Reviews

Although Zygon *thus far has not yet exemplified it, our hope has been to bring to our readers some inklings of the widespread literature pertaining to the yoking of religion and science often scattered in journals and publications of varied character. Some of the books and journal articles reviewed in the following pages represent a sample of the direction in which we contemplate moving. One element is the extended review, or review essay. The Editor will welcome comments and suggestions on this task, as well as suggestions and volunteers for the reviewing.*

R. W. B.

Issues in Science and Religion. By IAN G. BARBOUR. Englewood Cliffs, N.J.: Prentice-Hall, Inc., 1966. x+470 pages. $5.95.

Apparently designed primarily for use as a textbook in a college course on religion, this book is worthy of the strongest recommendation to anyone concerned with the nature and status of religion in this age of science. Its author is unusually, if not uniquely, competent to carry out the assignment indicated by its title. He has earned both the Ph.D. degree in physics at the University of Chicago and the B.D. degree in theology at Yale University. He is currently chairman of the Department of Religion and professor of physics at Carleton College, a Siamese-twin type of academic appointment rarely found nowadays in American institutions of higher learning.

Ian Barbour's father, a long-time friend of mine, is an outstanding geologist with an international reputation for his highly productive research in the earth sciences. Ian comes honestly by his well-developed scientific habits of mind. And knowing his mother as I do, it is evident that he also comes honestly by his dedication to the quest for a theology that is thoroughly respectable in the light shed by the new knowledge about the nature of the universe and of man.

True to the widely accepted pedagogical tradition, a brief introductory chapter is followed by a historical survey of the ideas advanced during the last four hundred years concerning the relations between science and religion and the prerogatives of each. Here one finds in clear, concise, and nontechnical terms admirable précis of the agnosticism of Hume, the dualism of Kant, the nineteenth-century reaction to evolution, and the neo-orthodoxy, existentialism, and linguistic analysis of the twentieth century. Summarizing his own reaction to the voices of the past, Dr. Barbour maintains that, "when correctly expressed, analysis in theological terms is not displaced by analysis in

scientific terms, since science and theology ask fundamentally different sorts of questions. In an age dominated by religion, it was necessary to assert the independence of science. Today, in an age dominated by science, it may be necessary to assert the independence of religion."

Before proceeding with that assertion, however, he further prepares its foundation by devoting the four chapters in the second part of the book to a critical examination of the methods of science vis-à-vis the methods of religion. The characteristic tone of his thinking is indicated by such statements as these: "Now if one sees science as the positivists do, and the humanities as the existentialists do, one does indeed have 'two cultures' of opposite characteristics. 'Intermediate' fields would have to choose one camp or the other. But we have suggested that the dichotomy is unsound. Science is a more human enterprise and the humanities have more universal intent than these images suggest, and the 'third culture' (the social sciences) has much in common with both; we have a spectrum of fields, not two opposing camps. . . . Both subject and object contribute to knowledge in all fields, and all events can be treated as unique or as lawful."

The last four chapters of the book deal with "Religion and the Theories of Science." Here the author's talents of creative imagination are fruitfully at work. His critique of the physical principles of indeterminacy and complementarity is lucid and convincing, as one would expect from an excellent teacher who is also a well-informed physicist. But so, too, is his treatment of the new knowledge about the genetic code and brain physiology, in the life sciences. As for physics, "it would be as dubious to attempt to build a metaphysics of idealism on modern physics as it was to build a metaphysics of materialism on classical physics." As for the life sciences, the "recognition of both the diversity of activities at various levels and the continuity between levels enables us to avoid the ontological discontinuity of dualism as well as the one-level metaphysics to which reductionism usually leads."

All of which brings the author to the book's concluding section, which he modestly entitles "Toward a Theology of Nature." This he insists is not a "Natural Theology," in the classical sense of that term. Stemming in part from the presence in man of levels of activity not found among other creatures, and stressing the concept of continuing creation, it envisions God as "creative influence," acting not by coercion but by evoking the response of his creatures. "Only in worship and reverence can we acknowledge the mystery of God and the pretensions of any human system that claims to have mapped out his ways."

Enthusiastic as I am about Ian Barbour's cogent thinking, several places in his presentation seem repetitious. I was reminded of the old-time preacher who said that in every sermon "he told 'em first what he was goin' to tell 'em, then he told 'em, and lastly he told 'em what he had told 'em." This may be good pedagogy, especially for college freshmen or sophomores during their initiation into new realms of cognitive inquiry. Should it annoy more mature and better informed readers, they will, however, find in this brilliant book satisfactory answers to many prickly philosophical and theological ques-

tions. I commend it most heartily to anyone who has ever worried about the validity of religious aspirations in a technological culture such as ours. (As I said before!)

KIRTLEY F. MATHER

Harvard University

Of Molecules and Men. By FRANCIS CRICK. Seattle: University of Washington Press, 1966. 99+xiii pages. $3.95.

This book has two aspects. On the one hand, it gives, in the second lecture, a simple and lucid account of the molecular biology of a bacterium, *Escherichia coli,* that has been more intensively investigated than any other organism. It is in this field that the author has made such distinguished contributions, and this lecture is a masterpiece in the exposition of one of the most important scientific discoveries of our time.

The first lecture, "The Nature of Vitalism," is frankly polemical, attempting to establish the thesis that all biology will eventually be reduced to physics and chemistry.

> The ultimate aim of the modern movement in biology is in fact to explain *all* biology in terms of physics and chemistry. . . . It is my argument that our present general knowledge of physics and chemistry is sufficient to act as an exceedingly solid foundation though, let me add, much of the *detailed* chemistry is incomplete and needs much further study.

One wonders why chemistry secures so exalted a status. Could not a physicist as well maintain that all chemistry will eventually be reduced to physics? Perhaps Dr. Crick would subscribe to such a view. But let us consider instead the alternative—that chemistry gives an account of properties of matter that are not simply derivable from physics—that, in fact, chemistry is concerned with new emergent properties of matter in molecules that were not predictable from physics. These properties represent a development under new boundary conditions in the manner of the concepts developed in Michael Polanyi's recent book, *The Tacit Dimension.* Then, in logical sequence, I would propose that in biology there are new emergent properties of matter in living cells that were not predictable from physics and chemistry. I am aware that this will be labeled "vitalism."

What is vitalism? According to Crick: "It implies that there is some special force directing the growth or the behavior of living systems which cannot be understood by our ordinary notions of physics and chemistry." But many biologists are now recognizing the failure and sterility of reductionism in biology, where it has become enthroned as some sort of religious dogma. Crick recognizes this association in a curious manner. "I have a strong suspicion that it is the Christians, and the Catholics in particular, who write as vitalists, and it is the agnostics and atheists who are the antivitalists."

I would regard this postulated "directory force" as a naïve concept in relation to biology; rather, I would postulate that in biology there are new emergent properties of matter not predictable from chemistry, just as chemistry is not predictable from physics.

In particular, the new developments of molecular biology exhibit these emergent properties in relation to information coding, storage, and transfer. Crick even seems to recognize in a tentative manner this emergence.

