

Reviews

The Blind Watchmaker: Why the Evidence of Evolution Reveals a Universe Without Design. By RICHARD DAWKINS. New York and London: W. W. Norton and Company, 1986. 332 pages. \$18.95.

In this book Richard Dawkins, lecturer in animal behavior at Oxford and author of two previous books—*The Selfish Gene* (New York: Oxford University Press, 1976) and *The Extended Phenotype* (Oxford and San Francisco: W. H. Freeman and Company, 1982)—sets out “to persuade the reader, not just that the Darwinian world-view *happens* to be true, but that it is the only known theory that *could*, in principle, solve the mystery of our existence” (p. x). By “the Darwinian world-view” Dawkins means the modern synthesis based not only upon the classical Darwinian idea of natural selection but also upon Mendelian genetics, molecular biology, and other disciplines; I will henceforth use the term *Darwinism* in this sense. Dawkins never succeeds in persuading me that Darwinism is any more than a plausible speculation. The *fact* of evolution seems beyond doubt, but I think there is ample room for questioning whether Darwinism provides a satisfactory account of the *mechanism* of evolution.

Let me interject a brief comment about Dawkins as prose stylist. He has frequently been hailed as a brilliant writer, partly on account of his supposed ability to invent helpful analogies for clarifying difficult scientific matters. I cannot deny his inventiveness, but I feel he has a tendency to fall in love with his analogies and to elaborate them beyond the point of helpfulness.

According to Paley’s classic treatise on natural theology, a man ignorant of the genesis of watches, finding one on a heath, could justifiably conclude from its intricacy and ostensible purposiveness that it was the product of design. But intricacy and ostensible purposiveness are even more pronounced in biological organisms than in a watch. Hence we must infer a Designer of organisms, a Divine Watchmaker.

Whereas Paley saw organisms as instances of *actual* design, Dawkins sees them merely as instances of *apparent* design. The semblance of design is due to the intricacy of adaptive adjustment between organism and environment. Such adaptation strikes awe and wonder in the human heart and cries out for explanation. In chapter 2 (“Good Design”) Dawkins bids fair to outdo even Paley at conveying a sense of awe and wonder through his fascinating account of bat “sonar.”

In chapter 1 (“Explaining the Very Improbable”) Dawkins states that the elaborate adaptation of organisms is inherently improbable but that it can nonetheless be accounted for by the operation of blind physical forces. If this statement is true, however, it presupposes both that the laws of physics themselves need no explanation and that biological laws are reducible to physical laws. Dawkins believes both propositions but does not argue sufficiently for either of them. The observation that the laws of physics, initial disposition of matter, and related phenomena are “just right” for the emergence of life

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certainly seems in need of explanation. To cite just one instance, some cosmologists believe that altering the rate of expansion at the Big Bang by one million millionth would have made the universe fall to bits too fast or undergo recollapse too quickly for life to stand a chance of evolving.

If as I suspect the demand for a non-physical explanation of physics is reasonable, then the hypothesis of design is perhaps one candidate. But it would have to be appraised relative to other candidates. One possibility is an explanation based upon logical or quasi-logical necessity: the universe is the way it is because it could not be otherwise. This sort of position is not easy to defend—but John Leslie has made a valiant and instructive attempt (*Value and Existence*. Totowa, N.J.: Rowman and Littlefield, 1979). Necessitarianism of this sort does not preclude design, since the Designer might also exist necessarily. With regard to Dawkins's second presupposition it should be pointed out that the program of reductionism still has a long way to go. Dawkins's explanation of modern genetics in chapter 5 ("The Power and the Archives") proceeds as if biology already could be cashed out in terms of physics. But as another champion of Darwinism concedes, "Notwithstanding the great molecular successes in genetics . . . it cannot be denied that we are still very far from a complete physico-chemical understanding of the whole spectrum of biological phenomena" (Michael Ruse, *The Philosophy of Biology*. London: Hutchinson University Library, 1973, p. 208). Admittedly it is *methodologically* sound to pursue reductionism as far as possible. Still the question whether life is really understandable in terms of physics must remain open.

