Reviews

The Origins of Order: Self Organization and Selection in Evolution. By STUART A. KAUFFMAN. Oxford: Oxford Univ. Press, 1993. 704 pages $75.00; $29.95 (paper).

Richard Feynman has said that, while the rhythms and patterns of nature are sometimes apparent to the human eye, it is often necessary to see what the eye cannot. There are, in the physical world, many instances of periodic and even repetitious events visible "only to the eye of analysis." These events, taking place again and again with great fidelity (fidelity to what? one wants to ask), are what we call physical laws. Or at least they appear to operate in ways so general and with application across such an enormous breadth of experience that we refer to their descriptions as laws. Feynman, in his book *The Character of Physical Law* (Cambridge: MIT Press, 1967), discusses what he calls the general characteristics of these laws, which he sees as another level of generality higher than the laws themselves. Laws of gravity, of inertia, and of forces may be stated according to fairly simple mathematical equations. Gravity, inertia, and a variety of forces can be measured. But we do not understand gravity or inertia or forces in general. That is, we do not attempt to reduce these laws to simpler components. These laws simply exist. They are sometimes referred to as *primitives,* meaning that they are the starting points for our further exploration. We do not need to question how they work but, because of their nearly universal application, we are able to assume, simply, that they do work. Physics and chemistry have gained much benefit from this, shall we say, easy approach to laws.

In biology, however, we are constantly asking how things happen. We want to know the detailed mechanisms of energy production or of genetic information processing or of developmental unfolding. In fact, we biologists appear to be so preoccupied with detailed explanations that we eschew laws altogether. It is somewhat shocking for a nonscientist, or even for a scientist, to be told that in biology there are very few laws, very few theories. In fact, biology has been described as an atheoretical science. Yes, we have the theory of evolution, but this theory is itself a rather loose fabric and open to criticism on several grounds, not the least of which is its inability to account for rapid morphological change actually demonstrated in the fossil record, or for developmental adaptation that is itself the material operated upon by natural selection. When it qomes to cellular life, we have the guidance of the so-called cell theory, which asserts that life comes only from preexisting life. But the last fifty years of explosive discovery in molecular and cell biology have not produced a major theory. The work has in fact been governed by the hope that reductionistic analysis and complete

[*Zygon,* vol. 30, no. 2 (June 1995).

description of all mechanistic operations within cells would be sufficient to yield a complete understanding of cellular processes. It now appears, however, that the details of cellular mechanism are infinite, or at least too many to be calculated (see Walter Elsasser's *Reflections on a Theory of Organisms,* Quebec: Orbis, 1987). It is now *not* clear that the next step in understanding will come from this mostly descriptive and atheoretical sector of modern biology.

Enter now Stuart Kauffman and his book *The Origins of Order.* What we have here is nothing less than the promise of a new way of looking at cellular and evolutionary process, a way that embraces genetic reductionism but also provides a theoretical basis for examining how living things guide and contextualize genetic mechanisms. According to Kauffman, Darwinism shows the dual flaws of (*a*) not recognizing limits within living systems and (*b*) assuming that natural selection alone creates unlimited possibilities for organismal adaptation. The new science of chaos will show us the hidden rhythms and patterns inherent in the living organization itself and will reveal the fact of context within that organization. His own hypothesis is that these patterns exist and that evolution, in addition to creating new forms, is also constrained to work within the deep patterns of living structure. What are these deep patterns? Kauffman keeps this question at bay while supplying an even more seductive response. Realizing the limits of reductionism in biology he offers the following on page 25: "If we should find it possible to account for, explain, predict widespread features of organisms on the basis of the generic properties of underlying ensembles, then we would not need to carry out in detail the reductionistic analysis on organisms in order to explain some of their fundamental features." He promises to release us from the housekeeping chores of modern molecular biology.

The discovery of generic properties of organismic ensembles, of course, goes beyond present-day physiology as it goes beyond contemporary molecular cell biology, where reductionism is rampant. Will chaos theory be up to the task? We will, of course, have to wait and see. But the new chaos theory promises to get the job done by revealing hidden constraints and preferences in cellular life. The promise here is that the cell, populations of cells, and higher levels of organization in organisms (tissue, organ, and system levels) all operate out of holistic processes ruled by laws of chaos. These laws can be discovered. Since chaotic systems are unpredictable but nevertheless determinative, it should be possible to redefine living systems and to predict outcomes. Such determinism will find useful application in biology and medicine, where holistic processes and their study can take their place alongside (or perhaps above) the reductionistic analysis now dominating our science. That we need both is made clear in the review by Skinner et al. in *Integrative Physiological and Behavioral Sciences* (27: 39–53, 1993). Here we see the early work by Stewart Wolf and his colleagues on sinus arrhythmia being taken up by complex systems analysis, with promising new results for Wolf's assertion, made more than twenty years ago, that the study of such arrhythmia would allow anticipation of sudden cardiac death (see W.C. Bond et al., *Conditional Reflex* 8(2): 98–107, 1973).

This promise of a new approach in medicine is seductive. Nevertheless, given the alternative of rummaging endlessly in the attic of infinite reductionistic detail, any attempt to provide theoretical structure for modern biology is to be welcomed, especially when that attempt is as comprehensive and sophisticated as this one by Kauffman.

The trouble with this book is that it will have to be read by a committee. Actually, not a bad idea at that. The author makes every attempt to supply an overview for the various sections, but these range from a historical outline of evolutionary theory to a description of chaos theory applied to evolution, to cells as dynamical systems with strange attracters. Chaos theory is used to examine all of life including the question of origin. The book is designed to bring scientists up to speed with the theory of dynamical systems. It should bring those physical scientists who are comfortable with mathematical reasoning closer to—and perhaps more alert to opportunities for—this kind of reasoning in biology. For biologists, the book is essential reading. They will be challenged by its theoretical structure and by the possibility, brought alive in this splendid effort, that there is after all a view of life that is at once holistic and scientific.

