greater than human, or both to some degree. The understanding of what is ultimate may be in terms of a state of existence to be attained or an agent that is the source of existence and goodness. And both the state or agent may be simple or complex, personal or nonpersonal.

However, the state or agent is usually considered to have the highest value; it is the greatest good.

In all this religious variety there is implied the idea that humans do not exist in a state of greatest good; there is more to life than has so far been realized. Obstacles to fulfillment have to be overcome; potentials have yet to be actualized; various actualized aspects of life have to be integrated into wholes. While *fulfillment* may mean that things need to be brought to completion in some final culmination of nature and history, it also may simply be (as for many empirical theologians) an ongoing succession of states of relative completion here and now. Thus, underlying many of the differences in religion is a common quest for value or what is good, not the value that has been attained but the good to be continued and the further good to be sought.

The quest for increasing value is what basically distinguishes religion from science. In oversimplified terms, we might say that the ideas, actions, and experiences of science are focused more on reality than value, on the way things are rather than on the way they ought to be. Religion seeks greater value and hence is concerned with maintaining and enhancing human well-being. Science seeks to understand human beings and the world in which we live, regardless of whether the knowledge attained is beneficial to humans or not; this is one important aspect of the so-called objectivity of science. In more complex terms, if we recognize that even in science there is a commitment to increasing value—the value of knowledge—we can still distinguish religion from science by saying that religion seeks not just knowledge for its own sake, as does science, but knowledge which is “salvational,” knowledge that lights the path toward greater good.

Even this distinction, however, needs to be qualified in a number of ways. While it fits much of traditional religion and what has been called “pure” science, it does not fit exactly empirical theology and what often happens today when the distinctions between pure and applied science, and between truth and beauty, are blurred.

In discussing how religious ideas (in the form of myths) are salvational, John Bowker insightfully draws out one implication for knowledge that differentiates science from religion. He notes the fact that many religious traditions have a variety of stories of creation, some of which even contradict each other. This means that religions are not interested primarily, like science, in describing the way things are. Speaking of creation stories, Bowker says that “in religions, the *descriptive* account of origins is subordinate to the way in which the conceptualization of cosmos and cosmic origins contributes to the

*salus* (the health and salvation) of the society which it sustains" (Bowker 1990, 10).

However, if one turns to empirical theology, this distinction of Bowker's, based on an analysis of traditional religion, must be qualified. Theology is not religion, but it is the rational, critical, constructive exploration of religious ideas, actions, and experiences, in order to understand more clearly what constitutes human fulfillment and how it is attained. In contrast to other theological approaches today, which may stress the authority of past writings, the authority of a church, or the nonrational faith of the individual as a means of determining the nature of human fulfillment and how it is attained, empirical theology makes the methodological assumption that such questions should be settled by appealing to experience.<sup>4</sup> In this regard empirical theology is like science: both are forms of inquiry seeking to gain knowledge, and both appeal to experience. In this sense, like science, empirical theology makes Eaves's "sacrifice of subjectivity," favoring results of inquiry that are not biased by human desires, wishes, or hopes. What distinguishes empirical theology from inquiry conducted by the various sciences about the world, human nature, and society is that it seeks to know—really or "in fact"—what it is that brings humans to fulfillment. In comparison with Bowker's assessment of religious thinking and science, empirical theology seeks to be descriptive—and wants to get it right if it can—regarding what brings about human fulfillment.

Some contemporary science also seeks to understand the way things are, in order to assist human well-being and fulfillment. Often scientists seem to be motivated in their inquiry to find out how nature, society, and human personality in fact "work," so that human beings will be better off. Medical research, agricultural science, and psychology and psychiatry are examples of this. At a deeper level, a scientist's search for the way things are may be intrinsically related to one form of human fulfillment: a coming to an appreciation, acceptance, and awe of the universe that creates and sustains us. In discussing the spirituality of science, Eaves appeals to Einstein's "cosmic religious feeling" as an affective element in scientific motivation: "I maintain that cosmic religious feeling is the strongest and noblest incitement to scientific research. Only those who realize the immense efforts and, above all, the devotion which pioneer work in theoretical science demands, can grasp the emotion out of which also such work, remote as it is from the immediate realities of life, can issue. . . . You will hardly find one among the profounder sort of scientific minds without a peculiar religious feeling of his own" (Einstein 1956, 28; quoted by Eaves 1989, 198).

Eaves continues his discussion of the spirituality of science by suggesting that scientists are motivated by three expectations: "First, rightly or wrongly, scientists believe they are engaged in exposing *reality* itself."<sup>5</sup> Second "is the expectation of simplicity. . . . The most informative theories are those which encompass the greatest range of data with the smallest number of parameters." Third "is the aesthetic principle. . . . The scientist's sense of what is 'ugly' keeps alive the quest for a better solution. The sense of what is 'beautiful' plays a significant part in deciding when a truth is at hand. A sense of what is 'elegant' determines the degree of enthusiasm for a new scientific strategy. The passion for simplicity and the appreciation of beauty are closely allied in scientific spirituality" (Eaves 1989, 199-200).

Motivated by the hope of understanding reality and the aesthetic sense of beauty, one might say the scientist is seeking a kind of fulfillment, and hence the scientist is on a "religious quest." In attempting to see things as they are, the so-called pure scientist, who is not interested in knowledge for the sake of improvement but knowledge for its own sake, may also be affirming the intrinsic value of energy, matter, and life in their various forms. In their own rational-empirical, precise, cognitive manner, scientists may be affirming what Zen Buddhists try to grasp more intuitively, an enlightenment that involves a direct seeing into the nature of things. Or it might be, in the terms of psychologist Eric Fromm, a kind of "mature love" that accepts other parts of the universe, as well as humans, as they are rather than trying to make them serve one's own interests and therefore controlling and dominating them (Fromm 1962, 20-21).<sup>6</sup>

This raises profound questions for religion and empirical theology: To what extent is the goal of living a coming to terms with the way things are, regardless of their impact on human well-being; and to what extent is the goal that of reshaping things for human improvement? Or for those empirical theologians who, like Henry Nelson Wieman, seek what in fact transforms: To what extent is the primary transformation that of human valuing consciousness, so as to appreciate things as they are without having to change them; and to what extent is the transformation of the human mind a prelude to engineering the transformation of some other reality? To echo Karl Marx: What is the human quest about, to understand the world or to change it? Scientists like Eaves seem involved in the quest for understanding; for others more technologically oriented, the goal may be to understand in order to change things for some perceived greater good.