Chapter 3 ("Accumulating Small Change") expounds the central idea of Darwinism that the progression from earlier species to later ones is accomplished through slow, gradual, cumulative natural selection operating on genetic variations random with respect to adaptive utility. Chapter 4 ("Making Tracks through Animal Space") is concerned mainly with the application of this general idea to a specific instance—the genesis of the human eye. Dawkins appears to reason from "It might have happened thus and so" to "It did happen that way." Thus having satisfied himself of a plausible scenario—namely, that each member of a series of Xs connecting the human eye to no eye at all was made available by random mutation of its predecessor, and that each such X worked sufficiently well to assist the survival and reproduction of animals possessing it—he also convinces himself that the scenario is true. How much better just to hold judgment in abeyance! The human eye might have originated this way, but perhaps it came about (at least in part) in some other way. (Beware of extrapolating from limited animal populations such as Darwin's finches or *Drosophila melanogaster* to the whole population of living organisms!).

Chapter 6 ("Origins and Miracles"), concerning the origin of life, is frankly speculative and anyway not directly relevant to Darwinism, which already presupposes the existence of some ancestral form of life.

Chapters 7 ("Constructive Evolution") and 8 ("Explosions and Spirals") indicate ways in which natural selection can work constructively so as to cause "a building up of complexity that has more in common with addition than with subtraction" (p. 169). Neither of these chapters, however, addresses explicitly a problem which worried Alfred Russell Wallace (a man who contributed as much to Darwinism as Darwin himself): How can natural selection explain the complexity of the human brain? More recently the philosopher Thomas Nagel has been bothered by essentially the same problem: "Even if natural selection explains all adaptive evolution, there may be developments in the history of

species that are not specifically adaptive and can't be explained in terms of natural selection. Why not take the development of the human intellect as a probable counterexample to the law that natural selection explains everything, instead of forcing it under the law with improbable speculations unsupported by evidence?" (*The View from Nowhere*. Oxford University Press, 1986, p. 81).

In chapter 9 ("Puncturing Punctuationism") Dawkins dismisses the significance of punctuationism by minimizing the difference between it and standard Darwinism. On the other hand and somewhat inconsistently he does admit one important difference between the two: "As I said, the one respect in which punctuationists do differ from other schools of Darwinism is in their strong emphasis on stasis as something positive: as an active resistance to evolutionary change rather than as, simply, absence of evolutionary change. And this is one respect in which they are probably wrong" (p. 248). It seems to me, however, that the punctuationists are at least *prima facie* right about this. It seems that there are particular life forms which actively resist evolution. Consider the "living fossils" like the ginkgo tree and *Latimeria* fish which have existed unchanged throughout exceedingly long stretches of time.

Chapter 10 ("The One True Tree of Life") is a technical and rather unrewarding discussion of alternative taxonomic systems. I found chapter 11 ("Doomed Rivals"), however, the best in the book. It contains penetrating criticisms of alternatives to Darwinism. Also very useful is the discussion of various biologically relevant meanings of the word *random*. It nonetheless seems to me that Dawkins commits what Norman Macbeth has appropriately called "the best in the field fallacy":

Darwinism has had to compete with various rival theories, each of which aimed to be a more or less complete explanation. The most famous rivals were vitalism, fundamentalism, Lamarckism, and the hopeful-monster suggestion of Goldschmidt. The Darwinians have shown that none of these theories are any good. . . . Thus the Darwinians are able to say that Darwin made a better try than anyone else, and they find real comfort in this. Does this mean that Darwinism is correct? No. Sir Julian Huxley says that, once the hypothesis of special creation is ruled out, adaptation can only be ascribed to natural selection, but this is utterly unjustified. He should say only that Darwinism is better than the others. But when the others are no good, this is faint praise. Is there any glory in outrunning a cripple in a foot race? Being best-in-field means nothing if the field is made up of fumlbers (*Darwin Retried* [Boston: Dell, 1971], p. 77).

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Darwin and the Emergence of Evolutionary Theories of Mind and Behavior. By ROBERT RICHARDS. Chicago: University of Chicago Press, 1987. 700 pages. \$29.95.