RICHARD C. STROHMAN
Professor Emeritus of Molecular and Cell Biology
University of California
Berkeley, CA 94720

Global 2000 Revisited: What Shall We Do? By GERALD O. BARNEY. Arlington, Va.: Millennium Institute, 1993. 105 pages $20. (Distributed by Public Interest Publications, Arlington, Va.)

During the Carter administration Gerald Barney was asked to conduct a comprehensive forecast of the economic, demographic, resource, and environmental futures of every country in the world. The result, *Global 2000 Report to the President,* has proven to be remarkably accurate. Recently Barney has updated and condensed his work, assembling a similar report, *Global 2000 Revisted,* which was used to prepare participants in the 1993 Parliament of the World's Religions to discuss the critical issues of the twenty-first century. The report is a tour de force of clarity, substance, and insight, one of those rare books one wishes could be read by everyone on the planet. It's a short book but written with such economy of style that the reader emerges as if enriched by an entire library.

Global 2000 Revisited addresses itself to two fundamental questions: (1) What's the matter with the world? and (2) What can and should be done about it? In the first half of the book Barney guides his reader through a series of critical issues: global population, land use and food production, energy needs and resources, threats to biodiversity, global warming, ozone depletion, and global justice concerns. The discussion is both informative and accessible, the charts and graphs illustrative and intelligible. Wherever possible, Barney keys his forecasts to the expected lifetime of a child born today, a device that gives poignancy to otherwise bland data. The virtue of Barney's discussion of familiar problems is that he keeps his reader mindful of the fact that they are not discrete problems but aspects of a single, complex megaproblem. As humans have begun to think globally, it has become clear that we do not have just a poverty problem, or a hunger problem, or a habitat problem, or an energy problem, or a trade problem, or a population problem, or an atmosphere problem, or a waste problem, or a resource problem. On a planetary scale, these problems are all interconnected (p. 7).

This megaproblem (the "global problematique") is global, systematic, immediate, and chronic—*it* is what's the matter with the world. The second half of the book turns to a consideration of what can be done about it. Barney assembles a daunting agenda: reduce human population and consumption, modify technologies, develop sustainable energy economies, invent alternatives to militarism, create the conditions for global cooperation, and so on. The general list of suggestions is then broken down in a discussion of more specific actions: those to be performed by the North, and those to be performed by the South. Barney's agenda does not amount to a lot of arm waving by some fuzzy-headed ideologue. It is sane, realistic, and commensurate with the problems, and has benefited from extensive research and consultation. The list of necessary actions is followed by a very helpful discussion of the principal barriers to their completion, most of them pertinent to the tendencies of human nature to resist fundamental change.

The most significant obstacle, Barney suggests, is that we are a species without a vision. The entire global community appears to be committed to models of social progress and individual success that are demonstrably unsustainable. If we are to address the challenges of the global problematique we must rethink these models and commit ourselves to a new vision:

> The task ahead is to reexamine, reconsider, and reformulate every human institution to ensure that it fosters and supports our first principle: a mutually enhancing relationship between the human species and Earth as an unavoidable necessity for mutually enhancing relationships among humans. The institutions in question include international organizations, nation-states, domestic and multinational corporations, the family, and the faith traditions. (p. 63)

Religion comes in for special attention in one of the final sections of the book. The section on "the role of faith traditions" challenges religious traditions with the task of self-examination and reform, so that they might become viable and relevant resources for responding effectively to the global problematique. The section (almost entirely composed of questions) is a veritable syllabus for theological reflection, and deserves to be studied with care by every person who has an investment in the future of organized religion.

This is a wise and measured book, but it is also written with passion. I consider it a "must read" for anyone who aspires to a global perspective. It also is a very useful book. I recently used it, with terrific results, as a primer in an environmental philosophy course, but it also would be suitable for a variety of religion courses, and (especially) for adult study groups in churches.

LOYAL D. RUE
Professor of Religion and Philosophy
Luther College
Decorah, IA 52101

Science as Salvation: A Modern Myth and Its Meaning. By MARY MIDGLEY. London: Routledge, 1992. 239 pages. $25.00

Science and Salvation: A Modern Myth and Its Meaning is the result of the 1990 series of the prestigious Gifford lectures, which in itself commends the author, renowned philosopher Mary Midgley, and her argument. Midgley is no newcomer to the subject matter. Her 1985 book, *Evolution as a Religion: Strange Hopes and Stranger Fears* (reviewed in *Zygon* 24: 2), addressed the undue mixture of science and myth in the name of the theory of evolution; here, she criticizes the bizarre dreams prompted by contemporary cosmology and by the soteriological slant of modern science. The method also is the same: in short, brisk chapters she leads, on behalf of sober thought and traditional wisdom, a remorseless attack on the strongholds of some of the most outstanding (and outspoken) comtemporary cosmologists, people like Barrow and Tipler, Atkins, Dawkins, Wheeler, and Dyson.

She starts by stating positively that mythmaking is a vital human function (p. 1). But in her estimation this function has recently been distorted by an "exuberant expansion" of claims on the meaning of life (p. 7) and "pieces of bad and ill-controlled teleology" (p. 9). Her basic goal, therefore, is "to point out some very bad ideas that are currently accepted" (p. 14), to put science "back in context" (p. 32), to indicate the "blind oscillation between scientific myth and scientific seriousness" (p. 36), and to thematize the "strange compensatory myths, dreams or dramas" that populate scientific vulgarization (p. 77; see also pp. 126, 219).

According to Midgley, what is at stake in all this wild mythmaking activity is the venerable problem of purpose, which came under attack especially after the Darwinian revolution, only to return in a distorted form: "Throw purpose out through the door and it seems to creep in up the drains and through the central heating" (p. 15). And she adds: "This attempt to think about cosmic purpose would surely be legitimte if it were approached realistically, with some recognition of our own ignorance and the scale of the text" (p. 16). As we will argue in more detail below, even though she underscores some sort of purpose for the universe, she remains remarkably agnostic when it comes to pointing out legitimate ways of discussing it.