ASSUMPTIONS ABOUT THE NATURE OF REALITY. Like scientific inquiry, empirical theology is conducted within a naturalistic worldview. Naturalism is foremost an appreciation of nature and human history as providing the primary if not the sole context both for scientific and scholarly inquiry and for attaining human fulfillment. Human fulfillment and the ultimate source of fulfillment are to be found not beyond the spatial-temporal world but within it. If there are realms of being other than spatiotemporal nature and history (as in supernaturalism), they are beyond our ken and have no relevance to life today. If there is an "eternal more-than-space-time" that is in some way the grounding of nature and history (as in panentheism), that "more" can be known only through ordinary rational-empirical inquiry and has relevance for human fulfillment only as it becomes actualized in space-time.<sup>7</sup> The appreciation of nature and history as the arena for God's work and for human fulfillment distinguishes empirical theology from some other kinds of theology; it also expresses a fundamental compatibility between empirical theology and science.

A second feature of the naturalistic worldview, which science and empirical theology hold in common, is that reality is basically organic. By this I mean it is both relational and historical. In discussing the radical empiricism of Wieman, Nancy Frankenberry points out: "the ultimate actualities of the world were conceived of as events, happenings, specific instances of energy. There is no substance or reality underlying this world of happenings. There are only relations, that is, structures, among these units of energy, at various levels of complexity" (Frankenberry 1987, 120-21). This statement by an empirical philosopher of religion could just as well have been written by any number of contemporary scientists.

In contrast to the mechanistic, substantive view of reality of Newtonian science, today's science sees everything as dynamic systems of energy, with larger systems being constructed out of smaller energy systems; atoms out of subatomic "particles"; molecules out of atoms; complex, self-replicating molecules out of simpler molecules; cells out of complex molecules; organs out of cells; living creatures out of organs. Thus, living creatures are complex systems of energy, organized out of smaller systems of energy. These living systems, built out of (caused by) the simpler systems, in turn exercise control over the simpler systems in what has been called downward causation.<sup>8</sup> Such complex, self-controlling systems also interact with the wider environment to procure more energy (food), in order to maintain, reproduce, and strive in various ways to fulfill their potentials. With this processed energy they interact in other ways

with one another and the wider environment, thus forming still more complex systems of relationships.

All of this evolves temporally. Traditional philosophy, theology, and even Newtonian science held that the mark of "true" reality was permanence (no change). However, when nineteenth-century evolutionary thinking was coupled with the slightly older empirical notion that what we observe is real, then change, growth, and development became significant. Time became the cornerstone of a new way of looking at the natural world so that nature became historical.

Thus, when scientists such as astrophysicist Eric Chaisson attempt to portray the "big picture" of the universe, they do so historically; "looking out into space is equivalent to looking back into time" (Chaisson 1981, 8). Because it takes illuminating radiation time to travel, even across the room, we are always looking at the past. When astronomers observe stars, galaxies, and systems of galaxies from a few to billions of light-years away, they are observing what happened from a few to billions of years ago. In order to speak about nature we must speak about nature historically. And when we speak of human fulfillment, we must speak of it as a continual succession of relative completions or wholenesses, which in turn serve as the stage for further events that make actual the potentials of existence in still wider and deeper integrated relationships.

Even though change is fundamental in the current scientific worldview, so is continuity. If everything is patterns of energy, with more complex patterns evolving out of and made up of simpler patterns, then there is no sharp distinction between energy and matter ( $E = Mc^2$ ), between viruses and life, between higher primates and *Homo sapiens*. And human history, whose various culturally evolving institutions are built on energy-matter-life foundations (brains, books, and computer chips), is simply the latest phase in the evolutionary history of the universe.

In light of this continuity it would be somewhat artificial for empirical theologians to limit their interaction with science primarily to the social sciences. While religion and other human activity is primarily cultural, still the humans engaged in such activity are also biological, chemical, and physical creatures. Further, as knowing subjects conducting scientific and theological inquiry in a rational-empirical manner, humans still are conditioned in their various inquiries by the biological, chemical, and physical systems of energy out of which we are composed.



THE HUMAN MIND AND BARRIERS TO KNOWLEDGE. In addition to the "sacrifice" of subjective bias to "objectivity," and to assumptions about the nature of reality, the scientific spirit includes assumptions about the human mind and an appreciation of the limits on human knowledge.

First, there is a general limit on what all normal humans can experience with the senses. Taking into account a general evolutionary perspective that includes the evolution of the human brain and human culture, the latter including religion and science, one can make the statement that the human knowing apparatus and the methods of knowing have evolved in an Earth environment through natural selection, and later through cultural selection pressures. While the capacities of the human brain and the methods of inquiry may go beyond what seems necessary for biological survival and reproduction, still, according to well-established, contemporary scientific theory, humans and their brains evolved from other higher primates in local environments. Thus, for example, the range of what humans see and hear is sufficient for what cooperating humans have needed to be successful so far in the biological, evolutionary "game." However, we now also know that what humans perceive in the visible and auditory ranges of energy wavelengths and frequencies is only a small percentage of the total wavelength-frequency spectrum of radiation. We know this because of scientific and technological advances in the twentieth century that have allowed us to process information from other wavelengths and frequencies, not immediately perceivable by the human body. These other frequencies and wavelengths of energy are marked by such names as cosmic rays, X rays, radio waves, and microwave radiation.

The import of this for empirical theology may be considerable. Insofar as empirical theology considers experience to be only direct sense experience or direct felt experience, we are limited by the evolved structures of our own bodies and brains. Of course, for matters of human fulfillment, these evolved structures may be primary. However, the fact that we now know there is much more to nature than we can directly perceive and feel is an important example of the kind of barriers that confront empirical knowledge.