Robert Richards has given us in this book an outstanding scholarly work that functions at several levels. Richards is an historian of science located in the history department at the University of Chicago. But he is also a philosopher with appointments in the department of philosophy and the Committee on the

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Conceptual Foundations of Science. With all of these interdisciplinary credentials, it is not surprising to find his book ranging from the history of science (this is the main interest of the book), to historiography and the philosophy of history, and finally to moral philosophy. The last two subjects—historiography and moral philosophy—are handled in excellent appendices that are worth the price of the book alone; of the two the one on historiography in the history of science is the stronger. Both of these appendices are constructive and venture ambitious normative proposals on their respective subject matters. Although they add a great deal to the book, the book is primarily a history of the development of the Darwinist theories of mind, morality, and instinct, and it is as history that the book primarily should be judged. On this score, it is a truly outstanding achievement.

The basic thesis of the book is that Darwin, rather than promoting a view of humanity as amoral, competitive, individualistic, and egoistic, actually promotes a view of the human as basically social, moral, and cooperative. Furthermore, Richards argues that mechanisms and materialism were not the primary metaphysical commitments of Darwin and his most faithful followers; rather, a kind of monism or spiritualism can just as easily be seen undergirding most of the Darwinist legacy, especially in the work of George Romanes, Floyd Morgan, William James, and James Mark Baldwin.

In the first chapters of the book, Richards shows that evolutionary ideas evolved not just to solve problems in zoology but as a response to issues in epistemology, psychology, and social philosophy as well. Lockean sensationalism was the reigning philosophical school when evolutionary thinking first started taking shape in the work of Charles's grandfather, Erasmus Darwin, and Lamarck. In this view, instinctual connections are products of habits of repeated sensations bombarding the organism from the outside world. It was as if all animal organisms were really bits and pieces of disconnected machines that got connected and patterned on the basis of schemes of repeated sensations from the environment. Within this view, the further idea of the inheritance and transmission of acquired habits is also very much a part of Lamarck's position.

Darwin began his own work on evolutionary theory within this philosophical context of Lockean sensationalism and in the first phases of his work was clearly influenced by the Lamarckian position. In fact, one of the important points that Richards makes is to show that Darwin never completely gave up a Lamarckian perspective. Natural selection became the dominant explanatory position in Darwin, not the only one; the Lamarckian view was always retained as a partial explanation.

The heart of Richards's interest, however, is to provide a map of Darwin's developing ideas on morality and conscience. Darwin was greatly influenced, according to Richards, by the "moral sense" theories of the philosopher James Macintosh. Richards believes that although Darwin did not address issues pertaining to human morality in his early *On the Origin of Species*, he ended up giving a biological base to Macintosh's theory that humans have a natural moral sense that is the foundation of all ethics.

Between the writing of *Origin* (1859) and the publication of *The Descent of Man and Selection in Relation to Sex* (1871), Richards believes Darwin was working to solve the riddle of how natural selection worked with neuter ants. It was in the context of this problem that Darwin came up with his theory of community selection. And it is the theory of community selection that is the foundation of Darwin's contribution to a theory of morality and conscience. Richards

summarizes Darwin's insight succinctly when he writes, "If a community of ants, for instance, happened to produce neuters whose structure and instincts benefitted the group as a whole, the nest would have a competitive advantage over the other nests and would hence be selected" (p. 150). Darwin, Richards tells us, believed that community selection also worked in humans to provide an instinctive foundation to their moral sense—the moral sense that Macintosh advanced. This moral sense fuels our sense of duty and expresses itself in our parental, conjugal, and social instincts.

Richards believes that Darwin never committed himself to a mechanistic view of nature. The mechanism characteristic of the later synthesis of Mendelian genetics and natural selection that began to come together in the early part of this century was not characteristic of Darwin. Darwin seemed to provide for a vague trend in nature toward cooperation and social solidarity. In some of his followers, such as Romanes, Morgan, James, and Baldwin, this got picked up and embellished into a kind of monism and spiritualism. Richards surprises us by implying that this view of the world may not be entirely incompatible with Darwinism. Evolutionary theory may not be the great enemy of religion that many believe it to be.