> In a certain sense it could be argued that natural selection is such an extra law, and I would certainly think it was a law of the most fundamental importance for biological systems. . . . Evolution may, therefore, for all we know, not be so susceptible to exact prediction.

Modern evolutionists, such as Simpson and Dobzhansky, deny the predictability of evolution. For example, Simpson in *This View of Life: The World of an Evolutionist* (1964) states:

> The fossil record shows very clearly that there is no central line leading steadily, in a goal-directed way, from a protozoan to man. Instead, there has been continual and extremely intricate branching, and, whatever course we follow through the branches, there are repeated changes both in the rate and in the direction of evolution. Man is the end of one ultimate twig. . . . Both the course followed by evolution and its processes clearly show that evolution is not repeatable.

The third lecture, "The Prospect before Us," is at a much more superficial level than the two preceding lectures and, at times, is almost at the gossip level. There is the conventional write-up of computers and their future, a great deal of which is pure fantasy. After all this mystical nonsense about computers, Crick proceeds to criticize the "soul" destructively. It is not at all clear what he is really talking about in this case, but he cannot resist using flippancies and gibes, such as in the following quotation:

> One difficulty about the soul is to know when it originated in evolution—most people would agree that all human beings have souls (though no doubt there are a few eccentrics who think that they are denied to women), but it is not at all clear whether a chimpanzee or a dog can have one.

He then proceeds to make a naïve statement like the following:

> I myself, like many scientists, believe that the soul is imaginary and that what we call our minds is simply a way of talking about the functions of our brains. The real difficulty comes from the vividness of our experience of consciousness, and even that is a matter to some extent of degree, since we can be conscious to various extents, either when we are half awake or when we are sleep-walking.

It will be noted that there is a confusion among soul, mind, and conscious experience or self-awareness. It is essential in discussions of this kind to separate the religious concept of the soul from the self-conscious experience which we can all talk about, as for example in all perceptions, memories, etc. It is pointless to state that "what we call our minds is simply a way of talking about the functions of our brains." Such statements are meant to provide a general atmosphere of soothing numbness in a field in which the most rigorous and critical inquiries are required.

We are told that, "once one has become adjusted to the idea that we are here because we have evolved from simple chemical compounds by a process of natural selection, it is remarkable how many of the problems of the modern world take on a completely new light," as if this were a completely established scientific position, which is certainly not the case. In fact, I would regard such

a statement as having the same status as a dogmatic religious assertion. As with all dogmatic statements, important problems are ignored, and one is presented instead with the simple dogma. Of course, Crick covers himself by stating that investigation of the nervous system is a "scientifically backward area of study." This would seem to indicate that Crick is poorly informed regarding the investigations of the last few decades!

SIR JOHN ECCLES

Institute for Biomedical Research
American Medical Association

The Bridge of Life: From Matter to Spirit. Credo Perspectives. By EDMUND W. SINNOTT. New York: Simon & Schuster, 1966. 255 pages. $4.95.

In this tightly packed and well argued volume, Edmund W. Sinnott returns to the themes he has made familiar to his readers in such previous works as *Cell and Psyche, Two Roads to Truth,* and many articles in an attempt to reconcile two world views usually held incompatible: theism and materialism. The significant contribution which the present book makes lies in its more logical and thorough recapitulation of the author's philosophy of emergence and in the urgency of the message calling for a world outlook that does justice to the values of truth, beauty, and goodness in the threatening atmosphere of nuclear war. Sinnott here is not merely a philosophical biologist, he is an impassioned evangel for world betterment.

The author firmly believes that mechanical materialism must be rejected, and he usually associates naturalism with materialism, while A. S. Pringle-Pattison wrote persuasively of a higher naturalism to explain a position not far from Sinnott's. The author also writes of the need for unification of men's thoughts and actions, especially under the threat of that materialistic philosophy which goes under the name of communism; but here again distinctions could have been made. While communism is a force to be resisted in its political manifestations by democratic methods, the cosmic philosophy of dialectical materialism is much more akin to theories of emergent evolution in the West than to the mechanistic views so rightly rejected by the author. Even such a vigorous critic of communism as Sidney Hook acknowledged this long ago.

Sinnott rejects the charge that he is to be relegated to the dubious realms of "mysticism" or "vitalism"; and those who have classified him as a vitalist would do well to read this work carefully, for they would note that he rejects the little "entelechies," those souls animating the cells of the body, according to the views of the vitalists. His reconciliation of science and religion lies in the general theory of levels made familiar by such philosophers as Bergson, Alexander, Smuts, Boodin, and, in our own time, by Teilhard de Chardin and Errol E. Harris. He emphasizes the development of the universe from matter to life, from life to mind, and from mind to God, known intuitively through aesthetic and ethical values as well as through the man of science's devotion to truth. This whole emergent process is characterized by protoplasmic patterns which condition not only the development of all forms of life but, in the mind of man, his psychic strivings and ideals. Here Sinnott seems to approach the double-aspect theory of body and mind elaborated by Spinoza.

Sinnott thus attempts to do justice both to a rejuvenated materialism open to the goals and ends present within the living organism and to a theism of divine immanence which he is able to harmonize with liberal Christianity, while remaining aware of the grave evils and injustices of organized religion in the past. It is a noble endeavor, providing the finishing touch to the great contribution of one who has pondered deeply the rival philosophies of mechanism and spiritualism. Yet, I shall be so bold as to make a few observations as to how the distinguished author could have strengthened his hand.

In addition to the approach of emergent organization, the author refers to the much-discussed Heisenberg principle of indeterminacy; he writes: "There is room in the atom for decision and choice—and so, perhaps in us as well" (pp. 83–84). This is an unfortunate way of presenting the issue, as if the whole problem of science and religion, of ethical goals, depended on choice within the atom and as if the atom were a psychic rather than a material entity. Just what bearing the principle of indeterminacy has on issues of atomic physics is a moot point among physicists themselves, and such a short-hand summary of the problem, ascribing decision both to the atom and to man, will mislead the author's critics, who may again raise the old battle cry of "vitalism!"

Sinnott is on much firmer ground when he stresses the protoplasmic patterns of organization at many levels within the organism, or in the various forms of life, so that new properties (such as consciousness and values) emerge only at complex levels in the time sequence of an evolving universe and are not to be read back within the atom itself. It is the rise of emerging levels with their own distinctive properties and qualities, and all in some way related to protoplasmic organization not to be reduced to chemistry and physics without a remainder, which provides the strength of Sinnott's synthesis. Not so persuasive are his occasional explorations of that other road which in popular but uncritical works searches frantically for an immaterial, psychic atomic force and then concludes erroneously that all problems are solved, since matter as such is not really there; we may invoke the ghost of George Berkeley!

A second observation has to do with the bridge of life so well adumbrated by the author in chapters entitled, "From Matter to Life," "From Life to Man," "From Life to Self," "From Life to Mind," and "From Life to God." The author tends to base his major argument on the superior sensitivities of distinguished men who aspire to the values of truth, beauty, and goodness as attributes of God. It would seem that God is reached only after all the bridges have been built, as if he were the vision perceived from the last bridge. And yet such a modern theologian as Paul Tillich constructed his whole theology on a re-establishment of the old *Logos* doctrine, the cosmic Reason creatively present *at all levels* of organization and not merely at the level of immaterial ideals. Sinnott could embrace an emergent materialism with more audacity were he to realize that the various levels of evolving matter are precisely the ways in which God manifests himself in the world. God realizes himself through the universe and not merely through the values of his worshippers. Tillich and Teilhard de Chardin presented a cosmic theology in which the levels of matter are integral.