A second limit on human knowing is related to individual variability. Genetic defects limit the rational-empirical capabilities of some humans. And even within the normal range of knowing capabilities there is considerable variation. Some people are more adept at mathematics, while others are more adept at art, and still others are more adept in processing information important in social relations. According to one reliable test for personality traits, the

Meyers-Briggs test, humans vary considerably on a number of factors that affect the way we perceive and process information about the world and other humans. Various combinations of these factors form “personality types” that have an effect on how we work and play (Provost 1990). This might also include how we work as thinkers—as scientists and empirical theologians—and how we practice religion. In *God’s Gifted People*, Gary L. Harbaugh (1990) interprets the Meyers-Briggs personality types as “gifts of the spirit.” From an evolutionary perspective the types result from genetic variations as well as from experience in the human life cycle.<sup>9</sup> Although factors in personality types limit the cognitive activity of each individual, all together they enrich total capacity of the human species for gaining knowledge.

These findings from some of the biological and social sciences fit well with an important assumption of inquiry in science and empirical theology: the methods of each must be self-critical and self-correcting. Thus it is recognized that all knowledge is tentative and not absolute. Neither science nor empirical theology finally appeals to methods of authority, “blind faith” that is no more than an assertion of belief in the face of or beyond experience, or rational agreement in a particular community. As Charles Sanders Peirce pointed out, such appeals cannot resolve differences between competing authorities, competing faiths, or competing communities, because each party appeals to what is already established by each respective method as “true,” making the truth of each absolute. The only way out is to recognize the tentativeness of all human knowing, the limits of our capability as knowers, and then to use a method that appeals to future experience as a way to resolve conflicts between present ideas (Peirce 1965b). The appeal to future experience that is repeatably accessible to all who are trained and in a position to have the experience is a hallmark of both contemporary science and empirical theology.

#### ON THE METHODS OF SCIENCE AND EMPIRICAL THEOLOGY

When one begins to consider the methods of science and empirical theology, one is faced with a complex set of relationships between experience and concepts. On the one hand, experiences present to the human mind phenomena to be explained and interpreted with concepts. On the other, concepts we inherit from our culture and from specialized communities, such as a particular scientific or religious tradition, influence how we experience the world and what

experiences we select as worthwhile for consideration. Furthermore, the development of concepts, both in religions and the sciences, is a complex process of mental construction. Beginning with a wealth of inherited ideas, our human imagination constructs metaphors, analogies, and models to extend existing ideas to cover new experiences. Then these ideas are tested by their coherence with other ideas, their ability to account for experiences, and, perhaps most importantly, their ability to lead to new experiences. Those concepts which meet the tests become part of the historical reposit of ideas for others to use. In what follows I shall simplify these complex relationships by loosely employing Eaves's shape of scientific exploration as a movement in the growth of a particular science from taxonomy or "identifying those contours of reality which demand our special attention, setting the subject-matter of the discipline," to the hypothetical-deductive constructing and testing of possible theories, and finally to the development of ongoing research programs in the "paradigmatic or technological phase" of mature science (Eaves 1989, 201-2).<sup>10</sup>

TOWARDS A TAXONOMY OF SCIENTIFIC AND RELIGIOUS EXPERIENCE. One function of taxonomy is to map out a domain of experience to be considered as subject matter for inquiry. We will begin by claiming, in line with the radical empiricism affirmed by many empirical theologians, that all our experiencing is of unified wholes. It includes at the same time a feeling of being acted upon; a sense of particular features, including such phenomena as shape, size, and color; and a feeling of value or affective tone.<sup>11</sup> In initial states of awareness, these aspects of the experience are not clearly distinguished.

*Experience as Value Laden and Theory Laden.* However, specific aspects of experience can become the center of our attention, depending on our particular interests. Our interests may be those most humans hold in common, such as meeting basic physical needs or achieving emotional satisfaction in interpersonal relationships. Or they may be more specialized interests such as those we spoke of above in comparing the basic objectives of science and religion. Or they may be the interests expressed in a particular scientific theory such as the genetic theory of DNA that focuses inquiry on the search for particular kinds of observable data. Or the interests may be expressed in a religious belief system, for example, in a claim that one must be "reborn" to enter the "kingdom of heaven," so that followers of this belief system seek experiences of rebirth or interpret past experiences in this way.

In both science and religion, concepts help shape our interests and actions and thereby the experiences we seek. In this sense, in both science and religion, experience is “theory laden.”

Furthermore, and perhaps even more interesting, is the possibility that experience is also “value laden.” Consider again our initial characterization of experience as the experience of wholes that includes valuational or affective aspects as well as perceptual aspects and the feeling of being acted upon. Results of scientific research on the human brain support the notion that as we process sense data, the stimuli we are processing pass through a particular region of the brain called the limbic system (located behind the nose above the palate of the mouth) and thereby acquire emotional tones. According to neuroscientist John C. Eccles, “by their projections to the pre-frontal lobes [located above the eyes in the forehead], the hypothalamus and the limbic system modify and color with emotion the conscious perceptions derived from sensory inputs and superimpose on them motivational drives” (Popper and Eccles 1977, 273). Our experience is value laden because we are genetically informed and biologically constructed to experience in this way.

It also is value laden because cultures program human brains to respond in different ways to different kinds of experience. This is done through learning as a child grows up and encounters different facets of the culture—parents, peers, schools, mass media, computers, churches. Likewise, more specialized communities educate us to focus our experience in terms of what that community values.

*Experience and Values in Science.* The scientific community values a certain kind of knowledge, “objective” or intersubjective knowledge that is free from personal and cultural bias due to genetically programmed feelings and other cultural values. One way science seeks to be free of bias—to sacrifice “subjectivity” in favor of its own bias for “objectivity”—is by precision in its use of language, by eliminating connotations as it tries to refer to experiences using only denotations. This is coupled with the kind of analysis that breaks down the whole of experience into precisely identifiable parts. And the relationships identified in the whole of experience are made more precise by the application of mathematics, by quantification.

In these ways science seeks to dampen some values and orient other values in experience in the service of the value of knowledge. This dampening of biological feelings and cultural values is necessary for intersubjective testability—the empirical methods of theory confirmation and the resulting observations that are “public”; that is, repeatable by those who are qualified in the particular scientific

discipline. And the values of appreciation, care, and even love for the subject matter being studied, say, a one-cell organism, while they may help a scientist “listen” to the material and attend to all that is there, are nonetheless put into the service of the goal of understanding this part of reality for what it really is.<sup>12</sup>

Furthermore, even as it seeks intersubjective knowledge, science affirms value in another way—in appreciating the beauty of precisely defined and quantitatively related structures, the beauty of abstract order such as that one finds in mathematics. Physicist John R. Albright compares the beauty of mathematics with that of the order in music: “If a Bach fugue can bring one closer to God, then what is to prevent Maxwell’s equations of electromagnetism (just to name one particularly beautiful scientific theory) from producing a similar effect? To those who appreciate such things, the beauties provided by science and mathematics ought to be recognized as enablers of faith in almost the same ways as those beauties provided by the arts that are more conventionally associated with religious experience” (Albright 1991, 17).