The constructive arguments of the book are developed in the two appendices. The first appendix, titled "The Natural Selection Model and Other Models in the Historiography of Science," is a truly masterful review of the major models of historiography of science. I will list them, for the reader's information, but will not take time to discuss them: the static model, the growth model, the revolutionary model, the gestalt model (Thomas Kuhn, Norwood Hanson), and the social psychological model (J. B. Bernal, Erik Nordenskiöld). In contrast to all of these, Richards—with the help of Karl Popper, Stephan Toulmin, and Donald Campbell—develops his own evolutionary epistemology and applies it to a conceptualization of how science develops. Science develops in analogy to the dynamics of evolutionary change; it is a matter of chance variation and natural selection. It is very impressive to see how Richards uses this model in writing his masterful history. He always places each author he discusses in biographical and historical context. This is not done to convey interesting information for the uninformed reader, although it certainly accomplishes that. It is done to help us understand how these scientists learn to identify and develop their scientific problems and how they develop their hypotheses out of the richness of their personal and institutional experiences. In the case of Darwin, his experiences on the *Beagle*, insights from his grandfather Erasmus, from Lamarck, Macintosh, and Paley were all sources of the chance variation that provided Darwin with his hypotheses. But in the evolutionary model, the true is the workable over time. Hypotheses which arise from a variety of sources must be tested. The better and more adequate hypotheses are selected by the feedback of experience and endowed with a provisional and open-ended status as truth. Richards is always showing us how scientific problems arise for each of his scientists, how they got some of their hypotheses from their personal and intellectual histories, how they tested their ideas both against the data and against other theories, and how finally their theories were selected, or failed to become selected, by the scientific communities of their day. The interaction between his explicit historiography and his actual historical writing is what makes this book so outstanding.

I found Richards's contributions to moral philosophy less convincing. In his second appendix, titled "A Defense of Evolutionary Ethics," Richards further develops Darwin's theory of community selection and what it implies for the

moral motivation of humans. Here the author uses but also criticizes the sociobiological formulations of W. D. Hamilton, Edward O. Wilson, and Michael Ruse on the role of kin selection in the moral motivations of humans. He draws parallels between this more modern concept and Darwin's theory of community selection. Basically Richards develops a picture of humans as motivated by a range of conflicting instincts; some of these are egoistic but others are social, cooperative, and sympathetic. Reason is also, for Darwin and Richards, a biologically grounded human potentiality; when reason sides with our social instincts, we have conscience. Richards's position, as I see it, is close to that of William James, and I believe there is much to be said for it. The author also tries to give metaethical justifications for his position and in doing this moves into conversation with Alan Gerwirth, Alasdair MacIntyre, and others.

Richards is quite convincing except for one very important point. His contributions, from my perspective, are more in the area of moral psychology than moral philosophy as such. He has much to tell us about the biological grounds of our moral motivations; he has very little to tell us about the relevance of all this to our actual moral decisions. On this score, in spite of the author's exhaustive familiarity with the writings on evolutionary ethics, certain important positions are not mentioned at all—notably Mary Midgley's *Beast and Man* (1978) and George Pugh's *The Biological Origin of Human Values* (1977). These positions go beyond an interest in moral motivation and suggest that evolutionary theory may be able to provide rough indices of central human tendencies and needs which moral arrangements should attempt to nurture, stay within, and hierarchically organize. This line of argument, which other contemporary evolutionary ethicists have also developed, seems not to interest Richards. What he does argue for is convincing to me, but it seems to have more to do with moral psychology than ethical theory as such. He leaves us with the feeling that Darwin tells us that humans have inclinations to be moral but that he has little to say more directly about what being moral might truly mean. When communally-oriented people come into conflict, does Richards's Darwin help us resolve this collision of social instincts?

But remember, all of this is mainly in the second appendix. The core of the book is historical, and for my money, very good history at that. In this book, Richards has clearly established himself as one of the leading historians of science of our day.

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American Religious Empiricism. By WILLIAM DEAN. Albany, N.Y.: State University of New York Press, 1986. 150 pages. \$44.50; \$14.95 (paper).

William Dean, professor of religion at Gustavus Adolphus College and a leader in the current revival of interest in empirical theology, has written an important and original study of American religious empiricism which will be of interest to those concerned with the relation of science and religion. Religious empiricism associated especially with the University of Chicago represents an attempt to reconstruct religious thought based on a thoroughgoing acceptance

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of scientific method and the naturalistic worldview. Dean's style is lively, includes color and wit, and is clear and accessible to the non-specialist.

