THE QUESTION OF GOD IN AN AGE OF SCIENCE: CONSTRUCTIONS OF REALITY AND ULTIMATE REALITY IN THEOLOGY AND SCIENCE

by Anna Case-Winters

Abstract. Both science and theology have lately faced a crisis of authority. Their shared realization of the extent to which knowledge is *underdetermined by the data* and *socially constructed* provides a kind of common ground for reconsideration of their respective methods of inquiry as well as of the status of the claims they have warrant to make. Both fields are now consciously and critically employing a *models* approach. This article proposes criteria for assessing models and applies the criteria to one model from each field. The model of understanding evolution as a *struggle for existence* is considered from the field of science, and the traditional model for understanding the God-world relation as that of a king's relation to his kingdom is considered from the field of theology. Each of these models is evaluated with respect to its credibility, religious viability, and moral adequacy. In each case an alternative analogy is proposed and argued for.

Keywords: authority; credibility; moral adequacy; panentheism; power; religious language (models and metaphors); religious viability.

A Crisis of Authority

Both theology and science have in recent years faced a crisis of authority (Peacocke 1990, 10). In a bygone era, theology—conducted under the roof of the house of authority—assumed a view of scripture and tradition as a kind of ahistorical, immutable deposit of truth needing no explanation and no defense (Farley 1982, 108ff.). This view no longer holds the intellectual credibility it once did.[1] In fact, under the weight of modern biblical criticism and the disturbing questions that

Anna Case-Winters is Associate Professor of Theology at McCormick Theological Seminary, 5555 South Woodlawn Avenue, Chicago, IL 60637. This article is based on a paper that Case-Winters presented at the Thirty-eighth Annual Summer Conference of the Institute on Religion in an Age of Science (IRAS), "The God Question in an Age of Science," at Star Island, New Hampshire, 27 July–3 August 1991.

[*Zygon*, vol. 32, no. 3 (September 1997).]
 ISSN 0591-2385

have been raised in the postmodern era concerning the ideological abuse of scripture and tradition by the church, the house of authority that once seemed solid has collapsed.

In the scientific arena a parallel crisis of authority has occurred. The "naive realism" (Peacocke 1990, 11) that was inherited from the nineteenth century has in recent decades been largely discredited outside the scientific community and to a lesser extent inside that community. Earlier understandings of the world and its processes have undergone radical revision. A decisive shift was made when the mechanistic and lawful universe of Newton gave way to an Einsteinian framework that admitted relativity and let go notions of firmly fixed time and space. Next, quantum physics, which admits a fundamental indeterminacy at the heart of things, provided yet another decisive shift, and its implications gained currency through succeeding decades. These were radical paradigm shifts. Taken together with the insights of sociology of knowledge, which insist that our knowledge of the world is socially constructed, they have resulted in a shaking of the scientific foundations.

The humbling effect of this crisis of authority in both fields of inquiry may set them free from unyielding dogmatisms that have characterized a bygone era. New space has been created for dialogue between science and theology, characterized by greater openness and teachableness than attended our recent history, where habits of conflict and separation have prevailed.[2] Some of the most fruitful insights in furthering the dialogue between theology and science in recent years have come from those who acknowledge the collapse of the house of authority. Admittedly, each field has a range of viewpoints on this issue, and some within each field vigorously oppose this interpretation of the situation. But those who do recognize a crisis of authority now find a common ground for theology and science in the admitted distance between our respective referents and our verbal representations of them. A similarity in the methodologies of science and theology now emerges in their use of metaphors and models as a tensive approach to their subject matter.[3]

Models Theory

Thomas Kuhn, in his groundbreaking work *The Structure of Scientific Revolutions* (1970), argued that there is no "naked eye," no innocent knowing. Scientists, like theologians and all other thinkers, conduct their work with certain "preunderstandings"; a basic set of assumptions, shared beliefs, key models, and accepted exemplars. There is no direct route from data to theory; theory is always "underdetermined by the data" and "subject to periodic radical revolutions" (Hesse 1991). The symbolic character of human concepts results unavoidably in "nonidentity" of concepts with actuality. (Gilkey 1990, 151). Many scientists

readily recognize the limitations and constructive character of the scientific enterprise: "We should not expect to find absolute truth by means of the scientific method. Unproved and possibly unprovable assumptions are fundamental to scientific method, for example, the validity of sensory perception in bringing us into contact with reality" (Emerson 1968, 132).

In recent years even more radical challenges have arisen that go beyond what Kuhn's analysis demonstrated. Ian Barbour proposes that "not only are data theory-laden and theories paradigm-laden, but it now appears that paradigms are culture-laden and value-laden" (Barbour 1990, 74). Sociology of knowledge claims to have uncovered ideological/political motivations at work, and critical theory seeks to show a decided influence of economic and class interests. It would appear that the myth of neutrality and objectivity has obscured what is really going on in science, theology, and other fields of inquiry. A strong suspicion has arisen that social location profoundly affects both perception and interpretation of data.

If these insights are accepted and incorporated, both theology and science go about their work differently; they are somewhat chastened and operate with a more self-critical attitude and a greater modesty in their claims. While it is the aim in both science and theology to depict "reality," there is a new recognition that there is no literal language for reality but only various symbol systems, patterning it in different ways. Both assume that there is a "something/someone" to which these depictions refer, but laboring after the collapse of the house of authority, neither science nor theology is as confident of its ability to directly describe its referent.[4] It becomes more obvious that our theories arise in acts of creative imagination. Metaphors, models, and paradigms play a decisive role in this imaginative constructive work, providing preferred analogues, whether they are held heuristically or ontologically (McFague 1982, 78). Models, in turn, yield hypotheses that can be tested (Barbour 1990, 45).

McFague has argued in her book *Metaphorical Theology* that religious language is like scientific language in its constructed (metaphorical) character—only more so. The situation of having a referent that is not a mundane entity in the world intensifies the challenge of description. In using human language to speak of God, we necessarily proceed from the better known to the lesser known. In the use of metaphor we propose a thread of similarity between subjects that are in fact dissimilar. The metaphor, pointing to the similarity in difference, illumines and discloses something of the character of the lesser known. It is an indirect way of speaking that maintains the tensive power of the *is* and the *is not*. As Ricoeur has observed, metaphor provides a way of redescribing reality that has the capacity to both rely on literal meaning and to subvert and extend it

through transformation (Ricoeur 1976, 51–55). Thus metaphors are not reducible to concepts. Their implications are open-ended and contextual. While concepts are abstract, metaphors are experientially rich and have power not only to redescribe but to transform; they express and evoke distinctive attitudes. They have life-orienting and reorienting power (Barbour 1990, 46).

McFague defines "model" as "in essence, a sustained and systematic metaphor" (McFague 1982, 67). "A model is a metaphor with staying power. . . . A model is a metaphor that has gained sufficient stability and scope so as to present a pattern for relatively comprehensive and coherent explanation" (McFague 1988, 34). These models, tentative, open-ended, and paradigm dependent as they are, do serve to order our experience (Barbour 1990, 49).

Barbour has observed that in this step two things are involved: analogy to the familiar on the one hand and creative imagination on the other. These metaphors are neither literal descriptions of reality nor simply useful fictions. Metaphorical theology might be thought of as somewhere between theology as hermeneutics (Tracy 1985) and theology as imaginative construction (Kaufman 1981). Both McFague and Barbour intend the metaphors/models to be ontologically grounded and not merely heuristic devices.