She is more explicit about the nature of scientific knowledge, and this surely is one of the highlights of the book. Mythmaking and scientific description come together, according to her, because both have to do with the primal drive for order: "all coherent thought about the world presupposes a background of some kind of order" (p. 44). We are born, in fact, with the "need to understand the world, to have a mental map to show the structure of the world" (p. 33), and so we should not separate reason from constructive imagination (p. 133). The fundamental level of the principles of organization is the level of faith, a commitment to world-pictures (pp. 57–58). In other words, "Knowledge is not an isolated phenomenon. It is made possible by trust, and we do have a choice about what we will trust." (p. 124). This act of trust is basically a religious one, and here lies any possible connection between science and religion. But, she warns, "Science can clash with religion if it—science—is in the business of providing the faith by which people live" (p. 57), and one of her tasks is to keep these two ways of ordering the world in their proper domains.

Her resort to religious metaphors being explicit, it is curious to note that

Midgley seems to take for granted the very concepts of salvation and perdition which give the book its title. Although she makes clear what strange proposals for human salvation have been advanced by contemporary mythmakers, she does not indicate what in her estimation constitutes the human predicament and "undistorted" salvation. A few hints are given: perdition is "being lost" (p. 65), the lack of connection and meaning, the lack of the sense of a rational order. Salvation would come in the form of a response to confusion—it is located more in the order of belief (having a legitimate faith) than in the order of action (pp. 62–63). Therefore, she is very sympathetic to the basic thrust of the Enlightenment: "Enquiry mattered, not primarily as a source of supply for the information-store, but as a way of teaching people to think for themselves" (p. 69). Throughout the book, however, she will criticize the "heroic Enlightenment puritanism" that marks "the scientistic project" in its multifarious forms, though it is hard for the reader to see why the hopes for salvation offered by them do not correspond to her own understanding.

If we now resort to the categories of restrictionism and expansionism in science (see Loren Graham, *Between Science and Values* [New York: Columbia Univ. Press, 1981]), we notice that Midgley is basically a restrictionist (i.e., she supports a restricted and well-defined domain of validity for the sciences), yet she fights enemies in both camps. Against restrictionists such as Monod, the seventeenth-century mechanicists, and the positivists, she argues that the "stern asceticism" that marks modern skepticism is biased against religion and imagination, and reduces reason to its critical function: "Spring-cleaning, in metaphysics and elsewhere, can become a confused obsession" (p. 108); but, as we will argue below, spring-cleaning is exactly what this book is about! The following quotation nicely illustrates her position:

> I have been suggesting that the idea of science necessarily has a much wider function in our lives than the neutral one of merely purveying information about a world conceived as alien and "objective." In so far as it is serious, its wider outlines express a world-picture that deeply concerns us, that shapes the meaning of our life, that affects our salvation. And I have backed that view by pointing out the dramas that have surrounded the arguments of thinkers officially promoting a neutral approach. (p. 92)

Instead of dwelling on some "serious" science, however, she turns to the other extreme. Her main targets are unbridled expansionists. First in the list are the advocates of some sort of anthropic principle; she emphasizes John D. Barrow and Frank J. Tipler, John Wheeler, and Freeman Dyson. Arguments are marshaled from several quarters: from the perspective of the progress of science itself (is new knowledge gained by the adoption of an anthropic principle? see pp. 30, 31) to making explicit that this sort of reasoning is little more than "wishful thinking" (p. 149). She rightly criticizes some of these authors for being too anthropocentric (p. 201 ff.) yet, while judging the restrictionists, she argues that our reasoning and our science is inevitably anthropomorphic (p. 73). She has some witty comments about the "eagerness for control and distaste for what is uncontrolled and natural" in these authors (p. 154), as well as the "fear of life and fear of the body" that their proposals display (p. 163). I think she has a point here: too much emphasis on information, as that which subsists into the

future, implies a devaluation of the individual as a unity of body and mind: "Information theory now saves us the trouble of paying any serious attention at all to the nature of thinking subjects" (p. 196). Earthly life now is despised by anthropicists (p. 223), as is any need for conversion and change in moral attitude (p. 221), a requisite for salvation in most religious traditions. She also aptly criticizes the temptation to use physics at all costs. "The Universe has no single secret" is her banner (p. 175). We should resort to the traditions in metaphysics and ethics, as "essential problems are timeless" (p. 180) and many views are possible about what makes sense and about what constitutes our salvation (p. 201).

Needless to say, her main question concerns these anthropicists' alleged advocacy of ultimate salvation through science (p. 183), through a complete understanding and use of the laws and phenomena of nature. This quotation from Peter Atkins nicely summarizes the mood that she has in mind:

> When we have dealt with the values of the fundamental constants by seeing that they are unavoidably so, and have dismissed them as irrelevant, *we shall have arrived at complete understanding.* Fundamental science can then rest. *We are almost there. Complete knowledge is just within our grasp. Comprehension is moving across the face of the earth, like a sunrise.* (p. 89, citing Peter Atkins, *The Creation* [Oxford: W. H. Freeman, 1987], 127; emphases Midgley's)

In a confused mixture of Pelagianism, Prometheanism, utopianism, and millenarianism, these authors, in "orgies of self-congratulation" (p. 224), advance wild predictions of an unbounded future glory for the human race: "Life and intelligence can succeed in molding this universe of ours to their own purposes" (p. 151; see also p. 199). In a "man of the gaps" (p. 200) attitude, some scientists today demand of physics an understanding of existence itself (p. 208), believing that "given enough science and enough confidence, possibilities become infinite" (p. 192).