The book is a program for the development of religious empiricism rather than an historical study. Its thesis is that religious empiricism is a uniquely American theological vision which is a viable position in the present. Dean feels that neo-orthodoxy and its kin temporarily eclipsed religious empiricism, but the emerging post-modern sensibility reveals that the revival of supernaturalism was the last gasp of an expiring system. Meanwhile, religious empiricism's rooting in pragmatism means that it has long affirmed the recently rediscovered "end of the modern era." Thus religious empiricism and deconstructionism are congenial. But the further development of this empirical tradition waits upon an historical presentation of its insights, a presentation which reveals the divine creative activity immanent in concrete, particular histories.

Dean sees several themes as central in religious empiricism. Belief is to be based on experience, but experience is understood as richer than any verbal description of it, and as encompassing aesthetic, religious, and moral perceptions and not merely "sense data"; this radical empiricism is thus a child of British empiricism, but a rebellious child. Theology is the constant reinterpretation of the past, and trust is placed in the emergence of new, more encompassing visions. God is identified with a creative process within the one world of nature.

This empirical liberalism is distinct from the pietistic liberalism of German idealist theology in that it is post-modern. Modernity was a protest against the authoritarianism of tradition. It insisted on the autonomy of interpretation. But in opposing the pre-modern fixity of interpretation, modernity sought certainty in an indubitable foundation for thought, in concepts like sense data, clear and distinct ideas, intuition. This in turn inevitably betrayed the promise of modernity by generating new fixities in movements as diverse as totalitarianism, positivism, and neo-orthodoxy.

Dean's sketch of deconstructionism as a protest against modernity is skillful and perceptive. The post-modern literary critics insist on the autonomy of interpretation, the freedom of the reader from the tyranny of the text. Dean is aware—as many are not—that this is in part a somewhat neo-Kantian attempt to mark off humanistic studies as isolated from scientific reason. According to dean, Jacques Derrida maintains that the error of modernity and pre-modern tradition alike is the claim that language reflected and is therefore responsible to reality, that it replicates the logos-structure of being. It is this which must be deconstructed. We must renounce this "logocentric" claim and admit that language is interpretation and that it is based on prior interpretations. Dean quotes the neo-pragmatist Richard Rorty who makes a similar point: "It is interpretations all the way down" (an allusion to William James's story about the turtles on whose backs the world rests). What remains is a form of play, the free interpretation of texts without the controlling presence of Being. The historical texts which we reinterpret include all human gestures, whether in art, politics, or warfare; thus historical events are interpretations, and serve as texts for further interpretation. The writer's work is free and interpretive rather than imitative.

Dean claims that those deconstructionists who draw a subjectivist conclusion from this overlook Derrida's historicism. It is false that the objective meaning of a text disappears and that its meaning is thus the free construction of the interpreter. The subjectivist misunderstanding of Derrida reflects the dualism

of modern thought: if knowledge is not objectively certain it is a subjective creation. Dean presents historicism as a third option; perhaps he is sensitive to this because of the concept of "contextualism" or "objective relativism" present in American pragmatism. This third option admits that all perception is conditioned by the perspective of the knower, but that nevertheless some genuine characteristics of the object are disclosed; while we do not know the object purely, we do grasp it *as it appears to the subject*. Thus interpretation is partly a free creation and partly a reflection of the given text. In terminology Dean does not use, interpretation is objectively relative—relative to the interpreter, yet a disclosure of the object.

This deconstruction of modernity's quest for certainty applies only to human historical works, and is probably part of a recurrent Continental attempt to isolate culture and science. Religious empiricism, however, is an interpretation of nature as disclosed in science and sees nature and human culture as continuous. Therefore, Dean adds a deconstruction of nature based on John A. Wheeler. In this view, nature is itself historical and lacks a fixed, eternal structure. Current cosmological speculation sees "natural law" as applicable just to the epoch between the "big bang" and the "big crunch." And quantum mechanics shows that the act of observation alters that which is observed. Thus "logocentric physics," physics interpreted as a reflection of the changeless structure of being, is deconstructed. The structure of nature is generated partly by the causation of the past and partly by interpretation in the present. As before, Dean maintains that this does not lead to subjectivism.

