THE TELEOLOGICAL ARGUMENT AND THE ANTHROPIC PRINCIPLE

Dr. William Lane Craig

William Lane Craig is Research Professor of Philosophy at Talbot School of Theology in La Mirada, California. He lives in Atlanta, Georgia, with his wife Jan and their two teenage children Charity and John. At the age of sixteen as a junior in high school, he first heard the message of the Christian gospel and yielded his life to Christ. Dr. Craig pursued his undergraduate studies at Wheaton College (B.A. 1971) and graduate studies at Trinity Evangelical Divinity School (M.A. 1974; M.A. 1975), the University of Birmingham (England) (Ph.D. 1977), and the University of Munich (Germany) (D.Theol. 1984). From 1980-86 he taught Philosophy of Religion at Trinity, during which time he and Jan started their family. In 1987 they moved to Brussels, Belgium, where Dr. Craig pursued research at the University of Louvain until 1994.

The discovery during our generation of the so-called anthropic coincidences in the initial conditions of the universe has breathed new life into the teleological argument. Use of the Anthropic Principle to nullify our wonder at these coincidences is logically fallacious unless conjoined with the metaphysical hypothesis of a World Ensemble. There are no reasons to believe that such an Ensemble exists nor that, if it does, it has the properties necessary for the Anthropic Principle to function. Typical objections to the alternative hypothesis of divine design are not probative.

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Introduction

Widely thought to have been demolished by Hume and Darwin, the teleological argument for God's existence has nonetheless continued during this century to find able defenders in F.R. Tennant, Peter Bertocci, and Stuart C. Hackett.

All of these have appealed to what Tennant called "wider teleology," which emphasizes the necessary conditions for the existence and evolution of intelligent life, rather than specific instances of purposive design. Unfortunately, they could speak of this wider teleology for the most part only in generalities, for example, "the fitness of the inorganic to minister to life," but could furnish few specific examples of experimental fact to illustrate this cosmic teleology.

In recent years, however, the scientific community has been stunned by its discovery of how complex and sensitive a nexus of conditions must be given in order for the universe to permit the origin and evolution of intelligent life on Earth. The universe appears, in fact, to have been incredibly fine-tuned from the moment

of its inception for the production of intelligent life on Earth at this point in cosmic history. In the various fields of physics and astrophysics, classical cosmology, quantum mechanics, and biochemistry, various discoveries have repeatedly disclosed that the existence of intelligent carbon-based life on Earth at this time depends upon a delicate balance of physical and cosmological quantities, such that were any one of these quantities to be slightly altered, the balance would be destroyed and life would not exist.

Let us briefly review some of the cosmological and physical quantities that have been found to exhibit this delicate balance necessary for the existence of intelligent life on Earth at this epoch in cosmic history.{1}

Examples of Wider Teleology

Physics and Astrophysics

To begin with the most general of conditions, it was shown by G. J. Whitrow in 1955 that intelligent life would be impossible except in a universe of three basic dimensions. When formulated in three dimensions, mathematical physics possesses many unique properties which are necessary prerequisites for the existence of rational information-processing observers like ourselves. Moreover, dimensionality plays a key role in determining the form of the laws of physics and in fashioning the roles played by the constants of nature. For example, it is due to its basic three-dimensionality that the world possesses the chemistry that it does, which furnishes some key conditions necessary for the existence of life. Whitrow could not answer the question why the actual universe happens to possess three dimensions, but noted that if it did not, then we should not be here to ask the question.

More specifically, the values of the various forces of nature appear to be fine-tuned for the existence of intelligent life. The world is conditioned principally by the values of the fundamental constants a (the fine structure constant, or electromagnetic interaction), m_n/m_e (proton to electron mass ratio, a_G (gravitation), a_w (the weak force), and a_s (the strong force). When one mentally assigns different values to these constants or forces, one discovers that in fact the number of observable universes, that is to say, universes capable of supporting intelligent life, is very small. Just a slight variation in any one of these values would render life impossible.