Criteria for Assessing Models

If indeed metaphors and models are central to the methodology of both science and theology, what criteria should be operative in their selection? Both science and theology in this changed climate eschew logical positivism and open the way to probable reasoning. Their research programs may therefore be compatible (Murphy 1990). They intend to present models that are, despite their constructed nature, in some sense *truthful*. How should the relative merits of one be measured with respect to those of the other? There are a number of criteria that might be taken into consideration when assessing models. They can be grouped under three broader rubrics, which are not absolutely distinct from one another but which may be thought of as dimensions of the *truth* of the models.

A. Intellectual credibility
    1. Correspondence: Does what the model implies correspond with what is experienced, the data?
    2. Comprehensiveness: Does the model take the widest observable data into account?
    3. Comprehensibility: Can the model be understood and serve well to help the thinker understand reality?

4. Internal consistency: Is the model internally free of contradiction and confusion?
5. Coherence: Does the model offer a reasonable and well-integrated picture?
6. Falsifiability (Lakatos 1970): Is the model such that it could be disconfirmed if relevant falsifying data were introduced?
7. Confirmability: Is the model such that it can be confirmed by "novel facts"[5] as they emerge?
8. Predictive value: Does the model help to predict what will occur in the future?

B. Religious viability

9. Explanatory value: Does the model help to explain and interpret human experience?
10. Disclosive power: Does the model disclose key features of reality not otherwise clearly visible?
11. Meaningfulness: Does the model contribute a framework of meaning to our experience?
12. Fruitfulness: Does the model offer insights that further thought and lead to new understandings and new hypotheses?

C. Moral adequacy

13. Instrumental value: What does the model urge/motivate people to do? When used as a guide to action, does it lead to positive outcomes?
14. Transformative power: What are the social consequences of the model? Does it motivate toward transformation in positive directions?

Social Consequences of Models

Both science and theology provide models that exercise profound influence on human behavior. Science provides models of the way things are or how the world works. Theology provides models of ultimate reality, or that which is highest/best/most valuable, or in Anselm's terms, "that than which nothing greater can be conceived." These models intend to present a true picture. As Emerson and Burhoe have observed, "the goal of both science and religion is to discover relative truth and to penetrate as deeply as possible into fundamental truth" (1974, 168). Viable models are not simply given by the data but are a function of interpretation/construction. They are in a sense useful fictions. They offer angles of vision that illumine some aspects of reality and obscure others.

The extent to which these models are constructions underdetermined by the data is often not fully acknowledged. In fact, models

influencing thought and behavior are often partially, if not totally,concealed. There exists, as anthropologist Victor Turner insists, "between the full brightness of conscious attention and the darker strata of the unconscious a set of ideas, images, concepts . . . these are the models of what people believe they do, ought to do, or would like to do" (McFague 1982, 70).[6] We live within our models as fish live in the sea. One of the tasks of working constructively with models is to raise to consciousness the models already in place and make them available for critique and counterproposal.

Models in both science and religion have real effects in terms of leading to some courses of action rather than others and thus result in important social consequences. Pertinent questions include these: What are the social consequences that attend a given model? What are the activities and social arrangements that it may promote or legitimate?

When science, for example, presents a model of the way things are, and that model becomes part of the interpretive framework of a given society, that interpretation of reality begins to carry something like a moral advantage. Certain activities or social arrangements may be declared "natural" or "unnatural" in view of that interpretation. They are either congruent or incongruent with "the way things are" and "the way the world works." The model then provides plausibility structures for these activities or social arrangements.

Something like this phenomenon functions in theological models as well. Models of ultimate reality are put forward and by their frequent association with the divine take on a heightened status. As McFague observes, the prevalent model of God as king lent a certain elevation/ legitimation to kingship as such. Mary Daly quipped, "if God is male, then male is God" (Daly 1973, 19).

To further demonstrate the way these models develop and come to influence human behavior, I will examine two models more closely, one from science and one from theology. Each model has a complex history of development and a variety of possible interpretations, which can be explored here only briefly. Social consequences, of course, depend on a wide range of factors at work in a given society. Prevailing models in science and theology are just one factor among myriad others. Furthermore, the effect of a given model depends to a great extent on the interpretation chosen and the use to which the model is put.

A Model from Science: The Struggle for Existence

A model from the field of science that has proven profoundly influential has been Darwin's theory of natural selection. A model's double trajectory (descriptive and formative) is evident here as elsewhere. The evolutionary theory that emerged has impacted more than the under-

standing of evolutionary biology: It has functioned more comprehensively as a way of describing and understanding "the way things are" and "the way the world works." It is "neither a fact nor a theory but a way of organizing knowledge" (*International Encyclopedia of the Social Sciences*, 1st ed., s.v. "evolution"). The model itself has had diverse interpretations and applications. By tracing one particular line of interpretation and its social consequences, I can demonstrate further the formative effect of models.

Evolutionary concepts had begun to appear in some of the social sciences many years before Charles Darwin's *On the Origin of Species* was published in 1859. *On the Origin of Species* contains four major arguments: that new species appear; that these new species have evolved from older species; that the evolution of species is the result of natural selection; and that natural selection depends upon variations and the maintenance of variations in spite of the tendency of natural selection to eliminate "unfit" variants. Darwin attributed variation to the effects of environment upon the organism (i.e., better food producing a better body) or the inheritance of acquired traits. Later scientific theory has discounted these as sources of variation. Mendel had not published his genetic theory (1865) at the time of Darwin's work.

Darwin himself never used the phrase "survival of the fittest" in discussing natural selection. He spoke rather of a "struggle for life" or a "struggle for existence."

> As many more individuals of each species are born than can possibly survive; and as, consequently, there is a frequently recurring struggle for existence, it follows that any being, if it vary however slightly in any manner profitable to itself, under the complex and sometimes varying conditions of life, will have a better chance of surviving and thus being *naturally selected*. From the strong principle of inheritance, any selected variety will tend to propagate its new and modified form. (Darwin [1859] 1964, 29)

Herbert Spencer ([1862] 1958) was the first to coin the phrase "survival of the fittest," a phrase which—although it does not convey Darwin's meaning—came to be the slogan of some who claimed to be applying to society the principles by which Darwin had shown that biological evolution had occurred. Darwin himself did not attempt to apply the principle of natural selection to sociology but limited his discussion to biological phenomena.

Social Darwinists[7] portrayed social existence as a struggle among individuals for environmentally limited resources. The *natural* relationship among organisms and groups of organisms is one of competition for survival. Those that survive (and reproduce themselves) are of a superior order, having succeeded where others failed. This presupposes natural

inequalities among individuals, which result in a stratified social organization—which is also "natural."

On the basis of its being natural[8]—in sync with the ways of nature (the way things are, the way the world works)—social Darwinism advocated free play for all processes involved in the "struggle for existence." In the struggle among individuals, the theory justified class stratification and cutthroat competition; in the struggle between groups of people, the theory was used to justify force.

Not all persons who sought to apply Darwin's theory of natural selection to social arrangements came up with the same conclusions. More altruistic interpretations than those of Spencer ([1862] 1958) and Sumner ([1883] 1952) were put forward. Lester Ward ([1883] 1926) and T. H. Huxley ([1865] 1964), for example, wished to modify the struggle for existence and recommended that society equalize conditions by supporting its less fit members (while at the same time discouraging them from reproducing!). Accepting some survival-of-the-fittest interpretations of how the world works, they sought to intervene in compassionate ways in the working out of natural selection.