We may now summarize some pluses and minuses of her argument. We should emphasize, to her credit, that Midgley does not shy away from very sensitive issues, frequently overlooked in the name of tolerance and openness to dialogue. She, in fact, is uncompromising when it comes to unchecked religious overtones in scientific discourse, and to the hysterical bias against organized religion: "Today, it is the admission, not the denial, of belief in central Christian doctrines that can damage the reputation of an academic in Britain" (p. 129); "No province of thought is marked on this outer region [the irrational, outside science] except religion. And religion itself is viewed as something subjective, non-rational, privatized, something we can only decide about 'as individuals'" (p. 181). As she points out, unconscious religion (or metaphysics) is bad religion, one prone to repeat the errors of the past, such as mind-body dualism (p. 220) and the resulting misconception of the "salvation of the souls" (p. 164), or a new brand of idealism without God as an ordering principle (p. 209).

But Midgley's argument suffers from the vice of its virtue. In her "spring-cleaning" zeal, she leaves little room for "summer construction," and the reader is kept wondering how to relate sound and traditional metaphysics and theology to contemporary cosmology. The result is a somewhat judgmental standpoint, as if the advancement of knowledge should not resort to bold conjectures. As any scientist knows, it is better to run the risk of speaking nonsense than to adopt a sober, but ultimately barren, way of

reasoning. Even though this is not her intention, in practice what she preaches is agnosticism—her own view of the relationship between God and the world remains at best implicit. Many side topics, moreover, are dealt with only in passing (such as Marxism and science, the use of teleonomy, the male bias in the scientific revolution), and their connection with the main argument is found wanting.

I would like to end this review on a more positive tone. Even though readers of *Zygon* may disagree with Midgley's restrictionism, and wholesale criticism of some attempts to draw moral and religious consequences from large-scale scientific theories, her contribution is unusual and insightful. Mary Midgley, in fact, has revealed an outstanding ability to dismantle intellectual pretensions, come from whatever quarters they may, pointing to the need to retrieve metaphysical and religious expressions in their autonomy. If we acknowledge that science and technology do bring us and the world salvation, we need to be at the same time aware of their limits and capabilities, and the perennial danger of illusion and wish-fulfillment. Midgley's analyses come as a timely contribution in this respect, and her book surely deserves serious attention.

EDUARDO RODRIGUES DA CRUZ
Assistant Professor of Theology
Departamento Teologia
Pontificia Universidade Catolica de S. Paulo
Sao Paulo, SP-05014
Brazil

Metaphor and Religious Language. By JANET SOSKICE. New York: Oxford Univ. Press, 1985. 200 pages. $26.00 (paper).

Religious language is replete with metaphors. So, according to current fashion, is the language of science. But what are metaphors and how do they function in these two respective discourses? These themes are the focus of Janet Soskice's provocative and informative analysis of the link between metaphors, science, and religion. Soskice, a University Assistant Lecturer in Theology at the University of Cambridge, has written a powerful, clear, and insightful book, which while philosophically rigorous is eminently readable.

The book divides naturally into two parts. The first five chapters contain illuminating analysis of fundamental questions concerning the nature of metaphor. The last three chapters take up the question of the comparative role of models and metaphors in science and religion. These chapters defend the view that the role of models and their associated metaphors in religion are more similar to those in science than is usually taken to be the case. From this, Soskice draws support for a fallibilistic theological realism which legitimates our ability to refer to God as a reality without compromising our inability to say much, outside of metaphors, about the nature of that reality.

Chapter 1 ("Classical Accounts of Metaphors") lays out the problems about metaphor that need to be addressed and discusses the ancient traditions. These problems include distinguishing metaphors from other tropes

(the problem of definition), accounting for how metaphors work (the problem of mechanism), and establishing whether metaphors are mere ornaments or whether they play a significant cognitive and referential role. Soskice's view that metaphors are cognitively significant hinges on seeing useful metaphors as linguistic exemplifications of underlying models. The two most influential ancient writers on metaphor, Aristotle and Quintilian, both tended to identify metaphors with single words rather than with representational networks (p. 8f.). In order to argue for the referential significance of metaphorical speech, this traditional view needs to be challenged. In chapter 2 ("Problems of Definition"), metaphors are defined as "figure[s] of speech whereby we speak about one thing in terms of another" (p. 14). This is merely one of more than 125 definitions that have been advanced. The key point for Soskice is that metaphors are linguistic entities. They may or may not involve two subjects. They have no particular form, and although single words may function as metaphors, the fundamental unit of a metaphor is an utterance, not a term per se. They both can establish new usages and extend old ones.

Chapter 3 ("Theories of Metaphor") discusses some of the major alternative views about how metaphors work, including work by Monroe Beardsley, Max Black, and Donald Davidson. Soskice divides theories of metaphor into three categories: substitution theories, emotive theories, and incremental theories. She sets out four adequacy conditions that any satisfactory account of metaphor must satisfy: (1) It cannot treat metaphors as either mere substitutions or merely emotive. (2) It must recognize that metaphors are cognitive and indispensable; they express what cannot be said in any other way. (3) It must explain how we get "two ideas for one" without slipping into a comparison theory. (4) It must give some account of the intentions of speakers and the reactions of auditors (e.g., how they distinguish metaphors from nonsense). If substitution theories are correct, then all metaphors are mere rhetorical flourishes and add nothing of either cognitive or emotive import to what is said. This seems false and such theories are rejected out of hand. Emotive theories violate condition 2 and are rejected as well.

Incremental theories view metaphors as both nondispensable and meaning-expanding. Soskice favors a version of this approach that she calls the "interanimative" theory. Soskice starts from I. A. Richards's insight that utterances as wholes are metaphorical (p. 46). Metaphors arise from the interaction of the networks of associated terms that are thrown together to form the metaphor. These networks reflect underlying models (p. 50). Fecund models underlie lively metaphors (p. 51). The duality of networks, which is integral to metaphorical construction, does not mean there is a duality of reference. Soskice follows Keith Donnellan and John Lyons in holding that reference is a function of utterances, not terms. (Donnellan, "Reference and Definite Descriptions," in S. Schwartz, ed., *Naming, Necessity, and Natural Kinds* [Ithaca: Cornell Univ. Press, 1977]; Lyons, *Semantics* [Cambridge: Cambridge Univ. Press, 1977]) She carefully distinguishes between the sense and denotation of terms taken in isolation from the meaning and reference of metaphors as expressed utterances. This is crucial for understanding that which is most distinctive of metaphors, namely, how they are capable of extending reference.