For example, if a_s were increased as much as 1%, nuclear resonance levels would be so altered that almost all carbon would be burned into oxygen; an increase of 2% would preclude formation of protons out of quarks, preventing the existence of atoms. Furthermore, weakening a_s by as much as 5% would unbind deuteron, which is essential to stellar nucleosynthesis, leading to a universe composed only of hydrogen. It has been estimated that a_s must be within 0.8 and 1.2 its actual strength or all elements of atomic weight greater than four would not have formed. Or again, if a_w had been appreciably stronger, then the Big Bang's nuclear burning would have proceeded past helium to iron, making fusion-powered stars impossible. But if it had been much weaker, then we should have had a universe entirely of helium. Or again, if a_G had been a little greater, all stars would have been red dwarfs, which are too cold to support life-bearing planets. If it had been a little smaller, the universe would have been composed exclusively of blue giants which burn too briefly for life to develop. According to Davies, changes in either a_G or electromagnetism by only one part in 10^{40} would have spelled disaster for stars like the sun. Moreover, the fact that life can develop on a planet orbiting a star at the right distance depends on the close proximity of the spectral temperature of starlight to the molecular binding energy. Were it greatly to exceed this value, living organisms would be sterilized or destroyed; but were it far below this value, then the photochemical reactions necessary to life would proceed too slowly for life to exist. Or again, atmospheric composition, upon which life depends, is constrained by planetary mass. But planetary mass is the inevitable consequence of electromagnetic and gravitational interactions. And there simply is no physical theory which can explain the numerical values of a and m_n/m_e that determine electromagnetic interaction.

Moreover, life depends upon the operation of certain principles in the quantum realm. For example, the Pauli Exclusion Principle, which states that no more than one particle of a particular kind and spin is permitted in a single quantum state, plays a key role in nature. It guarantees the stability of matter and the

size of atomic and molecular structures and creates the shell structure of atomic electrons. In a world not governed by this principle, only compact, superdense bodies could exist, providing little scope for complex structures or living organisms. Or again, quantization is also essential for the existence and stability of atomic systems. In quantum physics, the atom is not conceived on the model of a tiny solar system with each electron in its orbit around the nucleus. Such a model would be unstable because any orbit could be an arbitrary distance from the nucleus. But in quantum physics, there is only one orbital radius available to an electron, so that, for example, all hydrogen atoms are alike. As a consequence, atomic systems and matter are stable and therefore life-permitting.

Classical Cosmology

Several of the constants mentioned in the foregoing section also play a crucial role in determining the temporal phases of the development of the universe and thus control features of the universe essential to life. For example, a_G, and m_n/m_e constrain (i) the main sequence stellar lifetime, (ii) the time before which the expansion dynamics of the expanding universe are determined by radiation rather than matter, (iii) the time after which the universe is cool enough for atoms and molecules to form, (iv) the time necessary for protons to decay, and (v) the Planck time.

Furthermore, a fine balance must exist between the gravitational and weak interactions. If the balance were upset in one direction, the universe would have been constituted by 100% helium in its early phase, which would have made it impossible for life to exist now. If the balance were tipped in the other direction, then it would not have been possible for neutrinos to blast the envelopes of supernovae into space and so distribute the heavy elements essential to life.

Furthermore, the difference between the masses of the neutron and the proton is also part of a very delicate coincidence which is crucial to a life-supporting environment. This difference prevents protons from decaying into neutrons, which, if it happened, would make life impossible. This ratio is also balanced with the electron mass, for if the neutron mass failed to exceed the proton mass by a little more than the electron mass, then atoms would simply collapse.

Considerations of classical cosmology allow us to introduce a new parameter, S, the entropy per baryon in the universe, which is about 10^9. Unless S were $< 10^{11}$, galaxies would not have been able to form, making planetary life impossible. S is itself a consequence of the baryon asymmetry in the universe, which arises from the inexplicably built-in asymmetry of quarks ever anti-quarks prior to 10^{-6} seconds after the Big Bang.