Neither the ideology of social Darwinism nor the policies that it promoted can be laid at Darwin's door. Rather, social Darwinists were employing a model from science to further rationalize and legitimate the laissez-faire economic practices of the latter half of the nineteenth century that were already in operation. This model was pressed into service and provided the ideological underpinnings for social Darwinism.

The scientific theory to which the social Darwinists appealed can be separated from their values. With the introduction of genetic theory and the discovery that variations arise in the genetic process itself—rather than through inheritance of acquired traits—the scientific basis of social Darwinism was itself undercut. Nevertheless, this perspective still emerges here and there in political discourse as a vaguely articulated assumption used to justify particular economic and political arrangements.

CRITIQUE OF THE MODEL

A. Intellectual Credibility. Among the many questions that can be raised of the intellectual credibility of the survival-of-the-fittest model as understood and advocated by the social Darwinists is whether it is really a fair extrapolation from Darwin's understanding of the struggle for existence. If not, it loses much of its scientific aura, and the ideological motivations are unmasked.

Social Darwinists might defend their view by insisting that Darwin did assume that natural selection eliminates unfit variants. Even so it must be asked, what constitutes *fitness*? In terms of species survival, it may have

more to do with procreative proficiency than with the ability to overpower competitors. Another factor that may enhance fitness in this sense is adaptability to one's environment, "a capacity for pliable responses and adjustments to varying external conditions during the life of an individual or a population" (Emerson and Burhoe 1974, 159). This would presumably include adaptability to the other living beings in one's environment.

Emerson and Burhoe propose that *fitness* is properly measured by social and ecological homeostasis rather than competitive prowess, and they see the social consequences of these alternatives:

> If fitness is erroneously conceived as power and force with resultant selfish exploitation or mutually destructive warfare between individuals or nations or classes, improved homeostasis will not occur. Ignorance of this demonstrable principle on social decisions and choices is a major factor in the manifest deterioration, degeneration, and inviability of whole cultures, nations, and races around the world. (Emerson and Burhoe 1974, 158)

The character of *fitness* is rather fluid. Strategies of adaptation that are highly successful for a time may later lead to extinction. Conversely, strategies that lead to temporary reductions may soon lead to expansion. Prediction of outcomes is difficult if not impossible (Stebbins 1982, 67).

Questioning the more basic assumption, one might ask whether the struggle for existence is necessarily or even primarily an adversarial affair of competition for limited resources. If it is not, the class stratification, cutthroat competition, and exercise of force that social Darwinists were advocating could not really be justified on the grounds that this is the way the world works.

"Struggle for existence" is a potentially more comprehensive model than "survival of the fittest" in the form advocated by the social Darwinists. The latter approach fails in relation to the criterion of comprehensiveness in that there is much data it does not take into account.[9] "Living beings may struggle for existence by fighting each other or by helping each other" (Dobzhansky 1962, 133). In fact, it would appear that within the same species, individual exploitation of other individuals is harmful to the group and will be negatively selected, "whereas cooperation, integration, division of labor, and balanced compromise usually result in an increase of efficient homeostasis and will be positively selected" (Emerson 1968, 160). This fuller picture of the way things work effectively counters the social Darwinist extrapolation of Darwin's struggle for existence.

B. Religious Viability. Even though this model emerges from a scientific base and not a religious one, questions of religious viability emerge for people of faith. Any interpretation of "the way things are" has profound theological implications for those who think of God as Creator

of all that is, and a survival-of-the-fittest model of the way things are is difficult to reconcile with a concept of God as a good and loving Creator.

The deterministic character of the model is also problematic in terms of religious viability. The picture presented by the social Darwinists seems to give inordinate weight to genetic determination: There are natural (genetic) inequalities among people, and these genetic givens determine people's destinies. This way of thinking is religiously problematic on two fronts. First of all, it leaves little room for God's ongoing involvement in the world process. Genetic inheritance is automatic and all-determining. It begins to look as though God sets the world up, steps back, and says, "may the best genes win." Second, it seems to diminish or remove human responsibility—one's destiny and that of all others is finally a matter of genetic inheritance. The meaningfulness and significance of human activity is severely compromised.

Later evolutionary theorists have presented a much more complex picture. Dobzhansky, in *Mankind Evolving* (1962), suggests that human evolution is a function of the interaction between *two* components of evolution—the biological, or organic, and the cultural, or superorganic. These are interdependent components, both serving the function of adaptation to and control of the environment. Richard Dawkins, in *The Selfish Gene* (1976),[10] coined the term *memes* for units of cultural transmission comparable to genes as units of genetic transmission. This concept has been further elaborated by Burhoe: "One can say not only that as individuals we live within a socio-cultural organism but also that the socio-cultural organism lives within us. Not only are we individual units within an organized society, but organized society is represented and incarnate in our brains" (Burhoe 1979, 144). The recognition of the extent to which we are socially (as well as genetically) constituted broadens the possibility both for the exercise of human responsibility and for divine involvement in world process.

The social Darwinist interpretation left much human behavior and experience without an explanatory framework. Survival of the fittest fails to account for the altruistic impulse in the human being that faith claims and cultivates. Religion provides a vehicle of duration for the heritage of sociocultural values (memes, i.e., altruism) and a mechanism for their interpretation and application in changing contexts. The religious impulse and the altruism it generates are left unexplained by this model. Selfishness can be understood, but altruism is a complete anomaly—in Burhoe's words, "the culminating mystery of all biology" (1979, 146).[11]

Frans de Waal, in his recent book *Good Natured: The Origins of Right and Wrong in Human and Other Animals*, has made a compelling case in opposition to the view that animals are programmed by their genes to serve nothing but selfish interests.[12] He gives evidence of "intense social-

ity and conviviality" and "the existence of genuine kindness" among many animals (de Waal 1996, 5). He observes that the same process, that of natural selection, has given rise to both competition *and* cooperation. He holds these in juxtaposition and helpfully resists the tendency to reduce either of them to the other in the way that some have—by saying, for example, that what appears to be concern for others is really a form of enlightened self-interest.[13] De Waal contends that moral behavior has biological roots and is not simply a cultural imposition resisting and suppressing "natural" instincts. Moral behavior goes far back in evolutionary history and is "neither a recent innovation nor a thin veneer that covers up a beastly and selfish makeup" (1996, 218).

Why, one may ask, has it been the case that altruism and not selfishness has been taken to be the anomaly? May it have something to do with the struggle-for-existence model and its presuppositions? One criterion proposed for evaluating models is in terms of their explanatory value: whether they help explain and give meaning to human experience. Survival of the fittest as the social Darwinists advocated it, because it leaves altruism unexplained, does not meet this criterion.

C. Moral Adequacy. A particular model for understanding the way things are and how the world works may function to inspire, condone, and legitimate attitudes and behaviors. One gauge of the moral adequacy of a model is the behaviors and attitudes it inspires, condones, and legitimates (i.e., its social consequences). Articulating the reasoning of the social Darwinists as they promoted a survival-of-the-fittest model, Dobzhansky says:

> Since nature is "red in tooth and claw" it would be a big mistake to let our sentiments interfere with Nature's intentions by helping the poor, the weak, and the generally unfit. . . . In the long run letting Nature reign will bring the greatest benefits. . . . Pervading all Nature we may see at work a stern discipline which is a little cruel that it may be very kind. (Dobzhansky 1962, 133)

This might seem to be a caricature of their position, but in fact Spencer in *The Man versus the State* (1884) made a very similar argument when he argued that London's "good for nothings" ought not to be kept alive by charity but should be allowed to perish, for this was the universal law of nature. One may raise questions about the moral adequacy of the survival-of-the-fittest model in view of the attitudes and behaviors it inspires, condones, and legitimates.