Chapter 4 ("Metaphor among Tropes") distinguishes metaphors, as

figures of speech, from related nonlinguistic figures such as models, symbols, analogies, and images. Metaphors are further distinguished from other tropes such as hyperbole, synecdoche, metonymy, and simile. Chapter 5 ("Metaphors and 'Words Proper' ") presents diachronic and synchronic analyses of what distinguishes literal usage from metaphorical usage. "To say that a statement is metaphorical is a comment on its manner of expression and not necessarily on the truth of the matter which is expressed" (p. 70). Metaphorical meanings are not special kinds of word meanings nor are metaphorical truths special kinds of truth. From the diachronic perspective Soskice rejects the view that "dead" metaphors are not metaphors. Neither are they embodied myths; she argues that the view of dead metaphors as embodied myths and the associated view that language is fundamentally metaphorical reflect a confusion between word origins and word meanings. From the synchronic perspective, Soskice rejects the views that words as such have metaphorical meanings, that all metaphors have two meanings, and that most or all metaphors are false. In addition, she argues that metaphors are both irreducible and cognitively relevant.

The discussion in the first five chapters sets the stage for Soskice's argument that the role of models and metaphors in science is similar to their role in religion. Chapter 6 ("Model and Metaphor in Science and Religion: A Critique of the Arguments") argues that despite superficial differences the roles of models and metaphors in science and religion are significantly analogous. Chapter 7 ("Metaphor, Reference, and Realism") argues that the role of models in science and religion can be properly understood only from a realist perspective. Chapter 8 ("Metaphor and Theological Realism") draws some conclusions about what this means for philosophical theology.

The brain as a computer is a typical model in science. Following Rom Harré's distinction between homeomorphic and paramorphic models, this is a paramorphic model (Harré, *The Principles of Scientific Thinking* [London: Macmillan, 1970]). The domain of the model source (computers) is different from the domain of the subject target (brains). The model is intended to provide a potential explanatory grid in terms of which one can better understand brain activity. The model supports the metaphor "The brain is a computer." Such metaphors Soskice, following Richard Boyd, calls "theory constitutive metaphors" (Boyd, "Metaphor and Theory Change," in A. Ortony, ed., *Metaphor and Thought* [Cambridge: Cambridge Univ. Press, 1979]). The description of brain activity in terms of "feedback loops," "neural programming," etc., she labels "metaphorically constituted theoretical terms." In line with her previous distinction between terms and uses of terms, this distinction is important.

From a realist point of view, these scientific models are taken to be "reality depicting." That is, they are taken to fix a referent of some part of the causal structure of the world. If we are to understand religious language as employing models we must, Soskice argues, construe them as "reality depicting" as well. Authors such as Frederick Ferré and David Tracy acknowledge that models in science are "reality depicting" but that models in religion have at best emotive significance or, if they do refer, refer to the religious experience as such (Ferré, *Basic Modern Philosophy of Religion* [London: George Allen & Unwin, 1968]; Tracy, "Metaphor and Religion," in S. Sacks, *On Metaphor* [Chicago: Univ. of Chicago Press, 1979]).

This move seeks to avoid the "reality depicting" aspect of religious models. But to do so, Soskice argues, renders nonsensical the comparison between models in religion and models in science (p. 100). Taking the comparison seriously requires defending a version of theological realism and rests on a consideration of the aims and purposes of scientific and theological explanations (p. 107).

The differences between models in science and religion boil down to two alleged dissimilarities: (1) that models in science are intended to be explanatory and descriptive whereas religious models are emotive or affective; and (2) that models in science are, in principle, dispensable whereas models in religion, in principle, are not. Soskice rejects both notions. Regarding the first supposed dichotomy, she argues that religious models are affective or compel commitment only because they are taken as explanatory and descriptive. For example, images of "bloody swords" compel only because we take them as descriptions of an angry God (p. 109). In addition, religious models, insofar as they are models, must be paramorphic. But, paramorphic models are models that "suggest an explanatory grid between model source and model subject." So, religious models *as models* must be construed as putatively explanatory. Even so, what is being described and how are they explanatory? Soskice rejects what she calls the "hybrid" view that religious models are descriptive of human experience but not of some transcendent reality. "Typically, Christians respond to the models of their religious tradition not because they take them to be elegant and compelling means of describing the human condition, but because they believe then in some way to depict states and relations of a transcendent kind" (p. 112). "God the father" as the central image of the Christian faith guides action "in virtue of its claim to be reality depicting, namely, that this is how it is with our relationship to God" (p. 112). Religious models turn out to be more similar to scientific models than this alleged difference suggests.

The second alleged difference between religious models and scientific models involves the dispensability of models in science and their indispensability in religion. Here Soskice draws upon realist treatments of science from N. R. Campbell, Mary Hesse, J. J. C. Smart, and Rom Harré to suggest that theories bereft of models are "non-starters at worst and lacking in expansive potentiality at best." The claim that models are dispensable in science rests, she rightly suggests, on a dubious empiricist philosophy of science which sees theories as uninterpreted calculi resting on a base of observation statements. This view stands, at the moment, in disrepute. Realist theories of science place a heavy emphasis on the centrality and indispensability of models in scientific reasoning. However, the dispensability thesis rests on another aspect of empiricist philosophies of science that Soskice does not emphasize. The classical empiricist positions of the early twentieth century construed scientific theories as linguistic entities—as collections of sentences whose systematic import could be employed to explain a set of observation sentences. This point of view has come to be known as the syntactic analysis of scientific theories. In recent years it has been challenged by an alternative conception, which has come to be known as the semantic view of theories. This view construes theories not as collections of sentences but as collections of underlying models that support particular applications. On this construction of science, models are indispensable. This would seem to support Soskice's position, but for the fact

that not all philosophers who endorse this view are scientific realists. The most prominent exception is Bas van Fraassen (van Fraassen 1980), who endorses the indispensability of models but rejects their realist construal and prefers to defend what he calls "constructive empiricism." The import of this ongoing controversy for the issue at hand is that it is possible to defend the view that models in science are indispensable without defending realism. Thus, even if we construe the deployment of models in religion as sufficiently analogous to their deployment in science to warrant drawing significant conclusions about religious metaphors, the parallel does not unequivocally support the kind of theological realism that Soskice argues for. In any case, the apparent indispensability of models in science (at least as it is currently understood) makes the situation in science closer to that of religion. The net effect is that the gap between the deployment of models in science and religion is not as significant as the ostensible differences suggested.