In investigating the initial conditions of the Big Bang, one is also confronted with two arbitrary parameters governing the expansion of the universe: W_o, related to the density of the universe, and H_o, related to the speed of the expansion. Observations indicate that at 10^{-43} seconds after the Big Bang the universe was expanding at a fantastically special rate of speed with a total density close to the critical value on the borderline between recollapse and everlasting expansion. Hawking estimated that even a decrease of one part in a million million when the temperature of the universe was 10^{10} degrees would have resulted in the universe's recollapse long ago; a similar increase would have precluded the galaxies from condensing out of the expanding matter. At the Planck time, 10^{-43} seconds after the Big Bang, the density of the universe must have apparently been within about one part in 10^{60} of the critical density at which space is flat. This results in the so-called "flatness problem": why is the universe expanding at just such a rate that space is Euclidean rather than curved? A second problem that arises is the "homogeneity problem." There is a very narrow range of initial conditions which must obtain if galaxies are to form later. If the initial inhomogeneity ratio were $> 10^{-2}$, then non-uniformities would condense prematurely into black holes before the stars form. But if the ratio were $< 10^{-5}$, inhomogeneities would be insufficient to condense into galaxies. Because matter in the universe is clumped into galaxies, which is a necessary condition of life, the initial inhomogeneity ratio appears to be incredibly fine-tuned. Thirdly, there is the "isotropy problem." The temperature of the universe is amazing in its isotropy: it varies by less than one part in a thousand over the whole of the sky. But at very early stages of the universe, the different regions of the universe were causally disjointed, since light beams could not travel fast enough to connect the rapidly receding regions. How then did these

unconnected regions all happen to possess the same temperature and radiation density? Penrose has calculated that in the absence of new physical principles to explain this, "the accuracy of the Creator's aim" when he selected this world from the set of physically possible ones would need to have been at least of the order of one part in $10^{10(123)}$!

Contemporary cosmologists have found an answer to these three problems--or at least seem certain that they are on its track--in inflationary models of the early universe. According to this adjustment to the standard Big Bang cosmology, between 10^{-43} and 10^{-35} seconds after the Big Bang, the universe underwent an exponentially rapid inflation of space faster than the speed of light. This inflationary epoch resulted in the nearly flat curvature of space, pushed inhomogeneities beyond our horizon, and served to bury us far within a single region of space-time whose parts were causally connected at pre-inflationary times.

Inflationary scenarios have problems of their own --such as getting inflation started, getting it to end without excess turbulence, and having it produce irregularities just right for galaxy formation. Indeed, it is interesting to note that Hawking has recently declared both the so-called "old inflationary model" and the "new inflationary model" to be "now dead as a scientific theory"--though he still holds out hope for Linde's more recent "chaotic inflationary model."{2} Whether this model proves to be any more successful than its predecessors remains yet to be seen; the whole inflationary scenario seems rather *ad hoc*, and one cannot help but suspect that much of the attraction to such models is due to the desire to escape the sort of inferences as Penrose's conclusion above. More importantly, however, inflationary scenarios seem to require the same sort of fine-tuning which some theorists thought these models had eliminated. For example, in order to proceed appropriately, inflation requires that the two theoretical components of Einstein's cosmological constant, "bare lambda" and "quantum lambda," cancel each other out with an enormously precise though inexplicable accuracy. A change in the strengths of either a_G or a_w by as little as one part in 10^{100} would destroy this cancellation on which our lives depend. So although inflationary models may succeed in providing a unifying explanation of some of the forces which play a role in classical cosmology, it does not thereby dispense with the appearance of fine-tuning or teleology.

Biochemistry

Life which is descended from a simpler form of life and which ultimately came into existence spontaneously must be based on water, carbon dioxide, and the basic compounds of the elements C, H, O, and N. Each of these possesses unique properties which, while not sufficient for the existence of life, are necessary conditions of it.