An Alternative Model: The Matrix of Life

There have been some important developments in evolutionary theory since the days of the social Darwinists. Something akin to a new model of "the way things are" may be emerging. I would propose *matrix of life* as a

tentative description of the new model, a model more responsive to new developments in evolutionary theory and less vulnerable to the critique offered above. This model cannot be fully explored here, but perhaps its suggestiveness can be glimpsed. Three elements of the model show how it differs from struggle-for-existence thinking—and even more markedly from survival-of-the-fittest thinking. It does not assume that evolution equals progress (survival equals superiority), it is not deterministic in character, and it is not strictly competitive.

Historically one of the challenges evolution brought was a questioning of the fixity of the universe. Static stability in a deterministic/mechanistic model was the view prevalent prior to the eighteenth century. Change was viewed as exceptional. In the nineteenth century, however, change came to be viewed as the norm rather than the exception and took on a positive—change is good—hue. Evolution came to be equated with progress. At the end of the twentieth century the climate has shifted once again. Change is accepted as the norm, but nineteenth-century optimism is severely tempered by twentieth-century events. There is widespread disenchantment with the myth of progress. Evolutionary theorists are less tied to progressivist thinking. As Stebbins has noted, "attributing progress to evolution may be somewhat anthropocentric—assuming that what led 'up' to the human being is progressive. Many kinds of evolutionary change which zoologists could point to would not be recognized as progressive in this sense" (1982, 140).

According to contemporary thinking, progress is not a general property of evolution.[14] In the twentieth century, evolutionary theory is marked by concern for equilibrium and dynamic stability. What are the optimal conditions for a matrix of life? Emerson emphasizes "dynamic homeostasis" as the direction of evolution and observes that "optimal conditions of life and existence often require differentials, asymmetries, and variation, rather than uniformity, symmetry, and stability" (1968, 142). There is a downplaying of progressivist and perfectionist elements and a general reliance on the principle that *plus ça change, plus c'est la même chose* (the more that changes, the more it's the same thing). Most assume directionality in a movement toward greater complexity and integration,[15] but whether and in what sense this may be termed *progress* is an open question.

Contemporary evolutionary theories are less deterministic in character. There is a recognition that especially in the case of sociocultural organisms, genes are not all-determining. Both genotype and culturetype are admitted as factors in human development and behavior. These semi-independent but coadapted information systems are both at work (Burhoe 1979, 142). The world contains socially constituted interplay among responsible agents utterly connected to one another in a matrix of life.

This model provides an alternative that leaves room for the possibility of divine agency and human responsibility.

Contemporary evolutionary theorists do not think strictly competitively. As Stebbins reports,

> Almost all contemporary evolutionists have discarded such phrases as "the struggle for existence." To what extent does natural selection depend on the outcome of violent struggles or lethal combat? The answer is, very little. One cannot deny that life in nature is hard and brutal. . . . These hardships and untimely deaths are, however, interactions between different species, between a species and its biotic environment. Natural selection acts as different individuals of the same population display different rates of survival and reproductive capacity. Between such individuals struggles to the death are rare. In most species of fishes, insects, and plants, which constitute the majority of known organisms, active struggle between individuals belonging to the same population is completely absent. (1982, 66)[16]

In fact, it would seem that the instances of cooperation in nature are at least as numerous as the instances of competition. A case in point is the relationship of the hermit crab and the sea anemone. The anemone attaches itself to the shell that shelters the crab; this provides the anemone's partner with camouflage, and stray bits of the crab's food nourish the anemone (Margulis 1983, 49). A lichen is in fact a symbiotic partnership between an alga (the autotroph) and a fungus (the heterotroph). There is a plant, *Psychotria bacteriophila*, that contains its bacterial symbiont in its seed—this is the phenomenon of hereditary endosymbiosis. Even more complex and remarkable forms of symbiosis exist. In the Australian termite, for example, there lives a protozoan that is a symbiont (one aiding in the digestion of pulverized wood) that is itself host to three other symbionts (Margulis 1983, 50). Countless other examples of such close association and cooperation in nature could be given.

The groundbreaking work of Lynn Margulis is instructive here. She does not question that life-forms are shaped by natural selection, but she suspects that this is not the only or even the most important factor in evolution. While many biologists emphasize the role of competition in evolution, she stresses symbiosis[17] (McDermott 1989). She notes that "of all organisms on earth, only bacteria are individuals" (Cowley 1989, 38). The rest of us are in fact forged by symbiotic processes and are dependent upon our constituent microbes. "Every plant and animal on earth today is a symbiont" (McDermott 1989, 73).

Evolutionary thinking requires some reshaping if symbiosis is taken into account. In the twentieth century, scientists "have recognized that symbiosis has the power to generate great biological novelty and discontinuity" (Margulis 1990, 673). While chance mutations are commonly considered to be the basis of evolutionary change, symbiosis may be even more instrumental in this regard.[18] Amoebas, for example, have been shown in the research of Kwang Jeon to adapt in such a way that bacteria

that once killed them not only no longer harm them but become necessary to their growth and development (McDermott 1989, 76).

Life-forms and communities of life-forms can be cast in a matrix-of-life frame at micro and macro levels. What is true at one level within this matrix of life, with interlocking and mutually interacting levels, is true at other levels as well. Margulis observes, for example, that "just as the development of the nervous system allowed for a higher level of cooperation among microbes, the emergence of culture and science enabled individual nervous systems to join in a synergetic group perception" (Cowley 1989, 38).[19]

What if instead of imagining the way the world works as a struggle for existence waged by individual entities against their environments and in competition with other entities, we imagined it as an infinitely complex matrix of life in which communities of entities cooperate both to adapt to and to modify their environment? It would seem that some such model is needed in order to give a better account of the full range of phenomena, which include instances of competition but also instances of cooperation. We need "a better fit between our conceptual system and the actual events it models" (Burhoe 1979, 143). The new directions in evolutionary thinking and the field of endocytobiology make matrix of life an appealing model and a plausible alternative to struggle for existence, with its attendant difficulties.

As the search goes on in science for more adequate models of how the world works, so also the search goes on in theology for more adequate models for speaking of ultimate reality. It is to that parallel quest that we now turn.

A Model from Theology: God as King

Using images to speak of God is important, for there is much at stake in the naming of ultimate reality. Like the models science proposes regarding the way the world works, the models theology proposes regarding the nature of ultimate reality have social consequences. They shape our thinking and acting. There is a fundamental connection between theology and life. More specifically, there is a mutual influence between our theological affirmations and our sociopolitical arrangements—a situation of "two-way traffic." On the one hand, the concepts and images we employ in speaking of God are drawn from the realities of our context and reflect the values and arrangements that we find there. On the other hand, these concepts and images form those values and arrangements through a process of inversion, as the metaphors used for the divine (i.e., father, king) take on a legitimation and an enhanced status by virtue of their frequent association with the

divine (McFague 1988). Thus the images we use for God may function to legitimate or to challenge current values and arrangements.