A third observation has to do with the author's repeated emphasis on the

necessity of the world accepting such a spiritual philosophy as he delineates in order to overcome the threat of present-day materialism in its many forms, from behavioristic psychology to communism. But may not naturalists, humanists, and theists of many varieties collaborate on specific issues of peace and world order, and through such dialogues and ensuing action, learn to appreciate each other's contributions and reformulate their views in a search for a common philosophy? The world views need not be common at the start of the dialogue—they may well be at the end.

In spite of these minor observations, this volume is a tribute to a great man of science who, however much criticized by his peers for his explorations of biology and religion, has kept his sights on the distant vision of the eternal values and their inexhaustible nourishment for the mind and soul of man—that mind which stands as a "summit character" of our planet and is prepared and woven out of the stuff of the universe. In an age of confusion, doubt, and existentialist despair, this is no mean achievement.

ALFRED P. STIERNOTTE

Quinnipiac College

The Phenomenon of Life: Toward a Philosophical Biology. By HANS JONAS. New York: Harper & Row, 1966. x+303 pages. $6.00.

This volume consists of eleven philosophical essays ranging over a wide variety of topics at whose center are life and man. In these penetrating studies the author takes radical issue with the materialistic outlook of natural science and the anthropocentric ones of idealist and existentialist philosophy. Scientific biology is bound to *res extensa,* to the motions of matter distributed in space and time, and is therefore constrained to render essentially the same account of life as of the lifeless. It thereby neglects the distinctive features of life and, moreover, fails to allow for that perception and thought which constitute its own being and which are a manifestation of life's becoming aware of itself—something totally alien to *res extensa.* Idealistic philosophy, in contrast, by seizing on the mental half of the mind-matter dualism within which modern science developed, is equally incapable of giving an account of life, whose central characteristic is the unity of extension and inwardness. Existentialist philosophy, on its part, is generally too intent on stressing man's unique and isolated place in the universe to recognize that some of the dimensions of human inwardness have more primitive counterparts or are prefigured in the extra-human organic world.

Life, whose origin itself is closed to us, Professor Jonas argues, presents itself as an ascending scale, reaching from plants through animals to man, in the direction of increasing scope and distinctness of experience and, concurrently, of progressive freedom of action. The theory of evolution, conceived in a materialistic climate and itself the instrument of materialism's final triumph, implicitly transcended its own philosophical context. "If man was the relative of animals, then animals were the relatives of man and in degree bearers of that inwardness of which man, the most advanced of their kin, is conscious in himself" (p. 57). The dualism by which natural science

was given exclusive cognitive reign over the "inanimate" as well as the "animate"—alike conceived on a mechanistic basis—and whose credibility rested on the existence of a *res cogitans* vis-à-vis these mechanisms, an inwardness lodged solely in man, this dualistic sundering of mind and matter with the extrusion between them of "life" cannot be maintained once man is deprived of the uniqueness which this philosophy assigned to him. But where, then, "can we draw with reason a line with the 'nothing' of inwardness on its far side and the incipient 'one' of it on the near side? Where else than at the beginning of life can the beginning of inwardness be placed? But if inwardness is coextensive with life, a purely mechanistic account of life, i.e., one in outward terms alone, cannot be sufficient. The subjective phenomena defy quantification and accordingly cannot even have outward 'equivalents' substituted for them" (p. 58).

Elemental inwardness, the author contends, emerges in life's metabolic mode of being. The living form possesses an identity which is not only different from the material identity of the lifeless but is sustained by the very act of exchanging matter with the surrounding, that is, by *not* remaining the same matter. This peculiar independence of form with respect to its own matter is primordial freedom. At the same time, it constitutes the fundamental manifestation of selfhood—of an identity which is not graspable by purely external, physical description but is "continuity comprehended as self-continuation" (p. 82), "an identity which from moment to moment reasserts itself, achieves itself, and defies the equalizing forces of physical sameness all around" (p. 83). With selfhood comes also "absolute otherness," the foreignness and oppositeness of all of that which is beyond the boundaries of the organism: the polarity self-world appears in its most rudimentary form. This polarity is not only that of separateness, of the organism's self-isolation with respect to the environment, but also that of the organism's turning "outward and toward the world" (p. 84). Its self-continuation is an "openness" for other being. Openness toward the world is basic to life on all levels.

In animal life, inwardness, freedom, and self-world polarity show decisive new horizons. The relative immediacy of the plant-environment relationship gives way to pronounced mediacy. Perception, emotion, and motility, the characteristics which distinguish animal from plant life, imply "distance" in space and time between organism and related objects: the animal perceives at a distance, feels needs which are (or fail to be) satisfied at a later time, and moves about in space to reach the material substances required for its metabolizing process and, hence, its survival.

Long-range perception and motility establish the duality of subject and object. The separation between them provides an expanded scope of freedom (and hazard) and also the ground for the modes of subject-object relation—perceptive, active, and emotional—which constitute a new kind of unity.

For the animal, perception, emotion, and motility are the necessary means of self-preservation: the new scope of freedom is bound with necessity. But they are not only means—because the animal strives to preserve itself not just as a metabolizing entity but as perceiving, feeling, motile being. Thus the means become aspects of the end.

That ends constitute an essential dimension of life is persuasively urged in a number of ways, most notably in a carefully argued critique of cybernetics, the science which "is an attempt to account for purposive behavior without purpose, just as behaviorism is an attempt at a psychology without the 'psyche,' and mechanistic biology a description of organic processes without 'life' " (p. 120).

The making of images is interpreted as an especially revealing phenomenon marking the step from animal to man. It manifests a new and critical level of mediacy. In image-making, a form of things is separated from their concrete reality. Objects become present in imagination and representation. The mental sphere emerges. Form, *eidos,* detached from actual objects, becomes available mentally for apprehension and discourse. A new distance between subject and object and a new way of bridging this distance appear.

A further level of mediacy unfolds with the dimension of reflection, "where the subject of all objectification appears *as such* to itself and becomes objectified for a new and ever more self-mediating kind of relation" (p. 185). Here the subject-object split reaches its extreme form, and true man emerges. "Only over the immeasurable distance of being his own object can man 'have' himself. But he does have himself while no animal does" (p. 186). Questioning himself, his place and part in the scheme of things, comparing, modeling, and judging himself after the image of what is man's—an image which is worked out in the intercommunication of society and never leaves him, whether in acceptance or repudiation—he learns to say "I" and "discovers his own identity in its solitary uniqueness" (p. 186).

After developing this interpretation of life in the Introduction and first seven essays, the author turns in the remaining four to several key topics in man's attempts to meet the question of his own being: the meaning and relation of "theory" and "practice" in classical versus modern understanding and the implications of the change for human existence; the disruption between man and total reality, and the consequent alienation of man from the world as conceived in the very different, yet it seems in some respects profoundly kindred, movements of gnosticism and existentialism; the questions of objectification, objectifying language and myth in theology, and the bearing of Martin Heidegger's later thought upon these; and, finally, the possible meaning of immortality for modern man.