Dean believes that because of its roots in radical empiricism and pragmatism, American religious empiricism is compatible with deconstructionism. Paraphrasing Rorty, he says that when Continental thinkers arrived at the end of the road they found James and John Dewey waiting for them. Deconstruction is incompatible with theology that is ontological, that speaks of the eternal nature of God. Further, deconstructionism will contribute to religious empiricism a deeper sense of history, which will enable it to make clear its basic intuition of a divine creative activity in nature.

A problem arises here. It would seem that naturalistic theology makes an ontological claim or two of its own. Deconstruction will deepen empiricism's sense that the idea of the divine is the result of historical interpretation and reinterpretation. Yet in religious empiricism, God is not merely a sign, but is an interpretation of nature's creativity as it is perceived and valued by persons. Does Dean's adopting of the terminology of Derrida prevent him from granting the ontological claim in religious naturalism?

Dean says that the central claim of religious empiricism is that nature displays a "tropism toward complexity." This is an aesthetic perception, but it engenders a religious response because this tendency is pervasive throughout all levels of the cosmos, and because the experience of it is intrinsically valuable and the matrix of connections which it weaves is life-sustaining. This is a claim about nature, but it is an interpretation of nature—as Dean's deconstruction makes clear—from the point of view of human interests and needs. Is it incongruous to claim on deconstructionist grounds that nature has a certain character? Isn't this an ontological claim? Dean is deeply aware of this problem and is admirably self-critical in confronting it.

Dean replies that Derrida merely criticized the metaphysics of being as exemplified in those theologies which claim to reflect eternal structures; he wished to free thought from this notion which denies the free growth of interpretation. For Dean, Derrida's criticism does not apply to religious empiri-

cism because it knows that its concept of the divine creative activity is an historical interpretation of nature from a certain perspective. Yet the fact remains, if we understand "interpretation" in an objective relativist way (and not in a subjectivist way), then the religious empiricist's interpretation of nature is a claim about aspects of nature. It is not clear that this would become acceptable to deconstructionists merely because that structure which is discerned is not said to be changeless and beyond interpretation.

By the way, the later works of Henry Nelson Wieman, which are not discussed by Dean, turn away from the idea of a cosmic creativity and center on that creativity present within a certain sort of communication called "creative interchange"; in Dean's terms, the dialectic of interpretations. Wieman moved in this direction precisely because he was aware of the problem of characterizing a cosmic process on pragmatist grounds.

As Dean says, religious empiricism believes in something real, although it is less than universal and eternal. If we begin with that dualism characteristic of modernity, and we come to doubt that objective values are housed in the supernatural realm, then value will appear as a subjective imposition on the facts. Dean makes clear that if we begin as does religious empiricism with the continuity of nature and the human spirit, then human valuing is seen as a disclosure of the valuable within nature.

The above themes central to the book are presented in the introduction and the first two chapters. An additional chapter deals with the ways in which religious ideas are tested in religious empiricism, which may be of interest to students of history and the social function of religion. A sketch of a Whiteheadian aesthetic is presented which stresses the empirical as opposed to the intellectualistic side of his thought.

The conclusion of what I have presented as Dean's thesis is in his last chapter. American religious liberalism has failed to gain wide recognition because it has not made clear the concrete, local, personal reality of the divine creative activity which it discerns. It has not shown how its concept of the tendency toward complexity can be used to reinterpret historical events and personal experience. The poet William Carlos Williams is presented as a student of American empiricism who has a sense of that which is disclosed in the everyday and close at hand. Religious empiricism must develop narrative histories which interpret the religious reality disclosed there in its own naturalistic terms.

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Religion, Science, and Public Policy. Edited by FRANK T. BIRTEL. New York: Crossroad, 1987. 152 pages. \$16.95.

Given the title of this collection of essays, one anticipates a discussion of how and why religious and scientific institutions and/or individuals might cooperate in establishing appropriate policies, and what these policies might be, concerning ethical issues raised by scientific, medical, and sociological developments.