Prominent among the images used for God are political images: kingship, lordship, sovereignty, judicial and military images are all of this sort. It may be that the connecting link that makes the appropriation of political images in theological affirmations credible (and even attractive) is the predominance of the feature of power in both arenas. Supreme power is one of the central features the tradition has attributed to God. The political arena is a place where we see power most obviously displayed. Thus, the political arena provides a reservoir of images available for theological appropriation.

Many historical instances of mutual influence between theological affirmations and political arrangements can be noted. The model of God as king, ancient and perennially applied, assumed particular prominence around the time of the Reformation. It was in that time, as the feudal mode of social organization gradually dissolved, that a new conception of both God and state became predominant in Western Europe. It was the notion of divine and political authority characterized by will and command (i.e., God's eternal decrees). *Sovereignty* became the distinguishing feature of both God and king; supreme, benevolent power was attributed to both.

Each side of the God-as-king analogy can be seen to have illumined the other. God's just rule of the universe provided a model for monarchy. God, in turn, was envisaged as the sovereign monarch of the universe whose government was the most perfect that could be conceived. It was the projection of kingship as kingship "ought to be." The developing notions of God and king were surely wedded to one another.

In the mixed history of the use of this analogy, there is an implicit invitation to become more alert to the social and political consequences of our theological constructs generally. There is a sense in which the classical tradition is unfairly criticized for its monarchical understanding of power. In a predemocratic political system, this is the only live option available in the thought world. It is not an altogether negative model. Kingship had certain appealing features. A good king brought such desirable conditions as unity, order, justice, and protection to the people of the realm. Ancient Israel gloried in the Davidic monarchy. The power of the king was not something to be opposed; the more powerful the king, the more able he was to bring unity, order, justice, and protection—thus the mightier the better. A good monarch has the positive value of controlling conflictual and chaotic elements in the society and may even serve to protect the weak from the strong. This kind of power, or something like it, may be a necessary condition for the existence of any society at all.

Nevertheless, the critique from the standpoint of a democratic political system cannot be avoided, for it opens up a whole range of heretofore unavailable options for thinking about the exercise of power. This political innovation presents the possibilities of social power, shared power, self-rule, government by the consent of the governed, order created by mutually agreed-upon laws, and so forth. These political developments make thinkable changes in the way divine power is conceived. Images other than God as king, images that are perhaps less amenable to cooptation by the strong against the weak, are made available. New understandings of the nature and operation of divine power are made available that have real advantages in terms of their intellectual credibility, religious viability, and moral adequacy.

CRITIQUE OF THE ANALOGY

There is a question that needs attention before we criticize this model: Given the priority that has been attached to power as a feature of the divine, what kind of power is being attributed to God? Is there an underlying agreement in the tradition about what *power* means? If so, what is the underlying consensus as to the meaning of power in general and divine power in particular? Is the meaning one that readily lends itself to the appropriation of *king* as a proper analogue for God? I have argued fully elsewhere (Case-Winters 1990) that the meaning for *power* that underlies the traditional doctrine of divine omnipotence is *power in the mode of domination and control*. If this is the case, then indeed images that convey ruling/governing, dominating/controlling power are best suited, and the model of God as king is a good fit. But it may be that this meaning for *power* needs reconsideration in the interest of intellectual credibility, religious viability, and moral adequacy.

A. Intellectual Credibility. Divine power as all-dominating and all-controlling meets a serious intellectual challenge in terms of the coherence of the concept. Can God do absolutely anything? The concept is vulnerable to various forms of the omnipotence paradox. (Can God create a rock so large that God cannot lift it?)

In examining the model of God as king and the understanding of divine power that has attended it, process theologian Charles Hartshorne argues that the traditional monarchical, unidirectional, all-determining concept of divine power is lacking in credibility. It does not take into account the nature of reality as social and relational. To construct a notion of divine power that assumes God has all the power there is—a monopoly—simply does not make sense if there are other actualities. The only form of power philosophically intelligible for a being that has *all* the power is power over nothing at all or power over powerless things (which

are in fact *nothing* if it is true that being is power). "Omnipotence in the only religiously sensible meaning, is the ideal case of power assuming a division of power, the maximal concentration of power that permits distribution of powers among a plurality of beings" (Hartshorne 1943, 220).

For Hartshorne, as for modern science, direct divine intervention overriding nature and directly determining events in the pattern of classical theism is simply not credible. Where nature has actuality and freedom of its own, unidirectional, all-determining divine power fails to make sense. A more credible conception views God's power as one power among other powers. It is power in relation; it both influences and is influenced by other powers. Its exercise is persuasive rather than coercive.

B. Religious Viability. In terms of religious viability, two problems arise with the model of God as king and the traditional meaning for power that accompanies it. First, the theodicy problem is exacerbated; if God is both good and all-powerful (in the sense of all-dominating and all-controlling), why is there evil in the world? Second, human freedom and responsibility seem to be denied or at least seriously compromised by this understanding if God has all the power there is.

The model of God as king attended by this understanding of power is theologically problematic in the kind of God it portrays. As Hartshorne notes, it is an idealization of the tyrant-subject relation. In this image, there is no stimulus to admiration and respect, much less love. Since we do not admire this figure in human relations, why would we admire it in God? He calls this the most shockingly bad of all theological analogies (Hartshorne 1941, 203). He quotes Whitehead and notes that in the formulation of the doctrine of omnipotence, "the deeper idolatry, the fashioning of God in the image of the Egyptian, Persian, or Roman imperial rulers was retained. They gave unto God the properties that belonged to Caesar" (Whitehead 1929, 503).

C. Moral Adequacy. Feminists have made a distinctive contribution to the current discussion of omnipotence by pressing the questions not only in terms of credibility and religious viability but also in terms of moral adequacy. The critique is two-pronged: First, the tradition's whole preoccupation with power is a stereotypically male preoccupation, and the meaning for *power*—power in the mode of domination and control—is shaped by a male bias. Second, attributing this kind of power to God and thereby elevating and legitimating this power promotes its exercise in the realm of human affairs and results in various forms of oppression, exploitation, and violence. Therefore it can be argued that this is a morally inadequate understanding of divine power.

In its conservative appropriation, the model of God as king provides the powerful with an instrument for promoting obedience and submis-

sion, a sword that cuts the nerve of rebellion. It contributes plausibility structures to support the power arrangement of the status quo. If God is ruling, governing, and in control of world process, then whatever powers there be are of God. There is a divine sanction for the rulers of this world. Rebellion against established authorities can be equated with rebellion against God. An ethic of obedience and humble submission is promoted by this model.

As is the case with models in science, so also in theology, models are open to a variety of interpretations and uses. The model of God as king, is a case in point. It is, in a sense, a sword that can cut both ways.[20] In its conservative appropriation it provides the powerful with an instrument for promoting obedience and submission. But in its revolutionary appropriation the analogy may provide for critique of political authority by appeal to the higher, divine authority: a sword to cut through the ideological mystifications attached to political arrangements. Despite this revolutionary prospect, the history of use of the model of God as king seems most often to reflect a conservative appropriation and to have been at home in an authoritarian framework legitimating and solidifying the power of the powerful. Thus, despite the revolutionary potential of the model, it may be useful to seek a model that does not so easily lend itself to this appropriation.

An Alternative Model: God as a Mother with Child

What if instead of imaging the God-world relation as like that existing between a king and his kingdom, we thought of it as being like the relation between a mother and the child she carries in her womb?[21] If this model is pursued, the nature of the exercise of power shifts from images of ruling (dominating and controlling) to images of life giving and world generation.