The book closes with a brief Epilogue whose theme has been foreshadowed throughout: that ethics, which must be included in a philosophy of mind, becomes, through mind's connection with organism and organism's with nature, part of the philosophy of nature. "The contention—almost axiomatic in the modern climate of thought—that something like an 'ought' can issue only from man and is alien to everything outside him . . . is part of a metaphysical position, which has never given full account of itself" (p. 283). A philosophy which pays due attention to life and thereby overcomes both monistic naturalism, with its abolition of man as man, and subjectivism, with its unbridgeable gulf between man and nature, may discover that, while man alone can acknowledge obligation, this obligation may yet be grounded in the whole of existence.

The importance of the kind of thought which Jonas presents to us is very

great. We are in dire need of overcoming many of our ruling conceptualizations, especially those concerning man. Despite the decisive protests by men of various backgrounds and commitments over the last century (Dostoevski, Bergson, Whitehead, Collingwood, Husserl, Marcel, Mumford, to name only a few at random), we have admitted the materialistic, mechanistic, behavioristic outlook into increasingly dominant position. And in the face of its fatal reductionism and degradation of man, we have sought to maintain the realm of humanness by retreat into equally disastrous subjectivism and isolation. Jonas indicates a direction beyond this crisis. Its basic kinship to the direction shown by other thinkers, most notably, perhaps, Whitehead's (not overlooking significant differences between the two), gives added evidence of the book's importance for the reorientation of the modern mind.

The depth and scope of the book are such that every reader, even a sympathetic one, is bound to find some of his own ideas put in question. And he, in turn, is bound to have questions to raise. Among the ones which I would wish to ask, one stands out above the rest. The polarity of self and world, the subject-object rift, and the bridging of the rift by relation are key themes of the author's philosophy. Now, whatever may hold for the animal kingdom, human existence cannot be grasped without acknowledging radically different kinds of relation. My question is whether this is done in this book. Since I cannot develop the question here, I will try only to indicate it very briefly by two examples.

Speaking of the extreme form of the subject-object rift and the relation which bridges it, that in which the subject takes himself as object, the author says, "It is in the gulf opened by this confrontation of oneself with oneself, and in the exercise of the relation which in some way or other always has to span the gulf, that the highest elations and deepest dejections of human experience have their place" (p. 187). But *does* man's highest elation have its place in self-confrontation? Is it not found, rather, in a certain kind of confrontation of self with other, in true meeting, in the realm Martin Buber has called "I-Thou"? And if deepest dejection *does* have its place in the confrontation of oneself with oneself does not this experience, too, nevertheless imply meeting—its failure or lack?

The second example arises in connection with man's faculty for image and speech with which a "further degree of mediacy is reached and the distance between organism and environment widened by a further step" (i.e., beyond the animal level). "The new mediacy," Jonas writes, "consists in the interposition of the abstracted and mentally manipulable *eidos* between sense and actual object. . . . Imaging and speaking man ceases to see things directly: he sees them through the screen of representations of which he has become possessed by his own previous dealings with objects, and which are evoked by the present perceptual content, impregnating it with their *symbolic* charge, and added to by the new experience itself" (p. 184). Now there is no doubt that the symbolic sphere has a far-reaching influence on our being; nor that symbols often *are* a screen, and even a distortive and opaque one. But does this mean that man is unable to see things directly? Or does it mean, rather, that there are different kinds of seeing, different kinds of relation? In an I-Thou relation, there are no screening symbols. Such a relation can occur

without images or speech. But when these are present, they truly serve it, and that means they further direct encounter.

It is only by acknowledging this kind of relation, I believe, and its radical difference from another, that we can avoid the Scylla and Charybdis between which, as Jonas says, the modern mind hovers: "the stare at isolated selfhood" associated with much existentialist thought and the "monistic naturalism which . . . would abolish the idea of man as man" (p. 234). For with regard to their modes of relation to otherness, both belong to Buber's second realm, the I-It, the realm of abstraction, system, conquest, use, manipulation, and are occupied, respectively, with one and the other pole.

The Phenomenon of Life (portions of which have previously been published in various journals) is to be recommended to everyone to whom the questions of life, mind, and man are salient. The exploration of these questions draws upon a wealth of knowledge. The presentation is cogent and the style lucid, on the whole, though perhaps occasionally harder than necessary to follow. Readers who are not accustomed to such philosophical inquiry, however, and who have not given sufficient thought to the issues involved, will probably experience difficulty, and perhaps be obliged to omit some portions. This is largely unavoidable. Those who are able to deal with the book and to consider seriously what it says will find it amply rewarding.

GEORGE MORGAN

Brown University

The Thought of Teilhard de Chardin: An Introduction. By MICHAEL H. MURRAY. New York: Seabury Press, 1966. 177 pages. $4.95.

This little volume about the learned Jesuit who has made such a deep and at times controversial impression on the Roman Catholic world as well as on the scientific community is one of the best introductions on the meaning of Teilhard's evolutionary and mystical philosophy. It is written not so much to explain the cosmic outlook of Teilhard based on his law of complexity consciousness as to relate the whole philosophy to such traditional themes as "Christ and the Cosmos," "The Christian Life," "The Christian Tradition," "Christianity and Society Today," this last chapter dealing effectively with the issues of secularism. The chapter on "Teilhard's Methodology" takes up the much-discussed question as to whether Teilhard's claim in *The Phenomenon of Man,* that he was basing his entire outlook strictly on the findings of the sciences, can be justified in view of the latter part of *The Phenomenon,* where the ascent of evolution to Christ-Omega is affirmed. Murray deals skilfully with this issue, indicating that the scientific methodology of Teilhard is not based on a narrow empiricism but on a synthetic view of the whole evolutionary process, regarded as a continuous creation culminating in the Christ. No doubt Teilhard's Christian faith informs his Christology, but it is a Christology of an entirely new character in which Jesus is rooted in the cosmic process in which the old dualisms rejected by men of science and philosophical naturalists are overcome. Murray reinforces his argument by referring to Thomas S. Kuhn's *The Structure of Scientific Revolutions,* in which changes in total world views are due to the primacy of the new con-

ceptual framework displacing the old outmoded framework. The classic example is, of course, the rejection of the Ptolemaic theory by the Copernican, and Murray suggests that a proper appreciation for Teilhard must be based on an understanding of his basic position, a conceptual framework utilizing both analysis and synthesis, the latter tracing the complexification and unification of things in a dynamic cosmic process. The intense awareness of this total process is precisely Teilhard's mysticism—the mysticism of Process.

Quinnipiac College ALFRED P. STIERNOTTE

The Biology of Ultimate Concern. By THEODOSIUS DOBZHANSKY (Vol. 2 in a series on "Perspectives in Humanism," planned and edited by Ruth Nanda Anshen.) New York: New American Library, 1967. 152 pages. $5.00.