Models in science are open to revision and subject to replacement. This is, Soskice notes, not an indicator of their dispensability but rather of the fallibility of scientific truth. Soskice argues that religious models are, in principle, revisable as well. The fact that they are not so easily revised is more a reflection of their rootedness in an ancient scriptural tradition and the sense among theologians that these are the best they can come up with. Of course, in science as well there are models that are rooted in tradition and difficult to dislodge. Einstein, for example, was reluctant to abandon classical models of realism and determinism in the face of quantum anomalies. In general, Kuhnian considerations suggest that "normal science" traditions embody central models which are more or less difficult to modify in the light of putatively anomalous experiences. Even so, scientific models have a shorter turnover time. After all, the general tradition that we call "modern western science" is barely four hundred years old, and a cursory comparison of the prevalent models of the 1600s with those of contemporary science should suffice to make the point that scientific models are more easily revised than religious models. If we focus on the turnover time, this may appear to be only a matter of degree. However, if we ask why the turnover rates are so different we discover that the testability of the scientific models is the core source of their revisability. This testability is the result of the fact that experiences that are deemed relevant to the truth of our scientific models can be produced and reproduced at will. This is not the case with the core religious experiences. This marks a significant difference between models in science and models in religion.

The debate over the role of models is a debate about the nature and purposes of explanation. Soskice divides the views about the nature of science and religion into four categories: naive realist, positivist, critical realist, and social constructionist. The naive realist view is construed as the view that takes unobservable phenomena to be uncritically like the models we use to describe and refer to them. Thus, the brain as computer becomes *literally* "the brain is a computer." To say that God is angry means the same as saying that John is angry. Soskice dismisses these uncritical views out of hand (p. 118). The positivist position is characterized as a retreat to the observational level and an attendant suspicion of all theoretical terms which cannot be constructed out of "observables"; such terms are "ciphers" or mere "calculating devices." Critical realism allows for models of things and

processes which may forever "transcend" observational experience. The social constructivist position, a form of idealism, allows for models but takes them to be models of a socially constructed reality. Although positivism and social constructionism disagree about the importance and relevance of models for science they stand opposed to the realist position in rejecting the search for transcendent realities and in construing nonobservational terms which purport to reveal such realities as at best heuristic fictions (p. 121).

Soskice puts much stock in the standard realist response that such views make scientific activity unintelligible since we can neither account for the success of science nor for the confidence with which researchers pursue the implications of their models. For the realist, science makes sense only on the presumption that there is a transcendent reality. It is this reality that scientists are trying to fathom. Since it transcends our experiences, how can they do it? They are able to gain insight into the "real," as opposed to the "nominal," essences of nature by employing models which support "metaphorical webs." The key question is how these metaphorical webs can lay claim to being "reality depicting" in light of the fact that "in the cases which interest us (in both science and religion) we are using models to discuss that which we cannot fully comprehend" (p. 124).

The resolution of this problem rests on using the fact that causal theories of reference raise the possibility of fixing reference without being committed to unrevisable descriptions of the referent thereby fixed. The fixing of reference occurs through ostension. Once fixed, competent speakers within a linguistic community can successfully refer even though all their particular beliefs about the referent may be false. By distinguishing between the reference of a term (its sense) and the reference of a use of a word, Soskice seeks to use the best of both the traditional view that sense determines reference and the causal theory which allows the referents of expressions to remain constant while the sense of what is being said about them changes (p. 130).

Models as applied to experiences carry metaphorical webs which serve of grids for explaining the experiences in terms of underlying realities. The initial introduction of the metaphorical predicates fixes a reference in the light of some perceived similarities between the model employed and the phenomena to be understood. The "sense" of the terms of the model "guides" the initial introduction. Thus, brain activity strikes us as being relevantly similar to computer activity. We use our understanding of how computers work to develop a model of brain activity. Exactly how we are to exploit the model is left open. The metaphors we employ are vague and open-ended. This open texture creates a potential for further descriptive articulation of brain activity. Our descriptive account may, in the end, diverge considerably from the descriptive account that accompanied the first introduction of the computer model. But the referent of researchers who use the computational metaphor need not have changed.

The options in the philosophy of religion parallel the options in the philosophy of science. Theological empiricism leads to religious skepticism. From an empiricist point of view, either we must be able to describe God or God is unknowable. We can't do the first, and the second seems unpalatable. But, empiricist theories of meaning are under attack in other areas of philosophy. Why shouldn't they be abandoned in philosophical theology as well (p. 143–44)? The use of metaphors to fix reference without the ability to completely describe that to which we refer suggests that we can

use religious or theistic metaphors to refer to God without claiming to be in a position to completely or even adequately describe that to which we refer.

The argument of the last two chapters is to the effect that "the empiricist and idealist accounts of scientific models fail because they cannot account for (1) actual scientific practice or (2) for the predictive and cumulative success of investigations which are model-based" (p. 148). With respect to theological realism the point is not to prove that God exists but to demonstrate "that we may justly claim to speak of God without claiming to define him, and to do so by means of metaphor. Realism accommodates figurative speech which is reality depicting without claiming to be directly descriptive" (p. 148). This distinction between "reality depictive" and "directly descriptive" is the heart of Soskice's case for a realistic reading of metaphor use. Can it be maintained?