*Values and Experience in Empirical Theology.* If the scientist dampens biological feelings and cultural values, and orients other values toward the value of the search for intersubjective knowledge and the beauty of abstract relationships, empirical theologians open up the value dimension of experience to encompass a still wider range of values, such as the beauty of felt qualities and not just the beauty of formal structure. Empirical theology also seeks to orient all values, including genetically and culturally programmed biases, towards human fulfillment. However, in doing this the empirical theologian may also be somewhat selective; not everything people value will be highlighted, for some things people think worthwhile may not contribute to long-term human fulfillment. The standard ethical distinction between what people desire (or value) and what is desirable (valuable) still applies.

Ascribing to a naturalistic view of the world and history, empirical theologians speak of human fulfillment in terms of a successive series of completions that expand the valuing consciousness of persons. *Expansion of the valuing consciousness* can be understood as coming to see and appreciate an ever-richer set of relations of mutual support and the qualities so related. These richer relations may be cognitive, aesthetic, interpersonal; they may involve other individual humans, other communities, other species, or the wider natural world. Hence the valuing consciousness may be expanded not only in knowledge and formal beauty (as in science), but also in love and justice in

regard to other persons, other types of people, other animals, and the rest of the natural world.

Also, the valuing consciousness may on occasion be expanded to include "classical" religious experiences, such as conversion, in which a guilt-ridden, divided self is transformed into an integrated, self-affirming person in loving relationships with others, or in which there is the mystical experience of being unified with the creative ground of existence with feelings of joy, harmony, serenity, and peace. Empirical theologians do not interpret these kinds of experience in terms of supernaturalism but in terms of a form of naturalism that is more extensive than that affirmed by more traditional empiricists, positivists, and many scientists. Following William James's idea of "radical empiricism," which sees our normal experience as the experience of wholes that includes the experience of both perceptions and values in what may be called "full facts," many empirical theologians affirm that "not *another* world but a *wider* world is the locus of religious interests" (Frankenberry 1987, 104).<sup>13</sup> This wider world allows for more extensive events that describe the process of becoming complete or fulfilled.

Thus, in comparing the experience involved in scientific inquiry with that of the empirical theologian, one might say that scientific analysis, the precise use of language to speak of experience as experimental variables, and the quantification of relations all act like the zoom lens of a camera to focus more deeply on more narrow ranges of experience. In contrast, the empirical theologian seems to be using a wide-angle lens in an attempt to encompass as much of experience as possible, even the totality of experience, insofar as it is related to human fulfillment.<sup>14</sup>

On the other hand, the empirical theologian may also be interested in "zooming in" on specific instances of fulfillment or increases in the valuing consciousness, in order to more precisely define in an operational manner what can be expected to occur if one is properly related to whatever it is that brings human fulfillment. Even though the empirical theologian takes into account a wider range of experience than the sense data and quantified relationships of scientific inquiry, this does not necessarily mean that in speaking of increases in experience of value, considered as relations of mutual support, the empirical theologian has to sacrifice precision in specifying concrete and in some cases even measurable growth of the valuing consciousness. Later, we will develop this part of the taxonomy of experience in showing how concepts about the source of value can be justified empirically in scientific-like research programs. But first we must turn to the formation of concepts in science and empirical theology.

CONCEPT FORMATION IN SCIENCE AND EMPIRICAL THEOLOGY. Experience, though essential, is not sufficient for understanding; instead, experience often presents problem situations that “ask” to be understood. Humans seek to understand by forming concepts that in one way or another make “sense” of experience, of why and how certain experienced events happen. Forming concepts is a constructive task of human imagination. In the construction of ideas, science and empirical theology employ some of the same mechanisms and share compatible goals.

*Two Aids in Concept Formation: Affirming the Opposite and Analogy.* In his pioneer writings on pragmatism and the methods of inquiry, Peirce argued that the construction of theories was not a matter of induction (generalizing from observations) or of deduction from already established principles. Instead, it involved an imaginative leap he called “abduction” (Peirce 1965c). If one examines historical examples of the imaginative thought construction, one discovers two kinds of thought processes that assist in forming new concepts. One can be called “affirming the opposite”; the other, analogy.

Affirming the opposite has been exemplified in traditional theology in the *via negativa*: forming concepts about God as infinite, eternal, and unchanging in contrast to the human experience of finitude, temporality, and impermanence. It is also seen in Hegelian dialectical thinking: positing an idea, which then gives rise to its negation, which in turn brings forth the negation of the negation that unites both the original thesis and its antithesis in a higher-level concept. Affirming the opposite was employed by Einstein in developing his special theory of relativity: He denied the then accepted theorem of the addition of velocities, that the velocity of light emitted from a moving object was calculated by adding the velocity of light to that of the object from which it was emitted. Instead, he held the velocity of light constant regardless of the motion of the frame of reference from which it was emitted, thus leading to the conclusion that measurements of space and time were relative to an observer’s frame of reference. Affirming the opposite was also an aid for nineteenth-century mathematicians whose denial of the Euclidean postulate of parallel lines never intersecting provided the basis for non-Euclidean geometries. Empirical theologians may, in effect, be affirming the opposite when they argue that becoming rather than being, or events rather than substances, are fundamental features of reality.

A second aid to creating new concepts is the use of analogy. Throughout history and in a variety of cultures, religious people have used their own inner experience of themselves as persons who have

intentions, plans, and purposes, and who then act to carry them out, to develop via analogy the idea that the observed forces of nature acted the way they did because they possessed an inner, personal spirit. Such personal analogies have also been used to develop concepts about a single invisible divine reality. Sometimes the analogies express the relationship between humans and divinity, as when God is conceived as king, father, mother, or friend. However, personal analogies have also been used as aids for thinking about the nature of the divine in and of itself; based on human introspection, God has been thought of as thinking, intending, or suffering. On the other hand, religious thought is not limited to personal analogies. Often the divine is simply understood as “the way,” for example, the Tao as the way of heaven and earth. Or physical realities such as wind are used as analogies to speak of God as Spirit, which, like the wind, is invisible but has observable effects.