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John Noonan addresses the comprehensive question of how a religious institution ought to formulate a stance with regard to a controversial issue by specifically outlining how the Catholic Church has addressed the nuclear arms race and abortion. The essay is articulate, and though highly supportive of the Church's policies themselves, it also informs the reader of the potential pitfalls that are inherent in such endeavors by religious institutions.

Save Noonan's chapter, however, there is no specific reference to policy formation at all; rather, this is a collection of public lecture texts examining the epistemological relationships between religion and science. Inasmuch as each chapter is independently presented by different authors, the style and complexity are highly variable, though all are theological in language and approach. From either a scientific or a theological perspective, however, the text is well worth reading. Interesting and significant parallels within the endeavors of theology and science are presented, useful in the development and assessment of models and metaphors in both fields. Yet there is no acknowledgement that because the very foundation of theology is the interpretation of the nature of God, a concept that cannot be incorporated into scientific explanation, the parallels sought in theology and science cannot and do not generate an equivalence of realities.

Frank Birtel's preface provides a unifying thesis for the otherwise diverse essays in the collection: "There cannot be two ways of knowing that contain distinctly different methodologies and means of corroboration. What is proposed is a radical break with the past epistemological bipartite of science and religion . . . [to offer] a framework for interpreting what has come to be called post-modern science" (p. x). Though the reader remains mystified as to Birtel's referent when he states that "without the anomalies caused by post-modern science, a shift in model would not have occurred" (p. xi), his introductory remarks concerning each of the contributed chapters helps focus upon the theme and intent of the individual authors more clearly.

Arthur Peacocke of Oxford authors the first two essays in the collection. In the first, he provides a concise analysis of the working approach scientists use, a "sceptical and qualified realism" (p. 16) which outlines the strengths and limitations of the so-called scientific method. He concludes that "because of experimentation . . . the attribution of reality to postulated entities can change from doubt . . . to successful application . . . to an assured confidence in their existence" (p. 17), and that the "models, and the metaphors they generate, should be sufficiently flexible to . . . be capable of generating new inquiries" (p. 20). Given this framework, Peacocke draws a parallel form of critical realism for the role of theory (doctrine) and model (metaphorical imagery) in religion. The parallel is acknowledged as incomplete, however, inasmuch as "the model of God . . . as Creator, Redeemer, Sanctifier, is a root metaphor which has a comprehensive role at the summit of a hierarchy of theological models and metaphors explicating religious experience, and no scientific theory yet stands so in science" (p. 23). And indeed it seems that no scientific theory (or law) can stand in such a position: this difference describes the very basic distinction between science and theology, and failure to address the significance of this difference leaves the reader unconvinced that a bipartite characterization of the fields is in fact inappropriate.

Peacocke's second essay specifically addresses evolution within a theological context. Again his introductory descriptions of the evidence for evolution, historical responses to Darwinism, and the establishment of evolution as fact are generally concise and cohesive. He then nicely transfers the reader's focus

to humanity's nonbiological needs which arose when self-awareness and consciousness evolved in the human species, leading to the conceptualization of God, and thus establishing a theological reality. But then Peacocke invokes the simplified and disappointing thesis that theology thus has "to develop the notion of God as exploring in creation, . . . of unfolding fugally all the derivatives and combinations inherently possible for and derivable from the tune he originally called" (p. 46). This imposition of God upon evolution is not an integration, nor even an overlay of one concept upon another; it is a denial of the very core of the evolutionary process—that the emergence of complex and diverse forms is without design or intent.

In an essay entitled "Is Religious Faith Possible in an Age of Science?", Langdon Gilkey demonstrates that while "modern societies structured around an ideological center have replaced archaic societies structured around a religious center" (p. 53), there remains a need to retain some form of "the religious" in order to continue to address the "limit questions" which have been posed in all cultures throughout time (p. 55). Gilkey then briefly delves into the interactive roles of science and religion in a scientific age, with particular attention paid to the significance and limitations of symbols in each. His presentation is rational, enlightening, and supportive of both religion and science within society, calling for a creative faith that will address religious dilemmas and support scientific creativity and intellect. "At one time, science seemed to make religion difficult if not impossible, not only because religion had claimed the competence of science in matters of fact, but also because science had usurped the role of religion as the sole effective redemptive force in history. Now that both have largely ceased to make these claims, their ancient warfare may be said to have ceased" (p. 62).