Metaphors arise from the context of communities of discourse. As such they become emblematic of traditions, and those that receive priority over others do so by virtue of the strength of the traditions that they shape and from which they emerge. The images and allusions in religious literature are not arbitrary but arise within a tradition (p. 154f.). Thus, it is misguided to treat texts not in the tradition, however great and moving (such as Shakespeare) as having the same religious significance as, e.g., the Old Testament. "The Old Testament's importance is not principally as a set of propositions but as the milieu from which Christian belief arose and indeed still arises, for these books are the source of Christian descriptive language and particularly of metaphors that have embodied a people's understanding of God" (p. 159). But, do scientific traditions work in the same way? When traditions conflict, whether they are religious or scientific, how are these conflicts adjudicated? Doesn't aspiring to the real require more than the weight of tradition? The validity of a scientific tradition rests not merely on the freighted metaphors that emerge from its tradition but on its anointment by some extratraditional touchstone. What similar indication of the extratraditional emerges in conflicts between religious traditions? Are the differences between Buddhism and Christianity, for example, analogous to the differences between Cartesian and Newtonian physics? If not, how are we to understand such differences from the standpoint of theological realism? How, indeed, are we to compare alternative traditions? Are they rivals or do they complement one another? If the former, then testability is an issue. If the latter, then why opt for one religious model over another? Being born a Christian is a good predictor of whether one will be a Christian, although not everyone retains the religion, if any, of his or her birth. What leads people to reject one faith and embrace another? Whatever the considerations are, they do not seem to have the compelling force that reasons for abandoning Cartesianism in favor of Newtonian theory had and have.

Despite such reservations this book is a mine of information and insights about the general theory of metaphors and about the role of models and metaphors in scientific and religious discourse. It ought to be read by all who are interested in these issues.

MICHAEL BRADIE
Professor of Philosophy
Department of Philosophy
Bowling Green State University
Bowling Green, OH 43403

Toward a Theology of Nature: Essays on Science and Faith. By WOLFHART PANNENBERG. Ed. TED PETERS. Louisville, Ky.: Westminster/John Knox Press, 1993. 166 pages. $19.99 (paper).

This book consists of seven papers on issues in science and Christian theology, published in various journals or edited collections since 1970 by Wolfhart Pannenberg, Professor of Systematic Theology at the University of Munich. The themes of these essays are set out very well in the editor's introduction and in the first essay, "Theological Questions to Scientists."

Pannenberg assumes that "religion is . . . concerned with the experience of the power that determines the reality of being as a whole" (p. 74). Thus it should not be possible to understand nature properly without reference to its creator. This is a provocative start, since atheistic scientists claim to understand nature quite well. Pannenberg would argue, however, that they can achieve only a limited and partial understanding, and he puts five main questions to scientists, which may suggest a positive relation between Christian belief and scientific understanding.

The first question is whether the interpretation of the principle of inertia may need to be revised. He makes this clearer in later essays, showing how the principle was used historically to render God superfluous as the sustainer of nature. He asks whether a view of the universe as made up of events or of field-forces may not render the hypothesis of a sustaining power, perhaps of God as an ultimately environing force-field, necessary. Whether the universe is somehow self-explanatory is certainly an important question in physics. But of course even a mechanistic view of the universe leaves its fundamental laws and states in need of explanation, and it is hard to see how appeal to "fields of force" renders God any more necessary as a sustainer than appeal to basic elements and laws. It is precisely in quantum cosmology, with its very nonmechanistic apparatus, that it is sometimes claimed that the universe may be wholly self-explanatory. It is perhaps not so much the principle of inertia as the possibility of a "theory of everything" that threatens theism as an explanatory hypothesis, and that needs to be examined.

The second question is whether natural processes are contingent and irreversible. Pannenberg uses the term "contingent" in an unusual way, to mean that "new and unforeseen events take place" (p. 76), rather than the normal logicians' sense that alternative states are logically conceivable. He wants to see nature as a historical, not a repetitive, process, and physical laws as abstractions from its concrete history, open to development over time, say, from the big bang to now. The laws of thermodynamics offer support for this view, as do those quantum or dynamical principles which undermine deterministic accounts of the universe. I think Pannenberg is right in supposing that a creator God might be expected to create a nondeterministic and purposively oriented universe, though it is worth noting that this is a view which was probably itself prompted by the scientific theory of evolution; classical theists had little difficulty in seeing God as determining all things in a universe whose basic structures were unchanging. The "historical view of nature" thus seems to be a synthesis of scientific and theological hypotheses—which, of course, supports Pannenberg's main point that science and theology should interact in a positive way, though more at the level of underlying worldview than of first-order scientific theorizing.

Pannenberg's third question is whether biology has any equivalent for the idea of the divine spirit as the origin of life. In a number of these essays, he develops the idea of Spirit as a "universal field of energy" (p. 132) which engenders a process of creative unification, leading organisms to transcend themselves toward increasing complexity and integration (p. 140). He appeals to the work of Teilhard in developing this view, and also to Polanyi's idea of a morphogenic field, which may be an explanatory factor in individual development. This is perhaps the most contentious area of all, and some biologists would be quick to accuse him of vitalism or mere hand waving at this point. Pannenberg has taken from science the ideas of evolution and of field theory and put them alongside biblical ideas of spirit, which were admittedly framed in a very different context of beliefs. What results is a creative synthesis, the reinterpretation of religious concepts within a scientific worldview, that leaves neither unchanged. In such a view, theism will challenge reductionist strategies and suggest more holistic and value-oriented approaches. In that sense, theology will not simply accept and timidly conform to scientific results but will engage in a tentative but positive dialogue.