Man's conception of his own nature has always been a fundamental element of his religious beliefs—that is, his beliefs about what concerns him most, or ultimately. Theologians and other interpreters who are seeking to make a doctrine of man's meaning credible and relevant in this period when our concepts of human nature are being drastically altered by the sciences should add Dobzhansky's book to the newer testaments of their bible.

Dobzhansky combines the perspective of one of the world's most eminent scientific revealers of evolutionary processes with the perspective of one whose experience and study have made him sensitive to the twentieth-century disruption of the great culturally evolved concepts of human nature on which civilizations thus far have been nourished. Born in Russia within a few days of the beginning of the century, he was nursed on Darwin as well as Dostoevsky, and on the philosophies as well as the events of a revolutionary time. After teaching evolution and genetics in Kiev and Leningrad until he was twenty-seven, he came to the United States, where, at the California Institute of Technology and Columbia and Rockefeller universities, his studies of genetic mechanisms and evolution have made him a world leader. He has also become interested and versed in cultural evolution and has stimulated new developments of our understanding of the relation of cultural to genetic evolution.

Dobzhansky is one of an increasing number of great scientists of our day who are making clear that the sciences have come of age for illuminating human values and ultimate concerns—the "Big Questions" of man's meaning. He suggests that the commonplace judgment "that Darwin's discovery of biological evolution completed the downgrading and estrangement of man begun by Copernicus and Galileo" can hardly be more mistaken. "Perhaps the central point to be argued in this book is that the opposite is true. Evolution is a source of hope for man" (p. 7).

In his introductory chapter he responds to the recent and still prevalent aversion of many humanists and theologians to the sciences: "One may detest nature and despise science, but it becomes more and more difficult to ignore them." He declares, "Self-knowledge lacks something very pertinent to the present condition if one chooses to ignore what one can learn about oneself from science. . . . A coherent credo can neither be derived from science nor arrived at without science" (p. 9). Dobzhansky is particularly sure that "The relevance of biology and anthropology is evident enough . . . , man . . . still is, and prob-

ably will remain, in goodly part a biological species. His past, all his antecedents, are biological. To understand himself he must know whence he came and what guided him on his way. To plan his future, both as an individual and much more so as a species, he must know his potentialities and his limitations. The problems are only partly biological and scientific, and partly 'theological' " (p. 10).

In his second chapter, "On Gods of the Gaps," Dobzhansky recognizes that in response to the growth of scientific "mechanism," defenders of the faith have asserted that God intervenes in "gaps between natural events." But he suggests this is a poor defense, for "The hypothesis of mechanism has triumphed everywhere. . . ." He notes that mechanism has led many to a feeling of despair and meaninglessness about life, and led others to presently untenable doctrines of vitalism or of a god of the gaps to account for purpose in life. Dobzhansky suggests that, if we discard the untenable, we are not reduced to mere mechanism. He follows his colleague in the study of evolution, George Gaylord Simpson: " 'In biology, then, a second kind of explanation must be added to the first or reductionist explanation made in terms of physical, chemical, and mechanical principles. This second form of explanation, which can be called compositionist in contrast with reductionist, is in terms of the adaptive usefulness of structures and processes to the whole organism and to the species of which it is a part, and still further, in terms of ecological function in communities in which the species occur' " (p. 22).

It is not clear to me that these two approaches are ultimately different, especially if natural selection is itself a mechanical process, explainable as the cumulative historical interaction of a living system with its environment (including other living systems). Dobzhansky himself states that the two approaches "are not rival or competing but complementary" (p. 22).

It seems to me that he finds meaning for man, not so much by finding a non-mechanistic explanation, as by the opposite: a non-accidental and enduring continuity. "Man certainly consists of molecules and atoms, but he does not arise by an accidental concourse of these molecules and atoms. The fact that must constantly be kept before our eyes is that every organism of any species alive today is a direct lineal descendant of some kind of primordial life, which is estimated to have appeared two or more billion years ago" (p. 24). "The history of the living world has not been wasted; atoms, molecules, and 'groceries' achieve in living organisms feats of virtuosity, because natural selection is a process which makes possible the realization of what would be in the highest degree improbable without it" (p. 25).

For theological interpretation he suggests that "Rejecting vitalism in no way conflicts with . . . 'reverence for life.' Man's conscience, the existence of life, and indeed of the universe itself, are all parts of the *mysterium tremendum.* Trying to find gaps in scientific knowledge, which is of course easy to do, turns out not to be the wisest way to approach the *mysterium.*" He quotes with approval theologian Carl Heim: " 'For faith gives us the strength which we need in everyday life, not when it is sustained by miraculous occurrences breaking through the order of nature . . . but only when one and the same occurrence, an occurrence of which we fully understand the natural causes . . . at the same

time in itself appears to us as an act of God, which we receive directly from his hands' " (p. 25).

Dobzhansky treats mind as a recently emerged product of this natural process, wholly tied to natural processes. "The particular mind which is myself arose by degrees, starting some sixty-six years ago, apparently from no mind at all, just from mindless chromosomes, cytoplasm, and nutrient substances. Before then, say seventy years ago, there was no such mind" (p. 31). Although Dobzhansky recognizes the objections of such investigators of the brain as Charles Sherrington, Sir John Eccles, C. J. Herrick, and Wilder Penfield that there is something very unmaterial, unphysical, about mind, consciousness, or awareness, he holds to the view that awareness "is nevertheless not some kind of vital force; it is an organismic phenomenon . . ." (p. 66).

Although I agree with him and with most of the scientific community on an ontological monism, I doubt if Dobzhansky's assertions will satisfy those who are baffled by the philosophical or common-sense convictions that mental images cannot mix with material machinery. I suggest that perhaps an adequate solution to this paradox of contemporary knowledge can only be found by following either such monist physicists as Erwin Schrödinger or P. W. Bridgman—who might be interpreted as saying that there is nothing else but mind, or "experience," of which physics or observed entities are simply a special category—or such monists as the psychologist B. F. Skinner—who use a seemingly opposite term, "the observed behavior," as the key, which amounts to the same thing when translated to operational definitions where "mental" entities become "private observations." The paradox is the result of verbal looseness.

In this chapter, Dobzhansky has suggested that a scientific monism is no barrier, but a revealer, of the nature and meaning of such terms as "god," "mind," and "hope" for man. Monism is related logically to monotheism for theologians who wish to tie their concepts to the scientific world view. (An interesting parallel is the attempt by theologian Gordon D. Kaufman to rid Christian theology of its dualism expressed in a paper, "On the Meaning of God," published in the *Harvard Theological Review* [April, 1966] and reprinted in *New Theology No. 4,* edited by Martin E. Marty and Dean G. Peerman [Macmillan Paperback, 1967].)

In his third chapter, on "Evolution and Transcendence," Dobzhansky interprets evolution as sustained change in history; and he suggests that "Christianity is, among the great religions, most explicitly history-conscious, and in this sense evolutionistic" (p. 37) and that "It is therefore not an accident that the idea of progress grew and developed on the Judeo-Christian cultural background . . . " (p. 38). He divides evolutionary theory into three levels—cosmic, biological, and human.