From the outset it must be admitted that this metaphor, like any other, has its limitations. For example, it must be used in a freeze-frame fashion, since the world will never grow up to be a fully separate, independent, and coequal being—which would be the normal trajectory for a child in the womb. To maintain the asymmetry and profound dependency that characterize this relation, we must bracket its temporal trajectory. Nevertheless, the metaphor has advantages over other mother-child images in better conveying the extent to which the world is *in* God and God is *in* the world. The nature and extent of this enveloping, permeating, life-generating relation of God to the world is, it seems to me, better communicated in this image. Transcendence, vital connection, and internal relation are maintained.

A more credible account of God's activity in the world is possible with this model. One of the decided disadvantages of the traditional model of

God as king is its account of God's activity in the world. Not only is this depicted as an all-controlling activity, but it is one that operates externally in a supernatural, interventionist mode. Such thinking is called into question by contemporary scientific understandings of how the world works. It seems an unnecessary, external tampering incongruent with scientific understandings of the world and its processes. The model of God as mother with child provides a model of divine activity that is immanent in world process and does not operate in a unilateral, all-determining manner that violates the freedom of creation or the integrity of the world's inherent processes.[22]

In terms of its potential for presenting a religiously viable account of divine power, this metaphor has real advantages. It offers a meaning for power as life-giving and world-generating (nurturing and creative power) in contrast to power as dominating and controlling. Religiously, it is a more worshipful portrayal of the divine being—a being worthy of worship, love, and emulation.

The model of God as mother with child highlights features of connection, relation, and interdependence. Although the relationship is asymmetrical, there is mutuality and reciprocity of influence here. The well-being of the one affects the well-being of the other. There is an intimacy here, an irreducible connection.

This new understanding also has the advantage of being able to give a more credible account of the presence of evil in world process and to affirm creaturely freedom and responsibility. It offers a fundamentally social understanding of both God and power. The existence of other powers places a metaphysical limitation upon God's power. If God's power is not all-controlling, the theodicy problem does not arise in the same way, nor are the freedom and responsibility of creatures compromised.

Two terms that fill out the meaning of worshipfulness for Hartshorne are unsurpassability and all-inclusiveness. The perfection of divine power is not in its *monopoly* but in its *unsurpassability*. God possesses power—like all other qualities—preeminently, in unsurpassable form. *All-inclusiveness* affirms that divine being includes within itself *all* positive values. Hartshorne criticizes the tradition for its one-sidedness in associating the perfection with one pole of the metaphysical contraries. He insists that God incorporates *both* poles (i.e., immutability *and* mutability, independence *and* dependence, activity *and* passivity) and each of these in the sense in which it is most excellent. For example, God is unchangeable in the sense of steadfast faithfulness, but changeable in the sense that God can manifest that faithfulness in different ways—as most appropriate—in different times and locations. It is a higher perfection to possess both active and passive power, the power to influence and *the power to be influenced* rather

than one or the other alone. All-inclusive and unsurpassable influence—which is uniquely *powerful* influence—is exercised persuasively in the direction of the divine purposes. But world process may or *may not* be brought into conformity with the divine purposes.

The model of God as mother with child and the reshaped understanding of power that attends it also have advantages in terms of moral adequacy. The character of the operation of divine power in this relation is best characterized as *empowerment*. It is loving and persuasive power that empowers—and does not coerce—action and response. This understanding of power does not assume that one gives up power in order to empower others. It is not a zero-sum or scarcity model of power. Power is rather an expansive phenomenon—like love—that is not reduced by sharing; rather it is generated and regenerated.

Another important way of characterizing the operation of this generating power is as *synergy*. That is, it *cooperates* with other powers. There is a decided emphasis on the collective functioning of this energy. When energies are joined with one another, power is built through synergy, and the energies may together generate energy greater than the sum of their separate generations. In this sense, God might be thought of as the world's life force (*dynamis zotike*), energizing all reality. Divine energy (power) flows within, between, and among us. It is the source of our power.

If divine power consists in domination and control, then the implied ethic is one of obedience. One humbly submits to the divine will. Sin consists in prideful self-assertion and rebellion against the divine will.[23] If, however, divine power is power in relation, power in the mode of life giving and world generating, which operates as empowering and synergy, then the ethical imperative is completely reshaped. The theory of virtue which seems most suited to the new model is an *ethic of solidarity*, centering on strengthened and enriched relationships with God and with one another.

Solidarity with God has roots in the mystical tradition, where it is more often spoken of as *union with God*. The mystical tradition has no place for deferring to a higher power, submitting to alien rule, or denying one's own strength. It does not urge that God be honored and obeyed because of God's power over us. Rather it calls us to immerse ourselves in God as in the depths of a sea of love.[24] We become one with God, and one with God's movement in the world. Our solidarity with God is made possible by God's prior solidarity with us. This is symbolized in the traditional symbols of incarnation and sacraments and is appropriately reemphasized in the metaphor of the womb. Solidarity is constitutive of human being.

Social consequences of the model of God as mother with child, and divine power as life-giving and world-generating power, have the poten-

tial of being very different from those associated with the model of God as king and divine power in the mode of domination and control. Power exercised as life giving in solidarity with others discourages independent, arbitrary assertion of the individual will over against the needs and desires of others. It seems that solidarity would by its very nature seek to avoid oppression, exploitation, and violence, which have been the heritage of the traditional paradigm of power. When solidarity is the mode of relation, harm done to another is perceived as harm done to oneself.

Conclusion

These alternative models, "matrix of life" as the way the world works and "life-giving, world-generating power" as the way God works in the world, seem promising in three ways. First, in their own right, they can be seen to have real advantages over "struggle for existence" and "God as king" when examined with respect to intellectual credibility, religious viability, and moral adequacy.

Second, they are promising for furthering the dialogue between science and theology. The model for ultimate reality avoids some of the supernaturalist, interventionist ways of thinking that have been a roadblock in the dialogue. These two models are easily brought into conversation with one another, enlarging the common ground for theology and science. If they are value laden—as all models are—they are laden with similar values. They promote in parallel fashion values of social relation and solidarity. Thinking about the world in terms of a matrix of life, and ultimate reality in terms of a mother with child, acknowledges our relationality, interdependence, and utter connectedness with all creation. They suggest modes of exercising power that respect relationality (empowerment, synergy, life-giving and world-generating power).

Third, they show themselves to be particularly useful in precisely those conversations in which theology and science need to engage one another and undertake in common cause. Our contemporary ecological crisis, for example, brings theology and science together in a new way. We share a common investment in the fate of the earth and a responsibility to provide interpretive frameworks that will promote the well-being of all creation. This involves a rethinking of the way the world works and the nature of ultimate reality. The models proposed here seem particularly conducive to environmentally conscious and life-enhancing attitudes and behaviors. Given the power of models not only to reflect but to shape our reality, it is to be hoped that these models may contribute to increasing the chances of the survival/flourishing of the earth and all its creatures.

In crucial issues such as the fate of the earth and the way we structure our social and political lives, scientists and theologians need to be in conversation. Models used to portray the way the world works and the

nature of ultimate reality are deeply influential in our thinking and acting. Thus they must be carefully chosen with attention given to their intellectual credibility (a concern that science has emphasized) and religious viability (a concern that theology has emphasized) and also to their moral adequacy. It is important to be alert to potential social and political consequences of each model proposed. Scientists and theologians continue to strive to find truthful models of the way things are and of ultimate reality. This paper is intended as a small contribution to that larger quest.