Science, too, develops new ways of conceiving things by using analogies. In physics, radiation (for example, light) has been thought of as a fluid, like water manifesting itself in waves; radiation has also been thought of as consisting of discrete particles, packets of energy that are either in one place or another. These two analogies for radiation lie at the foundation of the problems of wave-particle dualism in quantum physics. In the nineteenth century, biologist Charles Darwin took economist Thomas Malthus’s essay on expanding population in a world of finite resources (leading to shortages and a struggle for survival) as an analogy to explain the origin of species by natural selection. Finally, empirical theologians, who think of God not as a being but as a process (affirming the opposite?) may fruitfully use analogies from a developing new science, systems theory, to speak of the divine event as a dynamic system.

When the implications of analogies are systematically developed, the analogies become models. For example, as Sallie McFague points out, the analogy that God is like a king has been systematically developed in Western religious thought into an extensive monarchical model that speaks of the behavior of God, of how humans should respond to God, and in the Middle Ages in Europe, how all of society should be ordered hierarchically into a feudal system (McFague 1987, 63–69). Darwin’s basic analogy of competition for available resources, with the fittest reproducing more effectively, was further developed in the late nineteenth century in combination with American individualism and free-market economic theory as social Darwinism.

Both these extensions have been challenged and are considered by many to be factually incorrect and even, in terms of values, morally



flawed. This raises an important point regarding the methods of science and of empirical theology. The way an idea is formed does not determine its validity. In the past many have used some notion of affirming the opposite as a logic of existence to establish the validity of ideas, for example, the idealistic dialectical thinking of Hegel and its materialistic Marxist counterpart. Similarly, others have attempted to arrive at valid knowledge simply by making analogies. However, even though useful in forming new concepts, for an empiricist neither affirming the opposite nor making analogies can be used to justify them. The process of justification, as we will see later, depends on how well ideas so formed account for experience and lead to new experiences.

*Two Goals of Concept Formation: Explanation and Interpretation.* In terms of forming concepts, we have seen that both scientists and theologians can use the same procedures as aids in constructing new ideas. However, if one asks more specifically what the goals of such construction are, or how science and religious thought each try to understand experienced events, one can discover a difference in emphasis between the two. Stated in an oversimplified way, science seeks to understand *how* events happen; theology seeks to understand *why* they happen. Or, as Rolston puts it in his discussion of “scientific and religious logic”: “Science and religion share the conviction that the world is intelligible, susceptible to being logically understood, but they delineate this under different paradigms. In the cleanest cases we can say that science operates with the presumption that there are causes to things, religion with the presumption that there are meanings to things. Meanings and causes have in common the concept of order, but the type of order differs” (Rolston 1987, 22).

A few years ago I found myself in a situation that provides an example of the difference Rolston identifies. A friend, a man in his seventies, was diagnosed as having terminal cancer and given six to eighteen months to live. He was a physician, and his scientific leanings led him to attempt to understand and then inform his friends about the complex set of conditions that were the efficient cause of his cancer. After he died, in my grief I also attempted to understand this event. However, I was not content with knowledge of efficient causes; I wanted instead to know the meaning of the event—not the how, but the why. In seeking the meaning, I thought about my friend’s death in the context of other, similar events. In particular I thought about the general pattern of death and life in the universe: the “death” of stars bringing about the creation of new kinds of atoms from which our own solar system and planet are made; the death of

political systems, such as the Greek system when conquered by the Romans, leading to the rebirth of Greek culture within the much larger Roman empire; the death of Jesus of Nazareth and his rebirth in the minds of his followers as the spirit guiding the development of Christianity.

In thinking this way, I was not arriving at a set of causal explanations for my friend's death, but I was interpreting its meaning for me and those still alive. Rolston puts it this way: "In science cause is restricted to outward, empirically observable constant conjunctions, attended by an elusive notion of necessary production of consequent results by the preceding spatiotemporal events. Where causes are known, prediction is possible. . . . 'Meaning' is the perceived inner significance of something, again a murky but crucial notion. Occasional apprehension of meanings does not constitute a religion, any more than occasional recognition of causes constitutes a science. But where meanings are methodically detected out of a covering model, which is thought to represent an ultimate structure of reality, one has some sort of religion or one of its metaphysical cousins in philosophy" (Rolston 1987, 22–23). The ultimate structure I thought I discerned in my friend's death was the creative relationship between death and new life. By linking my friend's death to other deaths and new creations in nature and history, I discerned the possibility of new lives for those who were close to him—new opportunities for living for his wife and friends. And this understanding provided guidance in the form of the maxim, "look for the new opportunities for living."

In light of this difference between explanation by prior conditions and interpretation according to repeating patterns that give meaning, one might partly understand another difference between science and theology. Science tends to use nonpersonal analogies or metaphors and then develops these into nonpersonal models and quantified relationships. In so doing, it tends to rule out any interior dimension of things (including intentions, plans, and inner purposes). Of course, psychology might talk about human purposes and plans and hence use models that are personal in speaking of humans as causes of events. However, when one moves into events beyond the human, into the nonhuman realm of energy, matter, and life, scientists construct theories based on nonpersonal analogies and mathematical models. The almost exclusive use of nonpersonal metaphors and models is perhaps the best way to understand what is meant by the statement that science is materialistic.

On the other hand, if meaning is to be sought for human living, many find it helpful to be able to think of the activities taking place

in the universe and on our planet as being a part of a larger plan or purpose. It also is helpful, in a conciliatory way, to be able to interpret the plan or purpose as coming from a reality that acts for human well-being and fulfillment. Hence metaphors are developed that the ultimate source or cause of all events is a benevolent ruler, or a loving parent who at times might discipline what it has created for its own good, or a companion who is a source of strength in a time of crisis. At first glance, these personal metaphors and their more extended models appear to offer a kind of causal explanation for events. However, because of the difficulty of discerning the exact inner intentions of such a reality as a variable in a causal sequence, many regard such concepts as offering an interpretative rather than an explanatory kind of understanding. Yet, for interpretation's sake, a nonintentional relationship such as "death and rebirth" might be just as helpful.