The next two chapters provide historical perspectives on the inclusion of a cosmological framework in current Christian theology. Richard Westfall's essay "Newton and Christianity" focuses specifically on the dilemma Newton faced in making his theology and science consistent. "Newton did not find God in nature. Quite the contrary, he imposed God upon nature" (p. 81). Westfall's account is insightful, albeit narrow, providing an interesting assessment of Newton's theological works (save for the concluding section in which he responds to critics of his analysis). Stephen Toulmin's account of the universalization of Christianity, its focus upon the individual rather than on a people, and the reinforcement of these theological choices by several themes in Greek philosophy, provide a coherent backdrop for his equally concise summary of modern philosophical thought. Toulmin attributes the current efforts toward "the reintegration of humanity into our larger picture of nature" (p. 75) as a result of the growth of science into such areas as ecology, which studies the impact of humanity upon nature, and of behavior, in which humanity is both the subject and the observer, and in molecular biology and subatomic physics, where experimentation requires indirect and often predictive modes of thinking, model building, and data assessment. Toulmin's presentation is a timely piece. It provides a basis for useful and ongoing dialogue between theology and modern science, although the potential for a repetition of Christianity's prior error of "invest[ing] their intellectual credit too deeply in ideas and beliefs about nature . . . that might subsequently default" (p. 68) remains.

Karl Peters seeks to draw "analogous maps" of reality via scientific—in this case nonequilibrium thermodynamic—models and theological metaphors of creation. He presents a parallel between the effects of random fluctuation within the limits of natural laws in creating new forms of matter or levels of

order in the physical world, and the metaphorical roles of the Spirit (fluctuation and change) and the Word (laws and order) of God in divine creation. The analogies are thought-provoking and quite well developed. The difficulty lies in Peters's attempt to extend the analogy to include a trinitarian metaphor: "While scientists, who consistently maintain a naturalistic world view, might acknowledge Spirit and Word as metaphors that point to a process that science might also portray with its own map of how creation occurs, they are often most reluctant to speak of God the Father, if that means a reality that ontologically transcends nature or the universe" (p. 109). Indeed, the Spirit and Word metaphors were neatly stretched and blocked onto the thermodynamic model, but the inclusion of the Father imposes upon and thus weakens the entire effort, much as Peacocke's overlay of divine intent upon evolution imposes unacceptable implications to a "scientifically and theologically congruent reality."

Philip Hefner addresses the interaction of a totally different aspect of the scientific-theological sphere: sociobiology and ethics. As Hefner states, "to relate sociobiology to ethics and to introduce theological dimensions to the discussion is to invite . . . murkiness" (p. 123). Hefner initially avoids this pitfall as he discusses the evolution of consciousness, time-representation, reason, and morality, and explores altruistic behavior as an example of areas at which sociobiology and ethics readily intersect. The murkiness enters when Hefner seeks to coalesce evolutionary biology and cultural development: "for the theologian, who is attempting to relate the things of worldly existence to God, this complex system of biological and cultural information, mediated by the brain, is the means that God has chosen to unfold the divine intention and to bring nature/matter to fulfillment" (p. 129). From this perspective, Hefner attempts to overcome the dichotomy between the *is* and *ought* by identifying "primary value systems" underlying our seventeen billion year evolutionary history: "it is the task of ethics to properly discern what sociobiology is telling us about the *is* so as to direct our actions properly" (p. 133). From a scientific perspective, imposition of value emergence onto evolution is wrought with difficulty. Hefner's ideas are worthy of further consideration, but his thesis would be strengthened considerably by a careful discussion of how he defines the "primary values" as opposed to biological needs, morality, and reason. By not providing a specific and detailed delineation of these terms, Hefner allows the murkiness to remain in a discussion which has the potential to contribute significantly to our understanding of both sociobiology and ethics.

This collection would have provided a broader base for the science-religion dialogue had comparable chapters written by scientists been included. Nevertheless, these essays represent a useful initiative in several areas, and they merit careful reading and further contemplation. Whether scientist or theologian, one gains insights into and clearer perceptions of important parallels between scientific and theological endeavors.

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