NOTES

1. Nancey Murphy observes the impact on theology of Hume's critique of its methods: of using miracles as a warrant for belief in revelation, ascribing unquestioned credibility to the biblical witness to miracles, and arguing God's existence from evidence of design. It seemed that the cognitive basis of theology was undercut. Theologians since Hume set out either to separate religious thought from the realm of science (Kant removing it to the moral sphere and Schleiermacher to the realm of feeling) or to go on as though Hume's critique does not touch theology (i.e., Barth's abandonment of apologetics for revelation as the sole condition of all knowledge of God) (Murphy 1990, 12 ff. She goes on to observe that it is methodologies such as these and not subject matter that has kept theology trailing behind in an age of science (Murphy 1990, 126–27).
2. As Ian Barbour has pointed out, the conflict has been particularly pronounced where scientific materialism, on the one hand, has met biblical literalism, on the other. Scientific materialism claims that "1) the scientific method is the only reliable path to knowledge; 2) matter (or matter and energy) is the fundamental reality of the universe" (Barbour 1990, 4). Equally certain—though decidedly different—pronouncements about the path to knowledge and the nature of the universe were voiced from the standpoint of biblical literalism. The only way to avoid conflict seemed to be to declare the independence and autonomy of science and theology from one another, marking out distinctive domains, methods, and languages (Barbour 1990, 10).
3. In trying to articulate the contribution this insight has made, I am particularly indebted to Ian Barbour, *Religion in an Age of Science* (1990) and Sallie McFague, *Metaphorical Theology* (1982) and *Models of God* (1987).
4. "Theories provide patterns in which data appear intelligible. . . . This is not to say, of course, that theories create what is seen, only that theoretical knowledge allows the observer to organize the raw data of sensation into intelligible patterns. It does leave open the possibility, however, that there may be more than one intelligible pattern" (Murphy 1990, 164).
5. A novel fact is one not used in the construction of a theory that is taken to confirm it; it is a fact first documented or seen to be relevant after the theory is proposed (Murphy 1990, 168).
6. Sallie McFague adds that "the entire enterprise of advertising rests on exploiting this subliminal level where hidden metaphors of self-fulfillment are titillated" (1982, 70).
7. Social Darwinism was a short-lived theory of social evolution that rationalized and justified the harsh facts of social stratification in a attempt to reconcile them with the prevalent egalitarian ideology. See *International Encyclopedia of the Social Sciences*, 1st ed., s.v. "Social Darwinism." Herbert Spencer in England and William Graham Sumner in America were influential social Darwinists. For Spencer this was connected with his individualism and social contract theory of social order. For Sumner it was an advocacy of class stratification.
8. "It is natural that propertied individuals should exist at the expense of the propertyless; further, the social structure must be stratified according to 'natural' principles. Since inheritance does not involve variation, it follows that in a 'natural' and, therefore, presumably good society, the system of social stratification should be perpetuated. . . . if there be liberty, some will profit by the chances eagerly and some will neglect them altogether. Therefore the greater the chances the more unequal will be the fortune of these two sets of men. So it ought to be in all justice and right reason (Sumner [1883] 1952, 144–45).
9. There is a prevalent attitude among biologists that competition and cooperation are opposites and that the one prevents the other. Actually there is a fair amount of biological evidence that

there are optimal values of competition, too much or too little both being detrimental to the survival of the group. In the biological world there is evidence that competitive pressures have survival value and that evolution has resulted in optimal competition. In contrast to competition, the function of cooperation in attaining increased homeostasis is much more obvious, although neither biologists nor social scientists have fully explored the role of competition in its relation to cooperation (Emerson 1968, 150).

10. Dawkins's thesis in his book *The Selfish Gene* (1976) is that biological selfishness is selected continuously in genetic competition. That is, those within a species that seek their own advantage and that of their closest kin survive to propagate and thus have their contribution to the gene pool strengthened. There is a decline of altruism with the decline in the index of genetic relatedness. What he finds difficult to explain, given this assumption, is the phenomenon of human altruism, where populations with little or no genetic relation manifest a high degree of cooperation and altruism.

11. I have two puzzlements with this very helpful and insightful paper. First of all, I question the operating definition of *altruism*. Burhoe accepts Wilson's definition of altruism as "self-destructive behavior performed for the benefit of others" (Burhoe 1979, 159, n. 2). At its root, *altruism* means simply "concern for the welfare of others as opposed to egoism; selflessness." Must behavior be self-destructive to be altruistic? Second, the instances he gives of altruism are treated as explainable by virtue of those who perform the actions having assured reciprocity. In what sense, then, are they altruistic/unselfish?

12. "Be warned that if you wish, as I do, to build a society in which individuals cooperate generously and unselfishly towards a common good, you can expect little help from biological nature. Let us try to *teach* generosity and altruism, because we are born selfish" (Dawkins 1976, 3).

13. De Waal also makes a clarifying distinction between our *vernacular* usage of the term *egoism* (which has implications regarding motivation, emotion, and intention) and the *evolutionary* usage of the term, which refers only to genetic self-promotion. This would prohibit the step taken by some sociobiologists, who have literalized the metaphor and taken such statements as "we are born selfish" and "made the non-existent emotions of genes into the archetype of true emotional nature" (de Waal 1996, 15).

14. Evolutionists define *progress* differently. G. G. Simpson defines it as "change toward a particular sort of organism" (Stebbins 1982, 140) (so that evolution of blind burrowing moles from their wide-eyed, active, shrewlike ancestors is progress in the same way as development of human beings from less-intelligent tree-dwelling primates). Francisco Ayala, on the other hand, employs value-based language and defines progress as "directional change toward the better" (Stebbins 1982, 140). Another possible definition would be "directional change toward more complex organisms" as judged on the basis of anatomy, biochemistry, and behavior (Stebbins 1982, 140).

15. Process thought would echo these sentiments with a proposal that God in fact values, and lures the world toward, greater intensity and harmony.

16. Even those instances thought to be prime examples of this kind of struggle turn out not to be. "Even when two male deer . . . are competing for the favor of females they do not, as a rule, engage in lethal struggle. They may often fight with each other for a while, but when one of the fighters is evidently losing, he usually submits and is allowed to leave unharmed" (Stebbins 1982, 66).

17. Her definition of symbiosis is "protracted physical associations among organisms of different species, without respect to outcome" (Margulis 1990, 673).

18. While the ideas Margulis is proposing have met with some opposition, they are not without precedent and independent support. A Russian school of biological science in the early 1900s emphasized the role of symbiosis in evolution. This school coined the term "symbiogenesis" to signify the "origin of evolutionary novelty via symbiosis." One of its exponents argued that "mutual aid is as much a law of animal life as mutual struggle . . . as a factor of evolution, it . . . has far greater importance, inasmuch as it favors the development of such habits and characters as insure the maintenance and further development of the species together with the greatest amount of welfare and enjoyment of life for the individual with the least waste of energy" (Kropotkin 1902, 6, cited in Margulis 1990, 674).

19. Consider also the *propagule*. When faced with harsh conditions, many organisms release tough little packets that can carry genetic material into more hospitable surroundings—the walnut, the bacterial spore, etc. Similarly Biosphere II, a self-contained ecosystem for human beings currently under construction, could potentially seed the universe.