*The Goal of Concept Formation in Empirical Theology.* So far, what has been discussed applies to science and religious thought in general. When we turn to empirical theology and compare its construction of concepts with that of science, we can conclude that empirical theology has both the objectives of explanation and interpretation, with perhaps some degree of variation among particular empirical theologians depending on which objective is more the center of focus. Wieman, for example, offers a view of ultimate reality as the "creative event." With this general notion one can move toward seeking causal explanations of how humans find fulfillment through commitment to the creative event by asking what are the conditions under which the creative event is most effective. Or one can move toward interpretation and meaning by arguing that the creative event is a general, repeating pattern in the universe involving a breaking down of old structures, activities, and thought in order to give rise to new actualities (a death-and-rebirth pattern). As such, the creative event is an activity or process throughout nature and history; in light of it one can examine one's own life and discover meaning, or lack of it, by determining to what extent one allows oneself to participate in this kind of process. Further, in those times when one's life begins to "fall apart," one can live in the expectation that this is a phase of the creative event, which in the end will give rise to an experience of new value and thereby to a richer and fuller life.

CONCEPT JUSTIFICATION IN SCIENCE. The human imagination, in using analogies and models, exhibits the capability of going far beyond experienced events even as it tries to understand

conceptually the causes and meanings of such events. Therefore, a crucial part of any method is to have a way of justifying concepts, of sorting out among competing concepts those that are most true or valuable.

From the scientific perspective, there are a number of aspects to the justification of proposed theories. They should be rationally consistent with previously justified theories. They should also fit with the body of observations that are regarded as significant in a particular scientific discipline. They are further evaluated for their simplicity: theories with fewer assumptions are better than theories with a greater number of assumptions to account for the same set of experiences. Also, theories that are more comprehensive in their scope or ability to explain a wide variety of phenomena are better than theories that are more limited in what they explain. Finally, theories are evaluated for their fertility or ability to provide a framework for an ongoing research program. This means not only their ability to predict logically any previously made observations, but also their ability to conceptually predict what has not yet been observed.

Often, theories are not evaluated in isolation but in comparison with competing theories. In some cases, two or more competing theories might be judged to be equivalent in their ability to account for experienced events, their coherence with other theories, their simplicity, and their comprehensiveness. In such cases a critical question becomes what kind of ongoing research program each of the competing theories establishes.

Philosopher of science Imre Lakatos has developed the notion of research program as a way of solving problems left by the competing notions of scientific discovery and justification advanced by Karl Popper and Thomas Kuhn. Popper's objectivist idea of justification, with his important notion of falsification of theories, does not sufficiently take into account the persistence of theories that have been disconfirmed in the past in particular experimental situations. Evidence from the history of science suggests that scientific theories are simply not subject to a "quick kill" by refutation. On the other hand, Kuhn's notion of paradigm theories and the shift from one paradigm theory to another is problematic because it makes science at crucial points of development too relativistic and irrational (Lakatos 1978, 6). Without going into details because of space limitations, suffice it to say that the problems Lakatos points out with both Popper's and Kuhn's views of advances in scientific knowledge are significant, because both thinkers are frequently cited in discussions of possible advances in religious knowledge as well.<sup>15</sup> Insofar as Popper and Kuhn have been surpassed by Lakatos's idea of research

programs, the notion of research programs is very important for any theology that seeks to be empirical.

According to Lakatos, a research program contains two basic features, a hard core or basic theory and a set of auxiliary hypotheses. The auxiliary hypotheses serve as a protective belt around the hard-core theory. They may be modified or replaced due to observations that falsify them, but because this happens they prevent the hard-core theory from being falsified in any direct manner. As long as the auxiliary hypotheses of the research program can be modified in a manner that allows for the emergence of new observed events or facts, the hypotheses being modified become part of a progressive research program. Progress is due to the uncovering of new, unforeseen facts, even as the system of hypotheses in a research program continues to explain old facts. On the other hand, if the auxiliary hypotheses are simply ad hoc explanations made to protect the basic theory and there are no predictions of new facts, the research program is degenerative. If this continues for a period of time, the core hypothesis, even though not directly falsified, may be abandoned.<sup>16</sup>

Eaves gives some examples of hard-core hypotheses of both degenerative and progressive research programs.<sup>17</sup> Theories such as those that state the earth is flat and the world was created in six days may indeed appear to explain observed phenomena; however, they are degenerative because they do not lead fruitfully to new facts. Eaves writes, "Indeed, the earth may be flat, but the theory does not produce many good experiments and has not produced much insight. Indeed, the world may have been created in six days, but there are few papers in scientific journals which describe experiments based on that theory. As Claude Bernard observed, 'Theories in science are not true or false. They are fertile or sterile'" (Eaves 1989, 195; the quotation by Bernard is from Eysenck 1965). One theory that has become the core of a progressive research program is the double helix model of the gene, DNA. Eaves calls this kind of theory an *icon*—a part of reality that serves as a window to a much more extensive picture of reality. "The place of the double helix in biology provides a model system for the interaction between model and matter, the icon, in science. Molecular genetics is unlikely to revise the DNA icon because it has played such a crucial part in making biology a 'hard' science. . . . Once James Watson and Francis Crick had 'got it right,' DNA became the unifying feature which gave coherence to the facts of reproduction, evolution, chromosome behavior, Mendelian inheritance, protein synthesis, mutational change, and other processes. Furthermore, the icon became the key to new horizons—the details of gene regulation and biotechnology" (Eaves

1989, 195-96, referring to Watson and Crick 1953, 737). In other words, the Watson-Crick model of DNA has become a hard-core (or paradigm) theory of a progressive research program in biology.

TOWARDS A PARADIGMATIC EMPIRICAL THEOLOGY. According to Eaves, the mark of a mature science, that is, a science that has moved beyond the taxonomic and the hypothetico-deductive stages into the paradigmatic and technological stage, is the establishment of a major progressive research program. As we have seen, empirical theology is quite similar in many respects to science in the degree to which it has resolved issues of taxonomy and the formation of concepts in keeping with its own goals of seeking to understand human fulfillment. As we will see, empirical theology also maintains some clarity on the question of how theological ideas should be justified. However, if empirical theology is to become a mature discipline, comparable to a mature science, it will need to establish a progressive research program that unites the efforts of many theologians and philosophers of religion in justifying the concepts of empirical theology in relation to the rich understanding of experience in this field.