Water, for example, is one of the strangest substances known to science. Its specific heat, surface tension, and most of its other physical properties have anomalous values higher or lower than any other known material. The fact that its solid phase is less dense than its liquid phase, so that ice floats, is virtually a unique property in nature. Its melting point, boiling point, and vaporization point are all anomalously higher than those of other substances. For example, when calculated by atomic weight and number, the boiling point of water would be expected to be -100°C rather than +100°C. The disparity is due to its strong hydrogen bonds, which are difficult to break. Furthermore, because the H-O-H angle in water is so close to the ideal tetrahedral structure, water can form such a structure with very little strain on the bonds. As a result, it tends to polymerize into an open structure, so that ice is less dense than water. This property of water is essential to life, for were ice more dense than water, it would sink to the bottom of bodies of water, where it would remain in the deepest parts until eventually all lakes and oceans would be solidly frozen. Instead, ice forms a protective skin on the surface of reservoirs of water. Water also has a higher specific heat than almost any organic compound. This property allows water to be a store of heat and so stabilize the environment. The thermal conductivity of water is also higher than that of most liquids, which again permits water to act as a temperature stabilizer on the environment. Water has, moreover, a higher heat of vaporization than any known substance. This makes water the best possible coolant by evaporation, and living creatures make extensive use of it in temperature control. Water's high surface tension, exceeded by very few substances, serves to make biochemical reactions more rapid; and the way water bonds shapes organic molecules such as enzymes and nucleic acids into their biologically active forms and permits the formation of cell walls and membranes.

The elements H, O, and C are the most abundant elements in living organisms. They possess many unique properties and are vital to chemical reactions necessary to sustain life. For example, CO_2 has the property, unique among gases, of having at ordinary temperatures about the same concentration of molecules per unit volume in water as in air. This enables CO_2 to undergo perpetual exchange between living organisms and their environment, so that it is everywhere available for photosynthesis and thereby for molecular synthesis. The element N, on the other hand, is a rare element on Earth, but it does make up 80% of the earth's atmosphere, which is a unique stroke of fortune for Earth's living organisms.

This selective sampling of physical and cosmological quantities which are necessary conditions of the existence of intelligent life on Earth at this point in cosmic history illustrates the sort of wider teleology which Tennant emphasized, but could only dimly envision. The discoveries of contemporary science in this regard are particularly impressive for two reasons: (1) The delicate balance of conditions upon which life depends is characterized by the interweaving of conditions, such that life depends for its existence, not merely upon each individual condition's possessing a value within very narrow limits, but also upon ratios or interactions between values and forces which must likewise lie within narrow parameters. The situation is thus not comparable to a roulette wheel in Monte Carlo's yielding a certain winning number; nor even yet to all the roulette wheels (each representing a physical quantity or constant) in Monte Carlo's turning up simultaneously certain numbers within narrowly circumscribed limits (say, wheel 1 must show 72 or 73 while wheel 2 must show 27-29, *etc*.); rather it is like all the roulette wheels in Monte Carlo's yielding simultaneously numbers within narrowly prescribed limits and those numbers bearing certain precise relations among themselves (say, the number of wheel 3 must be one-half the square of the number of wheel 17 and twice the number of wheel 6). It seems clear that worlds not permitting intelligent life are vastly more to be expected than life-permitting worlds. (2) The constants and quantities which go to make up this complex nexus of conditions are apparently independent of one another. The development of inflationary models ought to cause us to be cautious in making such a claim; nevertheless, it is the case that there seems to be no nomological necessity requiring the quantities and constants of nature to be related as they are. The value of S, for example, seems to be utterly unrelated to the parameters W, H_o, or inflationary scenarios. But even if it were possible to reduce all the physical and cosmological quantities to a single equation governing the whole of nature, such a complex equation could itself be seen as the supreme instance of teleology and design. Hence, some of those whose hopes seem to lie in the discovery of such an equation are forced to assert that such an equation must be necessarily true; that is to say, there is really only one logically possible set of physical constants and forces. But such a hypothesis seems clearly outlandish. As Nagel observes, none of the statements of natural laws in the various sciences are logically necessary, since their denials are not formally contradictory; moreover, the appropriate procedure in science should then cease to be experimentation, but be deductive proofs in the manner of mathematics.{3} Hence, the notion that the nomological necessity of such an equation should reduce to logical necessity seems obviously false.