20. For a fuller treatment see Case-Winters 1993.

21. The choice of the model of God as mother is inspired by and dependent upon the work of Sallie McFague: *Models of God: A Theology for an Ecological, Nuclear Age* (1987, 103). She, however, prefers to think of the child as already born and growing toward maturity.

22. "If in some sense the world is 'within' God (a spatial metaphor), God is 'more than' the world and God is creator of the world, then a natural analogy is that of a mother bearing a child within her, with the obvious limiting ('is not') feature of this metaphor, namely, that God is the source of being of that which God creates within 'herself' whereas a human mother is not the *creator* of the growing embryo she carries within her" (Peacocke 1990, 211 n. 104).

23. "The conception of sin as primarily a kind of personal disobedience or violation of the divine will, and salvation as being rescued from that condition of alienation and guilt, is rooted almost completely in the mythic picture which presents God as a divine king and father, and our relationship to God as the interpersonal and political one of subjects and children" (Kaufman 1985, 35).

24. "Symbols from nature are preferred where our relationship with God is not one of obedience but of unity, where we are not subject to the commands of some remote being that demands sacrifice and the relinquishing of the self, but rather we are asked to become one with all of life" (Soelle 1984, 102).

References

Barbour, Ian. 1990. *Religion in an Age of Science: The Gifford Lectures 1989–1991, Vol. One*. San Francisco: HarperCollins.

Burhoe, Ralph Wendell. 1979. "Religion's Role in Human Evolution: The Missing Link between Ape-Man's Selfish Genes and Civilized Altruism." *Zygon: Journal of Religion and Science* 14 (June): 135-62.

Case-Winters, Anna. 1990. *God's Power: Traditional Understandings and Contemporary Challenges*. Louisville, Ky.: Westminster.

_____. 1993. "Theological Affirmations and Political Arrangements: Two Way Traffic or 'Fear God, Honor the King.'" In *Calvin and the State*, ed. Peter de Klerk. Grand Rapids, Mich.: Calvin Studies Society.

Cowley, G. 1989. "Rethinking Evolution." *Newsweek*, 2 October, 38.

Daly, Mary. 1973. *Beyond God the Father*. Boston: Beacon Press.

Darwin, Charles. [1859] 1964. *On The Origin of Species*. Facsimile ed. Cambridge: Harvard Univ. Press.

Dawkins, Richard. 1976. *The Selfish Gene*. New York: Oxford Univ. Press.

de Waal, Frans. 1996. *Good Natured: The Origins of Right and Wrong in Humans and Other Animals*. Cambridge: Harvard Univ. Press.

Dobzhansky, Theodosius. 1962. *Mankind Evolving*. New Haven: Yale Univ. Press.

Emerson, Alfred E. 1968. "Dynamic Homeostasis: A Unifying Principle in Organic, Social, and Ethical Evolution." *Zygon: Journal of Religion and Science* 3 (June): 129–168.

Emerson, Alfred E., and Ralph Wendell Burhoe. 1974. "Evolutionary Aspects of Freedom, Death, and Dignity." *Zygon: Journal of Religion and Science* 9 (June): 156–86.

Farley, Edward. 1982. *Ecclesial Reflection: An Anatomy of Theological Method*. Philadelphia: Fortress Press.

Gilkey, Langdon. 1990. "Whatever Happened to Immanuel Kant?" In *The Church and Contemporary Cosmology*, ed. James B. Miller and Kenneth E. McCall. Pittsburgh: Carnegie-Mellon Univ. Press.

Hanson, N. R. 1958. *Patterns of Discovery*. Cambridge: Cambridge Univ. Press.

Hartshorne, Charles. 1941. *Man's Vision of God and the Logic of Theism*. Chicago: Willett, Clark.

_____. 1943. "Is Whitehead's God the God of Religion?" *Ethics* (April): 219–27.

Hesse, Mary. 1991. "The Science Question in a Godless Age." Paper delivered at the Thirty-eighth Annual Conference of the Institute on Religion in an Age of Science (IRAS), Star Island, N.H., July.

Huxley, Thomas H. [1865] 1964. "Emancipation: Black and White." In *Science and Education*. New York: Philosophical Library.

Jeon, Kwang. In press. "Amoeba and X-bacteria: Symbiont Acquisition and Possible Species Change." In *Evolution and Speciation: Symbiosis as a Source of Evolutionary Innovation*, ed. L. Margulis and R. Fester. Cambridge: MIT Press.
Kaufman, Gordon. 1981. *The Theological Imagination: Constructing the Concept of God*. Philadelphia: Westminster Press.
_____. 1985. *Theology for a Nuclear Age*. Philadelphia: Westminster Press.
Kuhn, Thomas. 1970. *The Structure of Scientific Revolutions*. 2d. ed. Chicago: Univ. of Chicago Press.
Lakatos, Imre. 1970. "Falsification and the Methodology of Scientific Research Programs." In *Criticism and the Growth of Knowledge*, ed. Imre Lakatos and Alan Musgrave. Cambridge: Cambridge Univ. Press.
Margulis, Lynn. 1983. "Symbiosis and Evolution." *Scientific American* 22 : 49–57.
_____. 1990. "Words as Battle Cries: Symbiogenesis and the New Field of Endocytobiology." *BioScience* 40 : 673–77.
McDermott, J. 1989. "A Biologist Whose Heresy Redraws Earth's Tree of Life." *Smithsonian*, August, 72–76.
McFague, Sallie. 1982. *Metaphorical Theology*. Philadelphia: Fortress Press.
_____. 1987. *Models of God: Theology for an Ecological Nuclear Age*. Philadelphia: Fortress Press.
Murphy, Nancey. 1990. *Theology in the Age of Scientific Reasoning*. Ithaca, N.Y.: Cornell Univ. Press.
Peacocke, Arthur. 1990. *Theology for a Scientific Age*. Oxford: Basil Blackwell.
Ricoeur, Paul. 1976. *Interpretation Theory: Discourse and the Surplus of Meaning*. Fort Worth, Tex.: Texas Christian Univ. Press.
Soelle, Dorothee. 1984. *The Strength of the Weak: Toward a Christian Feminist Identity*. Philadelphia: Westminster Press.
Spencer, Herbert. [1862] 1958. *First Principles*. New York: Dewitt Revolving Fund.
_____. 1884. *Man versus the State*. London.
Spretnak, Charlene, ed. 1982. *Politics of Women's Spirituality*, Garden City, N.Y.: Doubleday, Anchor.
Stebbins, G. Ledyard. 1982. *Darwin to DNA: Molecules to Humanity*. San Francisco: W. H. Freeman.
Sumner, William Graham. [1883] 1952. *What Social Classes Owe to Each Other*. Caldwell, Ohio: Caxton.
Tracy, David. 1985. *Theological Method in Christian Theology: An Introduction to its Traditions and Tastes*, ed. Peter C. Hodgson and Robert H. King. Philadelphia: Fortress Press.
Ward, Lester. [1883] 1926. *Dynamic Sociology: Or Applied Social Science*. 2nd ed. 2 vols. New York: Appleton.
_____ 1885. "Moral and Material Progress Contrasted." *Transactions of the Anthropological Society of Washington* 3 : 121–36.
Whitehead, Alfred North. 1929. *Process and Reality*. New York: Macmillan.
Wilson, Edward O. 1975. *Sociobiology: The New Synthesis*. Cambridge: Harvard Univ. Press.