In my judgment, empirical theology is already partway toward its mature phase because, as we saw earlier, empirical theologians share the spirit of science, one feature of which is consistent with the idea that a progressive research program brings to light newly observed facts and continually improving models. This spirit recognizes that we live in a world that is much richer in its reality than what is to date conceptually known. For the empirical theologian, this richer reality is embodied in a notion of experience that is broader than distinct sense data and includes a "deeper and qualitatively richer form of apprehension." Bernard Meland, one of many empirical theologians who identifies this kind of experience, cites Whitehead's idea of consciousness: "Consciousness is the weapon which strengthens the artificiality of an occasion of experience. It raises the importance of the final Appearance relatively to that of the initial Reality. Thus it is Appearance which in consciousness is clear and distinct, and it is Reality which lies dimly in the background with its details hardly to be distinguished in consciousness" (Meland 1963, 62). Meland cites this passage when he raises a major problem with the thought of Wieman, namely how to incorporate the "more" of the rich fullness of experience that is a source of Wieman's naturalistic mysticism with his more critical rational-empirical method that is more selective of what is given in experience. One

possible solution to this problem is to suggest that the uncovering of new facts in progressive research programs is a way of accessing the richer, qualitative dimension of experience, even though this does not exhaust that dimension. This we will discuss a little later.

However, Meland's point also calls our attention to a broader notion of empirical justification than one finds in science, the justification of religious ideas in living, both by individuals and by whole communities. Because theology tries to understand ways to human fulfillment, because empirical theology attempts to understand what in fact brings about a continuous succession of completed states of living with a growth in what individuals and communities can know and appreciate, and because fulfillment so conceived is only accomplished in the course of human living here and now, in the final analysis religious research programs are carried out in the fullness of daily life and not only in carefully constructed situations in which experiments or controlled observations can be made. In other words, the justification of a theological concept is a general, pragmatic one of the concept's effectiveness in shaping behaviors that help one to an ever greater richness of experienced value.

This pragmatic form of justification need not conflict with the following, more limited but also helpful method of justification that has much in common with that of scientific research programs. Yet, even in this more restricted sense of justification, there is a difference between what the empirical theologian does and what most scientists do. While progressive scientific research programs are expected to yield new facts, theological research programs are also expected to yield a growth in value. Both fertility of facts and fertility of values are criteria for the justification of the claims of empirical theology.

Nancey Murphy, in her helpful essay "Acceptability Criteria for Work in Theology and Science," argues that "Lakatos' methodology provides criteria for distinguishing science from non-science and for distinguishing acceptable scientific theories and modifications of theories from those that are unacceptable." She goes on to say, however, "it would be useful at this point to have a widely accepted theory of acceptability criteria in theology, but I believe it fair to say that there is little agreement on this point among theologians" (Murphy 1987, 287). What I am suggesting here is that, on the one hand, empirical theologians not only justify their concepts according to acceptability criteria in science; following Lakatos, concepts are acceptable "insofar as they contribute to *research programs* that are *empirically progressive*—that lead to the discovery of novel facts" (Murphy 1987, 288; author's italics). On the other hand, empirical theologians have the added burden of justifying their concepts

according to how well they can lead to behavior that increases the experienced richness of value and thereby human fulfillment. As this is done, the increases in value are operationally defined as expected facts that can be observed and even measured. To understand this let us outline a possible research program in empirical theology.

There are many possible research programs in which empirical theologians could engage. However, their hard-core hypotheses would all reflect certain basic assumptions about the nature of reality, which we discussed earlier in comparing the spirit of empirical theology with the spirit of science: nature is the sole context for human inquiry and for attaining human fulfillment; reality is organic, that is, relational and historical; and, against dualism, there is a continuous development of ever more complex systems of energy, matter, life, and mind. In this context the empirical theologian can develop research programs to better understand what increases human fulfillment or the ever-continuing enrichment of the experience of value.

In seeking to understand what increases human fulfillment, one is seeking to understand empirically "the source of increasing value," one way many empirical theologians formally define *God*. One core hypothesis about the source of increasing value could be that it is a creative system. This core hypothesis is not directly falsifiable because it is protected with a belt of auxiliary hypotheses generated in terms of the core, and because empirical testing is directed at the auxiliary hypotheses instead of the core. Examples of possible auxiliary hypotheses are (1) the creative system of value is a two-stage temporal system, one stage being the disruption of the status quo by the experience of new events, the second being a new integration of what formerly existed with the new events, that is, "death and rebirth"; (2) a mechanism of disruption is seeking out values that are different from one's own, that is, "loving the enemy"; (3) a mechanism of integration is the deferring of critical judgment as one tries out new possible integrating patterns of thought and behavior, that is, "faith in things yet unseen."

Such hypotheses can then be operationally defined as ways of behaving in controlled situations (say, for example, a social-psychological experiment in interpersonal relationships and decision making regarding abortion) in order to see the degree to which the valuing consciousness of each person in the experiment is increased or the sense of community between participants deepened.<sup>18</sup> The situation can be controlled by having experimental and control groups that are equivalent in all significant respects except the auxiliary hypothesis to be tested. All groups might be asked to try



to resolve the abortion problem; however, half the groups might be instructed to incorporate the values of their "opponents" into their own way of thinking, an operational definition of "love your enemies"; the other half, as the control groups, would not be so instructed.

The point of this would not be to actually resolve the abortion problem, but to see if there was a difference before and after the experiment in the degree of "depth of community" between experimental and control groups. A measurement of "depth of community" could be constructed by operationally defining (partly) this idea as the degree of appreciation people have for those of opposing views, using a standard-type attitude scale constructed by social psychologists.<sup>19</sup> When this is done, one has defined values as facts to be observed and measured.

That this kind of experiment can be designed suggests that empirical theology, using justification in this more limited sense, can make use of studies done about creativity in the social and natural sciences. Like Eaves's DNA icon, hypotheses about the structure and conditions of the creative event can possibly unite work done in a number of fields, including social psychology, biology, and ecology.<sup>20</sup> Using this work as a source of possible ideas, to some extent already confirmed scientifically, if the "creative event" research program leads to new auxiliary hypotheses and new ways of observing increases in value, thereby increasing one's knowledge of God as the creative system of value, the program is progressive. If auxiliary hypotheses about the creative event do not bring to light how an increase in value occurs, but some other core hypothesis and its auxiliaries do, then the hypothesis that defines God as a creative system, while not directly falsified, will probably be abandoned in favor of the more fruitful program.