The Anthropic Principle

This pattern of discoveries has compelled many scientists to conclude that such a delicate balance cannot be simply dismissed as coincidence, but requires some sort of account. Traditionally, such considerations would have been taken as evidence of divine design--one thinks of Paley's teleological argument in his *Natural Theology*, for example. Loath to admit the God-hypothesis, however, many scientists are seeking an alternative in the Anthropic Principle, and a tremendous debate involving both scientists and philosophers has broken out concerning this principle, a debate which has spilled over into the popular press and captured the attention of science-minded laymen. The attempt to come to grips with the appearance of cosmic teleology has forced many scientists beyond physics into meta-physics, so that the boundaries between science and philosophy have become ineradicably blurred, well-illustrating George Gale's remark that "we are now entering a phase of scientific activity during which the physicist has out-run his philosophical base-camp, and, finding himself cut off from conceptual supplies, he is ready and waiting for some relief from his philosophical comrades-in-arms."{4} The theistic philosopher can therefore without apology or embarrassment introduce his metaphysical commitment to theism as an at least equally plausible, if not superior, alternative explanation to metaphysical, naturalistic accounts of the complex order of the universe.

Exposition

First proposed by Brandon Carter in 1974,{5} the Anthropic Principle has assumed a number of different forms, generating a great deal of confusion concerning what it is precisely that the principle means to assert. In their recent monumental book, *The Anthropic Cosmological Principle*, physicists John Barrow and Frank Tipler state various versions of the principle, the most fundamental being the Weak Anthropic Principle (WAP):

> WAP: The observed values of all physical and cosmological quantities are not equally probable, but they take on values restricted by the requirement that there exist sites where carbon-based life can evolve and by the requirement that the Universe be old enough for it to have already done so.{6}

Barrow and Tipler regard WAP as "in no way speculative or controversial,"{7} since it is "just a restatement . . . of one of the most important and well-established principles of science: that it is essential to take into account the limitations of one's measuring apparatus when interpreting one's observations."{8} For example, if we were calculating the fraction of galaxies that lie within certain ranges of brightness, our observations would be biased toward the brighter ones, since we cannot see the dim ones so easily. Or again, a ratcatcher may say that all rats are bigger than six inches because that is the size of his traps. Similarly, any observed properties of the universe which may initially appear astonishingly improbable can only be seen in their true perspective after we have accounted for the fact that certain properties could not be observed by us, were they to obtain, because we can only observe those compatible with our own existence. "The basic features of the Universe, including such properties as its shape, size, age, and laws of change must be *observed* to be of a type that allows the evolution of the observers, for if intelligent life did not evolve in an otherwise possible universe, it is obvious that no one would be asking the reason for the observed shape, size, age, and so forth of the universe."{9} Thus, our own existence acts as a selection effect in assessing the various properties of the universe. For example, a life form which evolved on an earthlike planet "must necessarily see the universe to be at least several billion years old and . . . several billion light years across," for this is the time necessary for the production of the elements essential to life and so forth.{10}

Now, we might ask, why is the "observed" in the quotation in the above paragraph italicized? Why not omit the word altogether? The answer is that the resulting statement

> 1. The basic features of the universe must be of a type that allows the evolution of observers

is undoubtedly false; for it is not logically or nomologically necessary that the universe embrace intelligent life. Rather what seems to be necessarily true is

> 2. If the universe is observed by observers which have evolved within it, then its basic features must be of a type that allows the evolution of observers within it.

But (2) seems quite trivial; it does nothing to explain why the universe in fact has the basic features it does.