For biology, "The fundamental postulate is that evolution consists mainly of responses of a biological species to the challenges of its environment. . . . If it is not to be snuffed out by hostile environments, life must at all times maintain, and whenever possible improve, its adaptedness to its surroundings" (p. 41). This seems to indicate that the ultimate determiner or god is the environment. He then points out that the creative innovations for adaptation or "The

raw materials of evolution are the genetic variants which arise by mutation" (p. 41). But mutations are largely accidental and are "adaptively ambiguous. Nature has not seen fit to make mutations arise where needed, when needed, and only [in] the kind that is needed. . . . They are manipulated by natural selection" which "maintains or enhances the adaptedness to the environment" (pp. 60, 57). "The genetic endowment of a living species contains . . . a record of its past environments, as well as an imprint of the present one" (p. 42). This endowment contains the "information" or "instructions" for a development of the organism suitably adapted to the requirements of the environment (p. 17). "This genetic endowment is not a mosaic of genes with autonomous effects; it is an integrated system, the parts of which must fit together to be fit to survive" (p. 42).

This picture of human evolution I recognize as one which Dobzhansky shares with other leaders of evolutionary theory; and I share with him and the Jesuit paleontologist Teilhard de Chardin and many others the interpretation that this is not "degrading" to man but is a clear ground for understanding our role and meaning in a cosmic process.

However, at this point Dobzhansky takes a step beyond what is, I suppose, the well-settled limit of the community of biologists and evolutionary theorists. It is even a step beyond his own more detailed and perhaps less religiously oriented classic of 1963, *Mankind Evolving*, for in that book I did not notice any reference to his present espousal of the notion that natural selection is "a cybernetic device which transfers to the living species 'information' about the state of its environments" (p. 42, and similarly in other parts of *The Biology of Ultimate Concern*).

While living systems themselves are clearly recognized as cybernetic devices that maintain their cumulated information and order, through a system of well-integrated homeostatic mechanisms, against the disordering disturbances from the environment, many will have difficulty in understanding the natural selection of biological organisms by the non-living environment as cybernetic in character. Most scientists recognize that the non-biological world operates according to the second law of thermodynamics toward increasing entropy, which is generally interpreted as meaning that the physical environment is a disordering system and the exact opposite of what is meant by a cybernetic or evolving living system that either maintains an order or may even increase its degree of order in a direction that is called the negative of entropy.

Now Dobzhansky has clearly indicated "that evolution consists mainly of responses of a biological species to the challenges of its environment," which means ultimately to the non-living environment. And, since evolution is by natural selection, ultimately by the entropic environment, how can it also be anti-entropic or cybernetic at the same time? Since it seems to be a well-established fact, however, that our entropic or disordering world has in fact produced this anti-entropic or order-cumulating progression of evolving life from the most primitive to the highest human levels on earth, we seem forced to recognize this order-producing, cybernetic, life-creating and sustaining character of the natural world revealed by physics. And herein lies much ground for theological contemplation, both mysterious and exciting, but requiring considerable sophistication from the point of view of physics and

considerable caution. It would seem to be a promising opportunity for theological reconstruction in the light of the sciences.

Dobzhansky's espousal of natural selection as cybernetic in character is not without clear support from a number of advanced physicists. I cite, for instance, Harvey Brooks, dean of engineering and applied physics at Harvard, who has said that "the process of natural selection in evolution is itself a type of feedback. The selection process—the particular population which survives in each generation—is the decision [the output of the cybernetic mechanism], and this is fed back into the genetic constitution of the next generation [the input]; in this way the characteristics of the population adjust to the environment over successive generations" (see Brooks's "Scientific Concepts and Cultural Change," in *Daedalus* [Winter, 1965]). Since it is now common to attribute ultimately to the characteristics of the environment both the production of the random variations and the forces that bind, select, or maintain-in-being certain among them (whether we are looking at the pre-living stages of complex molecular aggregates or at the definitely cybernetic living systems), we seem forced to recognize that the non-organic world itself is the ultimate source and control of life, including human life. In spite of the fact that this world appears to be dominantly and ultimately entropic and disordering, it is the source and determiner of the evolving progressions of life.

Dobzhansky raises the question "whether the cosmic, the biological, and the human evolutions are three unrelated processes, or are parts, perhaps chapters or stages, of a single universal evolution" (p. 42) and joins what I suppose is the leading scientific view today that sees the three stages or levels as parts of a single over-all system. But he sees significant differences of character. "The attainment of a new level of dimension is, however, a critical event in evolutionary history. I propose to call it evolutionary transcendence" (p. 44), since the former term "emergence" now has a bad reputation.

He points out that natural selection—which he apparently sees operating in the human cultural as well as in the genetic, although not in the prebiological or cosmic (pp. 46–48) stages of evolution—"is an anti-chance agency. It makes adaptive sense out of the relative chaos of the countless combinations of mutant genes" (p. 60). This is opposite to the popular supposition that selection and evolution are chance processes. The point which he makes is important for theologians and is backed by other leading evolutionary theorists, such as Simpson. Chance, they would assert, is involved in the provision of the variety of patterns from which the more viable will be selected; but the selection itself is not random: what is selected is ordered or increasingly ordered, rather than random.

However, Dobzhansky does not favor the notion that some investigators of evolution hold, that what is selected is itself *determined* by the nature of things, even though these others agree with him that what is selected is of course limited to the variations that a random process presents. I find it difficult to reconcile Dobzhansky's opposition to determinism with his picture of natural selection as an "anti-chance" agency. This latter implies determination. Of this, more later.

Chapter iv treats of the evolution of self-awareness and death-awareness in man, a central point in explaining the emergence and vital function of reli-

gion. Dobzhansky points out that "Genes made the origin of culture possible, and they are basic to its maintenance and evolution. But the genes do not determine what particular culture develops where, when, or how. An analogous situation is that of language and speech—genes make human language and speech possible, but they do not ordain what will be said" (p. 72). I think most biologists and cultural anthropologists would agree. But, unfortunately, he does not specify the functional equivalent of natural selection in the processes that select the successive patterns of human or cultural evolution. This is a gap in present scientific knowledge that he could well help us fill.

The means for providing the variant forms (including mutations and recombinations), for transmitting them (including duplication and reproduction), and for selecting them (including natural selection) are obviously different in each of the three major levels of evolution (cosmic, biological, and human). Many students of human nature are following such leaders as Dobzhansky in concluding that human or cultural history or evolution is an emergent or transcendent "superimposed on the biological and the inorganic" (p. 44). For them, each level is specifically dependent upon and interactive with the phenomena at lower levels which still continue to operate, although each level has its own characteristic patterns and laws. Only a few, such as some of the General Systems theorists (e.g., Milton C. Marney and Nicholas M. Smith, "The Domain of Adaptive Systems" in *General Systems,* Vol. IX [1964]) have ventured to suggest the common elements of functional equivalents for "natural selection" at all levels. For them, it turns out to be the inherent nature of things, which for theologians would mean a god immanent throughout nature—cosmic, biological, and human. While Dobzhansky seems to fall in this camp, he does not make it explicit in this book.

Dobzhansky holds that in human evolution "self-awareness, and also the death-awareness which is one of its products, are genetically conditioned" and hence arise from natural selection, although these "cultural and behavioral traits which anthropologists and psychologists study are at several removes from the genes . . ." (p. 73). "Self-awareness is . . . one of the fundamental, perhaps the most fundamental, characteristics of the human species" (p. 68). Its selection must have been based on its usefulness in organizing man's capacities to cope with or adapt to his environment.