In this manner concepts about God in empirical theology can be justified in a way that is comparable to that of justification in science. Any hypotheses so justified can then be put into practice in daily living to see if they meet the pragmatic test of leading to greater value in "real life." Together, the two methods of justification can help move empirical theology toward something comparable to Eaves's third stage of science, the paradigmatic-technological stage.

In conclusion, empirical theology has much in common with both the spirit of science and its methods. The differences between the two are related to what are often regarded as differences between "facts and values." This is a reflection of a basic difference between the goals of science and religion, one attempting to understand reality and the other seeking ways of human fulfillment. However, when

empirical theology and science are compared, this difference is more a difference in degree than in kind. And when values and their source are operationally defined in possible research programs, the fact-value distinction is overcome, and empirical theology becomes equivalent to a mature science. Even if this is done, however, empirical theologians should keep in mind the basic religious quest, the quest for real-life human fulfillment. Because this quest involves integrating value-laden experiences that are much richer than what can be considered in more focused experimental situations, the final justification of religious thought and practice is in the ongoing lives of human beings in an ever-changing world.

### NOTES

1. The lack of attention to American empirical theology is exemplified by the fact that leading empirical theologians such as Henry Nelson Wieman and Bernard Meland are at most mentioned in passing as examples of process theology in discussions of the nature of God or the relation of God and the world. They are not discussed in relation to questions of methodology, although Barbour, in his early book (1966), mentions philosophers Charles Sanders Peirce and William James in this context.

2. For this structure, which I will develop in my own way, I am indebted to Lindon Eaves (1989). However, the substance of my essay is based on my twenty-five years of experience with working scientists who have an appreciation for a wide variety of religious thought and practice and with theologians who have attempted to do theology in light of scientific knowledge. In all this I have been strongly influenced by the pragmatism of Charles Sanders Peirce and the empirical theology of Henry Nelson Wieman.

3. This definition makes no claim to encompass all religious activity in human history; nonetheless, it is useful in looking at many of the major world's religions.

4. Of course, empirical theology can include these other approaches insofar as sacred writings, church teachings, and individual beliefs are grounded in the past experience of individuals and communities.

5. Much has been written, in light of the sociology of knowledge, about how even science can be culturally biased and therefore how difficult it is for scientists to claim they are "exposing reality itself"; for a survey of some of this literature see Knorr-Cetina and Mulkay (1983). Feminist critiques offer a special kind of case regarding cultural bias in the way scientists approach their subject matter; e.g., Keller (1984) and Bleier (1984). Nevertheless, as we will discuss below, science strives for objective or intersubjective knowledge that removes both biologically and culturally grounded biases. In this sense it is critically realistic and tries to fulfill its expectation of exposing reality itself.

6. However, Fromm's discussion of mature and other kinds of love is applied only to humans.

7. Even the "consequent nature" of God, an aspect of the "eternal more" in Whiteheadian theology, depends on the actualization of potentials in space-time.

8. Two scientists give helpful explanations of "downward causation" in complex systems: neurophysiologist Roger Sperry (1985, 41-57; 1991, 242-45), and psychologist Donald T. Campbell (1990).

9. For a survey of recent evidence for the genetic basis of personality, though not focused on Meyers-Briggs indicators, see Eaves et al. (1989).

10. Also underlying the following discussion is Barbour's helpful analysis of the interrelationships between experience and concepts in science and religion in general (Barbour 1990, 31-39).

11. Alfred North Whitehead's notions of causal efficacy and presentational

immediacy underlie this statement regarding the aspects of a complete experience (e.g., Whitehead 1927).

12. That some scientists take this "personal" approach to their subject has been stated in meetings of the Institute on Religion in an Age of Science by Eaves and by microbiologist Ursula Goodenough. It also is a point made sometimes by scientists who are familiar with a feminist perspective; see Keller's (1983) discussion of Barbara McClintock's work.

13. The term "full facts" is in Frankenberry's discussion (1987, 105).

14. In one way, the experience of the scientist seems to be wider than that of the empirical theologian. This is because empirical theology has tended to limit experience to what can be directly sensed and felt by the human mind alone. However, science goes beyond this to use a variety of technologies to make "indirect observations" of a wide range of phenomena not directly accessible to the human sensing apparatus: e.g., subatomic particles, activities inside a cell, human brain waves, weather systems, the high-energy centers of galaxies, and astronomical phenomena billions of years old. Data from such indirect observations may be relevant to the empirical theologian because the technologies involved are, in the final analysis, instruments of human observation. And humans, in using them, finally observe what the technology makes possible with the same combination of sense and affective experience that is present in direct experience without the aid of technology. For example, those who see the photographs from computer-enhanced telescope images of the center of the Milky Way galaxy may be just as emotionally affected by the beauty of the images as they would be by directly observing a sunset. Such experiences can become part not just of a rational structure but of an aesthetic matrix (cf. Frankenberry 1987, 111). They can expand the human appreciative consciousness, enrich our values, and therefore be relevant to human fulfillment.

15. Lakatos discusses the problems with Popper's and Kuhn's views, as well as other positions regarding scientific methodology, in a section on "Fallibilism versus Falsificationism" in his essay "Falsification and the Methodology of Scientific Research Programmes" (Lakatos 1978, 10-47).

16. See Lakatos (1978, 48-52) for his more detailed characterization of scientific research programs.

17. The core hypotheses are basically the same as Kuhn's "paradigms."

18. An operational definition is here the same as Peirce's pragmatic understanding of defining the meaning of abstract terms in terms of "practical consequences either in the shape of conduct to be recommended, or in that of experiences to be expected, if the conception be true." This phrasing is by William James in Peirce (1965a, 1).

19. The auxiliary hypotheses and the means of testing them are a development of Wieman's fourfold creative event (1946, 58-69). However, I have separated Wieman's first two phases (stated in the first auxiliary hypothesis) from the last two (stated as the expected results). For further information about how one can develop and test empirically under controlled conditions, and hence scientifically, hypotheses about Wieman's concept of God as the creative process, see Peters (1971).

20. For work in social psychology, see *The Journal of Creative Behavior* (1967- ); for relating biology to creativity and values in a way helpful to empirical theology, see Birch and Cobb (1981, 176-202); for relating ecology to creativity and values, see Rolston (1988, 186-201).

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