But Barrow and Tipler contend that while WAP appears to be true, but trivial, it has "far-reaching implications."{11} For the implication of WAP, which they seem to interpret along the lines of (2), is that no explanation of the basic features of the universe need be sought. This contention seems to be intimately connected with what is appropriate to be *surprised at*. The implication of WAP is that we ought not to be surprised at observing the universe to be as it is, for if it were not as it is, we could not observe it. For example, "No one should be surprised to find the universe to be as large as it is."{12} Or again, ". . . on Anthropic grounds, we should expect to observe a world possessing precisely three spatial dimensions."{13} Or again,

> We should emphasize once again that the enormous improbability of the evolution of intelligent life in general and *Homo sapiens* in particular does not mean we should be amazed we exist at all. This would make as much sense as Elizabeth II being amazed she is Queen of England. Even though the probability of a given Briton being monarch is about 10^{-8}, *someone* must be. Only if there is a monarch is it possible for the monarch to calculate the improbability of her particular existence. Similarly, only if an intelligent species does evolve is it possible for its members to ask how probable it is for an intelligent species to evolve. Both are examples of WAP self-selection in action.[110]

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[110] F. B. Salisbury, *Nature* 224, 342 (1969), argued that the enormous improbability of a given gene, which we computed in the text, means that a gene is too unique to come into being by natural selection acting on chance mutations. WAP self-selection refutes this argument, as R. F. Doolittle in *Scientists confront creationism*, L. R. Godfrey (Norton, NY, 1983) has also pointed out.{14}

Here we have a far-reaching implication that goes considerably beyond the apparently trivial WAP. Accordingly, although Barrow and Tipler conflate WAP and the implications thought to follow from it, I want to distinguish these sharply and shall refer to these broader implications as the Anthropic Philosophy. It is this philosophical viewpoint, rather than WAP itself, that I believe, despite initial impressions, stands opposed to the teleological argument and constitutes scientific naturalism's most recent answer to that argument. According to the Anthropic Philosophy, an attitude to surprise at the delicately balanced features of the universe essential to life is inappropriate; we should expect the universe to look this way. While this does not explain the origin of those features, it shows that no explanation is necessary. Hence, to posit a divine Designer is gratuitous.

Critique

WAP and Self-Selection

Now it needs to be emphasized that what the Anthropic Philosophy does *not* hold, despite the sloppy statements on this head often made by scientists, is that our existence as observers *explains* the basic features of the universe. The answer to the question "Why is the universe isotropic?" given by Collins and Hawking, ". . . the isotropy of the Universe is a consequence of our existence,"{15} is simply irresponsible and brings the Anthropic Philosophy into undeserved disrepute, for literally taken, such an answer would require some form of backward causation whereby the conditions of the early universe were brought about by us acting as efficient causes merely by our observing the heavens. But WAP neither asserts nor implies this; rather WAP holds that we must observe the universe to possess certain features (not that the universe must possess certain features) and the Anthropic Philosophy says that therefore these features ought not to surprise us or cry out for explanation. The self-selection effect affects our observations, not the basic features of the universe itself. If the Anthropic Philosophy held that the basic features of the universe were themselves brought about by our observations, then it could be rightly dismissed as fanciful. But the Anthropic Philosophy is much more subtle: it does not try to explain why the universe has the basic features it does, but contends that no explanation is needed, since we should not be surprised at observing what we do, our observations of those basic features being restricted by our own existence as observers.

But does the Anthropic Philosophy follow from the Anthropic Principle, as Barrow and Tipler claim? Let us concede that it follows from WAP that

> 3. We should not be surprised that we do not observe features of the universe which are incompatible with our own existence.