He suggests that death-awareness is an accidental and disadvantageous by-product of self-awareness. He points to the many cases in evolutionary studies where certain disadvantageous characteristics commonly accompany the emergence of advantageous characteristics; and he concludes that religion has evolved primarily as the cultural adaptation to overcome the disadvantages of death-awareness arising as a concomitant of self-awareness. It is significant that the above-mentioned theologian Kaufman and others seem to concur. Dobzhansky quotes the anthropologist Malinowski, among others, to support this: " 'Religion, however, can be shown to be intrinsically although indirectly connected with man's fundamental, that is, biological needs. . . . The existence of strong personal attachments and the fact of death, which of all human events is the most upsetting and disorganizing to man's calculations, are perhaps the main sources of religious belief' " (p. 78). Dobzhansky concludes that a meaning for life can only be found by identifying the self with something that

transcends death. This theme of an immortality of basic values of life as a possible natural reality and, in any case, essential to religion, in which theme other eminent biologists and anthropologists have sided with Dobzhansky, is a challenge to (and an opportunity for) the theological community where doctrines of immortality have been hushed if not abandoned.

In Chapter v, on the "Search for Meaning," Dobzhansky notes that the "foundation of man's sociality is self-awareness and symbolic communication," whereas "that of insect societies is [genetically] inherited instinct." The "basic social unit in man is a nuclear family, an association of mother, father, and children" (p. 82). He outlines the interplay of various biological and cultural factors in the evolution of the human family to produce the ethical animal, summarized in:

> The importance for human development of the helplessness of the human child and of its complete dependence on its mother can hardly be exaggerated. For the species to survive, evolutionary adjustments had to occur, and these adjustments are of basic biological as well as cultural significance. As pointed out by [C. H.] Waddington, a child has a genetically established capacity to become an "authority acceptor" and an "ethicizing being." The [genetic] evolutionary process has not provided man with set ethical principles and values, but it has equipped his children with an inclination to absorb such principles from his parents, relatives, and other carriers of authority. This facilitates the transmission from generation to generation of culturally evolved ethics and values. . . . These latter come from the cultural, not from the biological, evolution [pp. 85–86].

A close tie beween genetic biology and religion in its early stages is indicated, and even ". . . modern variants of cults of fertility supply the meaning of existence to many millions of persons now living. Man (or woman) strives for sexual gratification, then for family attachments, and finally for the security and welfare of the progeny. These strivings form designs for living which are so firmly anchored in the genetically established instinctoid drives that their meaningfulness is taken for granted by almost everyone and is questioned by few" (p. 87–88).

But man's growing awareness of more complex aspects of self and the world has forced upon him the development of larger, verbally transmitted structures of meaning and purpose; and religions cumulate and transmit these meanings through linguistic and other symbols. Dobzhansky even suggests that religion is a capacity in man which natural selection has brought forth because it increases "the fitness of its possessors" (p. 90). Since a partial self-awareness leads man to a sense of "transitoriness and fragmentariness," in religion "Man overcomes his transitoriness and fragmentariness by becoming, at least in his imagination, a part of the sublime and eternal life" (p. 91).

> In every known human society, in every culture of the past that has left a historical record, peoples have arrived at some system of religious views concerning the meaning and the proper conduct of their lives. Although different religious systems are not alike, and at some points are incompatible, they perform indispensable functions. Religion enables human beings to make peace with themselves and with the formidable and mysterious universe into which they are flung by some power greater than themselves. Since remotest antiquity, religion has been a cultural universal in mankind, because its symbols, myths, and philosophies provided answers to the

ineffable problems of human existence. And it is because religion provides, or seems to provide, these answers that it has served as a social cement [p. 92].

Dobzhansky indorses the notion of Toynbee and others that "The great civilizations of the world do not produce the great religions as a kind of cultural by-product; in a very real sense, the great religions are the foundations on which the great civilizations rest" (p. 94).

However, this chapter ends with a gloomy picture of man's recent world-wide loss of religious belief. He notes that "Feelings of nausea, disgust, dry rot, emptiness, and of the hateful fraudulence of life, etc., are not exclusive privileges of the artistic and intellectual elites, of which [Jean Paul] Sartre and [Jacques] Barzun are eminent representatives. These feelings have percolated down to the 'mass man' " (p. 103). Whereas, "In the nineteenth century, most people in the West were convinced that progress does take place—more or less steadily and unavoidably," now, "We are no longer so sure" (p. 107).

Dobzhansky's last chapter evaluates "The Teilhardian Synthesis" of biology and religious meaning, as a step toward providing man with a more adequate formulation of religious faith. The book thus far has built up the evidence in the evolutionary history of man to show why now, more than ever, "man needs a faith, a hope, and a purpose to live by and to give meaning and dignity to his existence" (p. 108). In order to overcome the present world decay of higher religions and to maintain historical advance above the level of the fertility cults, he suggests that we need a new religious synthesis and that this must involve scientific understanding as well as a grounding in the world's great religions. He points out that

> The role of science in a religious synthesis has been stated with admirable clarity by [Paul] Tillich: "Of course, theology cannot rest on scientific theory. But it must relate its understanding of man to an understanding of universal nature, for man is a part of nature and statements about nature underlie every statement about him. . . . Even if the questions about the relation of man to nature and to the universe could be avoided by theologians, they would still be asked by people of every place and time—often with existential urgency and out of cognitive honesty. And the lack of answer can become a stumbling block for a man's whole religious life." To satisfy man's hunger for meaning, not only man but the whole of nature, living and nonliving, must be understood in their relatedness. For man, though he may be nature's spiritual vanguard and spearhead, is nevertheless only a small part of nature [pp. 109–10].

But Dobzhansky at this point goes far beyond Tillich and beyond his own customary cautious deference to the wisdom inherent in culturally evolved religions: "The central postulate of the [religious] synthesis must be that the universe and everything in it are evolving products of evolution. The synthesis must be an evolutionary synthesis" (p. 110). His insistence that evolutionary theory must be the core of the new synthesis of religious understanding is almost as fervent as that of his colleague, Sir Julian Huxley, whose *Religion without Revelation* is an evangelical hermeneutic of evolutionary doctrines of salvation. Dobzhansky makes explicit for himself what is probably implicit for Huxley, that evolutionary theory, like the Judeo-Christian tradition in which he was nursed, is grounded in an understanding of human nature and

reality in terms of time and history; and his prophecy attacks the theologians who have become too wrapped up in Greek notions of immutable essences.

Rather than set forth his own or an eclectic humanistic gospel as illumined by evolutionary theory, as Huxley did, Dobzhansky seems to suggest that the matter of religion is too complexly evolved a cultural structure for him to tackle alone; and since he feels that the synthesis must be tied to one of these already evolved religious structures, he contents himself with commenting on the virtues and weaknesses of the work of the Jesuit paleontologist, Pierre Teilhard de Chardin.