The fourth and fifth questions are about the relation of space-time to eternity, and the compatibility of Christian eschatology with cosmology. Here, Pannenberg outlines his view that "from the future the world is created" (p. 102). Eternity includes temporality, but in such a way that it is "the sounding together of all time in a sole present" (p. 100). Creation is "an eternal act that comprises the total process of finite reality" (p. 101). As such, it stands beyond time. Yet, insofar as creation is a process of increasing unification, "eternity enters from the future into time" (p. 102). One can see that, if creation is a timeless act, it is as proper to speak of it as from "the end" as from "the beginning," though both would be strictly improper. Pannenberg speaks of the future as more important because he holds that only the future will show the significance of past events. In the eschatological future one "will be able to look at creation as a whole" (p. 83), by participating in the glory of the creator.

There is a huge tension between the idea of a *future* experience of fulfillment and a "total presence" view of eternity, which one would not be able to think of as coming "at the end of time," or as being affected in any way by what happens in time, because, being one indivisible reality, it cannot have a later, affected part as well as an earlier, unaffected part. Does Pannenberg believe that, in the temporal future of the universe, there will be a time when the temporal "experiences itself as it stands in the presence of God" (p. 25), as it certainly does not do now? But then, how could all the generations of the past share in that future, as, in biblical eschatology, they do? Does that mean, then, that the eschatological fulfilment is beyond this space-time? But then, what is the relation of this space-time to it? Will this space-time not simply cease to be, in accordance with the law of entropy? In which case, how can there really be, as the final state of the universe, a "transfiguring presence of the eternal in the temporal"?

Pannenberg virtually gives up at this point, and it seems that he is caught between three views. First is a Teilhardian vision of a transformation of the physical into the spiritual at some future time. Second is the view that eschatological fulfillment lies beyond this universe, yet must be temporally posterior to it, since human destiny will be caused by events in *this* universe.

Third is the view that eternal life is participation in a *nunc stans,* and so is not, properly speaking, future at all. It is precisely at this point of eschatology that the Christian worldview seems weakest, and yet eschatology is at the heart of Christian faith. This tension remains unresolved. Yet in Pannenberg's vision of the Spirit as creative and unifying power, of the universe as open to new and emergent forms of being, and of the universe as somehow destined to find its fulfillment in relation to God, one has the beginning of a theological worldview, fashioned in fruitful dialogue with contemporary science. These essays provide material which raises some of the most important questions in the science/theology debate, and they suggest imaginative possibilities for developing a unified vision, all the more stimulating for not being complete.

KEITH WARD
Regius Professor of Divinity
University of Oxford
Christ Church, Oxford, OX1 1DP
United Kingdom

ALEXANDER RESPONSE TO COLE-TURNER

I wonder if I might be allowed two brief comments in reply to Professor Ronald Cole-Turner's response to my review of his book *The New Genesis: Theology and the Genetic Revolution* (*Zygon* 29: 3). First, my comment that there is not "a scrap of evidence for genetic inheritance of 'personal qualities'" was directed specifically at the vagueness of the term "personal quality," a phrase which usually implies personality traits described by adjectives such as generous, kind, irritable, jealous, etc. I stand by my critique on this point. As far as human pathology is concerned the correlation between many genetic defects and behavioral changes is clear and noncontroversial, although the causal chains whereby defects at the gene level translate into behavioral changes remain obscure. If the hardware is defective it is not suprising if the software does not work properly. With regard to the inheritance of complex patterns of normal human behavior, one can only say that the data remain controversial. Twin studies provide the most convincing evidence in this field, although many ambiguities remain. Attempts to correlate human behavior more specifically with genetic markers have not been very convincing so far (see *Science* 264 [1994]: 1686–739 for a recent critical survey of this research field). As a good Darwinian I find it difficult to believe that those particular human behavioral traits which lead to our effective survival and reproductive success are not to some extent inherited, but such is the power of human culture that the unequivocal demonstration of the inheritance of even this modest behavioral repertoire is certainly not trivial.

My personal view is not, as Cole-Turner suggests, that we can decide on such matters a priori, but rather that it is unwise to build either scientific or theological castles in the air using data which, as far as the genetic inheritance of complex patterns of human behavior is concerned, are so far neither clear nor reproducible. In educating the general public about the

very real potential benefits of genetic engineering it is important that we do not alarm people unnecessarily by talking of future scenarios ("genetically engineering human behavior") when the present scientific basis for making such a statement remains so flimsy.

With regard to my second point, I am not, as Cole-Turner suggests, "a Pelagian with a Fall" but rather someone who believes (contrary to Pelagius) that the Fall had profound consequences for humankind resulting in our alienation from God and from each other, which in turn led to disorder in nature ("thistles") as a result of poor stewardship. That is why we need redemption and why the earth also needs redemption. However, unlike Cole-Turner, I do not believe that "fallenness" implies genetic change and least of all that it is a result of Darwinian evolution. Fallenness is a theological problem that requires a theological solution. Genetic problems require genetic solutions. The link between the two is that the redeemed community, of all people, should be most responsible as stewards in their use of the new genetic technology for the good of others. Calvin, who was no Pelagian, put the point very succinctly back in 1554 in words that very well could be applied to the right use of genetic engineering today:

> Let him who possesses a field, so partake of its yearly fruits, that he may not suffer the ground to be injured by his negligence, but let him endeavor to hand it down to posterity as he received it, or even better cultivated. Let him so feed of its fruits, that he neither dissipates it by luxury, nor permits it to be marred or ruined by neglect. Moreover, that this economy, and this diligence, with respect to those good things which God has given us to enjoy, may flourish among us; let everyone regard himself as the steward of God in all things which he possesses. Then he will neither conduct himself dissolutely, nor corrupt by abuse those things which God requires to be preserved. (Calvin, *Commentary on Genesis,* [1554; Carlisle, Pa.: Banner of Truth, 1965])

DENIS R. ALEXANDER
T Cell Laboratory
Department of Immunology
AFRC Babraham Institute
Cambridge, CB2 4AT
United Kingdom