"Teilhard was a Christian mystic, who happened also to be a scientist, and who had in addition a gift of poetic imagery." He tried "to create a coherent *Weltanschauung,* including his mystical Christianity as well as his scientific knowledge. . . . It is not my intention to review here the whole range of Teilhard's ideas; it is rather to scrutinize his synthesis from the standpoint of modern biology, and perhaps to suggest some modifications" (p. 115).

Teilhard's cardinal postulate, he says, is that "Evolution, human and biological and cosmic, is not simply a lot of whirl and flutter going nowhere in particular. It is, at least in its general trend, progressive" (p. 116); and Dobzhansky agrees that "The evidence of progress and directionality in biological evolution is clear enough if the living world is considered as a whole" (p. 119). But he rejects Teilhard's espousal of orthogenesis or predestination, not only on biological grounds, but also because he finds that such a rejection provides a more sensible theology. "Any doctrine which regards evolution as pre-determined or guided collides head-on with the ineluctable fact of the existence of evil. . . . Teilhard certainly knew all this, and knew that the only hope for a solution lies in the replacement of predestination by freedom as the mainspring of creation. On the human level, freedom necessarily entails the ability to do evil as well as good" (p. 120).

"Teilhard describes the method of evolution as groping. . . . This is a more poetic and impressionistic than a rigorously scientific characterization, and yet it is remarkably apposite" (p. 121). The "groping" seems to be a poetic expression for "mutation," and a small fraction of the mutations are the source of creativity or advancement of biological species, although most of them are harmful. "At the level of mutation, evolution is neither directional nor oriented nor progressive. . . . Mutation alone would cause chaos, not evolution. Natural selection redresses the balance. Harmful genes are reduced in frequency, and useful ones perpetuated and multiplied. . . . The evolutionary changes are creative responses to the challenges of the environment. They are not alterations imposed by the environment . . . " (p. 122).

Dobzhansky's argument that creativity and progress arise from the freedom to grope, to err, or to do evil is not only the valid picture of life biologically, but also is a reflection of one side of a dilemma recognized for thousands of years by theologies: the fact of evil in a world that monotheists have wanted to claim is at the same time completely under the control of a good god. The evolutionary picture of the creation and advancement of life by groping, by mutation, by error provides new grounds for understanding the problem of evil in theology. It becomes clear why error, evil, or sacrifice are essential; without them there is no life and no progress of life. It is the source of the creativity or

variation without which natural selection can do nothing. Yet, at the same time, Dobzhansky leaves us with the same paradox of freedom and determinism so long characteristic of theology. Or does he? Since, at the level of chance mutation, he says, there is only chaos and no progressive evolution, the balance is redressed by a non-random, anti-chance, or deterministic agency of natural selection. Here my logic requires me to say that, since the anti-chance, natural selection is the ultimate determinant of destiny, there is ultimately no freedom, even though Dobzhansky does not seem to be bothered by asserting both the freedom of mutation and the determinism of natural selection. I do not feel he has done here any better than in his treatment of the paradox of mind and matter mentioned earlier to give a satisfactory resolution.

Resolving the freedom paradox by introducing evil as a second kind of reality in the world, a devil distinct from the good god, would violate Dobzhansky's basic monism. Moreover, for scientists generally—while these two obviously different kinds of operations in the world, random mutation and natural selection, are basic for understanding evolution—both operations are usually taken as belonging to a single reality. Most scientists are determinists. The physicist, Erwin Schrödinger, writing on this same problem in his *What Is Life?* declared that life (including mind), where "quantum indeterminacy plays no biologically relevant role," is "if not strictly deterministic at any rate statistico-deterministic."

In spite of his use of the term "freedom," Dobzhansky does not seem much different, for he makes it quite clear that natural selection is the ultimate power that converts the groping into advancing life:

> Teilhard describes the method of evolution as "groping." He also claims that "Groping is directed chance." . . . Natural selection operates with mutations and gene combinations in the origin of which "chance" plays an important role. Natural selection "directs" this "chance" into adaptive channels. One must, however, beware of personalizing natural selection. It is not some kind of spirit or demon who directs evolution to accomplish some set purpose. "Groping" in the dark is, indeed, the only way natural selection can proceed [p. 128].

Yet, through natural selection of chance events, evolution is creative. "Evolution has achieved more than to preserve life on earth from destruction. It has created progressively more complex and adaptively more secure organizations" (p. 129). And "The meaning of an individual life is its inclusion in the evolutionary upswing of noogenesis" (p. 135), where noogenesis refers to Teilhard's notion of the evolving "thought envelope" of *Homo sapiens* now converging toward "planetization" and "megasynthesis" or greater, global integration, as the peoples of the world move toward a common culture. Dobzhansky is at pains to point out, however, that neither he nor Teilhard thinks this integration means uniformity, but an integration of diversities.

In "natural selection," Dobzhansky seems to be setting forth a scientifically grounded characterization of a functional equivalent to the religious term "God." On this account especially, I should like to see him develop the concept of "natural selection" beyond the limited descriptive version applicable in biology: "differential reproduction." For religion as for biology, it would be significant to understand (as I have indicated above) more about what "directs chance"

or determines the outcomes at all three levels of evolution and what is the relation of "natural selection" to the ultimate character of the cosmos.

One might conclude by noting that, while Dobzhansky feels that Teilhard "remains a consistent evolutionist throughout," when Teilhard suggests that all evolution moves toward the ultimate coming of Christ, it "is evidently the inspiration of a mystic, not a process of inference from scientific data" (p. 137).

Thus Dobzhansky remains faithful to the scientific caution set forth in his Preface: "Speculations in the realms of philosophy and religion . . . are often regarded, among scientists, as regrettable foibles or even as professional misdemeanors. They are as often as not kept secret, for being caught at them is liable to damage a scientist's professional reputation. Let me, then, try to make clear the nature of my enterprise. This is not an attempt to derive a philosophy from biology, but rather to include biology in a *Weltanschauung*" (p. 2).

I would suggest, however, that evolutionary theory, which is now intimately tied into the whole range of scientific theories from astrophysics to the "science of the soul" (psychology) is already a "philosophy" of whose implications for religion Dobzhansky has become a primary prophet through his combination of religious sensitivity, scientific range, and intellectual integrity. Perhaps in the future he and other leading scientists can be less timid in making contributions to man's understanding of his ultimate concerns, and carry further Dobzhansky's conviction that science has come of age for positive theological relevance.

But theologians can already find in this book solid grounds for integrating with the sciences a theology attuned to a single or monist trans-human source of history which provides a direction, purpose, hope, and meaning for man transcending the limits of death; a meaning for the risks of freedom, chance, evil, sacrifice, and death as the way toward creation of higher levels of life that is supported if not guaranteed by an ordering or anti-chance judge; and perhaps a doctrine of the church (or the meaning and purpose of religion) as a necessary ingredient of human culture indorsed if not ordained by the ultimate judge of human viability.

RALPH WENDELL BURHOE

Meadville Theological School

In The Periodicals

One of the focal points in discussions of issues between science and religion has to do with the mind-body problem. Six different solutions are usually enumerated in elementary textbooks of philosophy, but recent literature indicates the problem is receiving new attention. Brand Blanshard and B. F. Skinner meet head on in their discussion of behaviorism in "The Problem of