For if the features of the universe were incompatible with our existence, we should not be here to notice it. Hence, it is not surprising that we do not observe such features. But it follows neither from WAP nor (3) that

4. We should not be surprised that we do observe features of the universe which are compatible with our existence.

For although the object of surprise in (4) might at first blush appear to be simply the contrapositive of the object of surprise in (3), this is mistaken. This can be clearly seen by means of an illustration (borrowed from John Leslie{16}): suppose you are dragged before a firing squad of 100 trained marksmen, all of them with rifles aimed at your heart, to be executed. The command is given; you hear the deafening sound of the guns. *And you observe that you are still alive,* that all of the 100 marksmen missed! Now while it is true that

5. You should not be surprised that you do not observe that you are dead,

nonetheless it is equally true that

6. You should be surprised that you do observe that you are alive.

Since the firing squad's missing you altogether is extremely improbable, the surprise expressed in (6) is wholly appropriate, though you are not surprised that you do not observe that you are dead, since if you were dead you could not observe it. Similarly, while we should not be surprised that we do not observe features of the universe which are incompatible with our existence, it is nevertheless true that

7. We should be surprised that we do observe features of the universe which are compatible with our existence, in view of the enormous improbability that the universe should possess such features.

The reason the falsity of (7) does not follow from (3) is that subimplication fails for first order predicate calculus. For (3) may be schematized as

3'. ~S: (x) ([$Fx \times \sim Cx$] É ~Ox)

where "S:" is an operator expressing "we should be surprised that" and "*F*" is "is a feature of the universe," "*C*" is "is compatible with our existence," and "*O*" is "is observed by us." And (7) may be schematized as

7'. S: ($x) ($Fx \times Cx \times Ox$)

It is clear that the object of surprise in (7') is not equivalent to the object of surprise in (3'); therefore the truth of (3') does not entail the negation of (7').{17}

Therefore, the attempt of the Anthropic Philosophy to stave off our surprise at the basic features of the universe fails. It does not after all follow from WAP that our surprise at the basic features of the universe is unwarranted or inappropriate and that they do not therefore cry out for explanation. But which features of the universe should thus surprise us? --those which are necessary conditions of our existence and which seem extremely improbable or whose coincidence seems extremely improbable. Thus, we should amend (7) to read

7*. We should be surprised that we do observe basic features of the universe which individually or collectively are excessively improbable and are necessary conditions of our own existence.

Against (7*), the WAP is impotent.{18}

WAP and a World Ensemble

Now proponents of the Anthropic Philosophy will no doubt contend that I have missed the whole point of the WAP. For (7*) is true only if the basic features of our observable universe are co-extensive with the basic features of the Universe as a whole. But proponents of the Anthropic Philosophy avoid (7*) by conjoining to WAP the hypothesis of a World Ensemble, that is to say, the hypothesis that our observable universe is but one member of a collection of diverse universes that go to make up a wider Universe-as-a-Whole. Given the existence of this wider Universe, it is argued that all possible universes are actualized and that the WAP reveals why surprise at our being in a universe with basic features essential to life is inappropriate.

Various theories, some of them quite fantastic, have been offered for generating a World Ensemble. For example, Wheeler proposes a model of the oscillating universe in which each cycle emerges with a new set of physical laws and constants.{19} Linde suggests an inflationary model according to which our observable universe is but one of many different mini-universes which inflated from the original larger Universe.{20} One of the most widely discussed World Ensemble scenarios is Everett's Many Worlds Interpretation of quantum physics, according to which all possible states of a quantum interaction are actualized, the observer himself splitting off into each of these different worlds.{21}

Now it needs to be emphasized that there is no evidence for any of these theories *apart from the fact of intelligent life itself*. But as John Leslie, the philosopher of science who has occupied himself most thoroughly with the Anthropic Principle, points out, any such evidence for a World Ensemble is equally evidence for a divine Designer.{22} Moreover, each of the above scenarios faces formidable scientific and philosophical objections.{23} Wheeler's theory, for example, not only succumbs to the problems generic to oscillating models,{24} but insofar as it posits singularities at the termini of each cycle, it is not even a model of an oscillating universe at all, but of just a series of unrelated worlds. Inflationary models not only face the problems of how to get the inflation started, how to get it to end without excess turbulence, and how to get it to allow galaxy formation, but more importantly they themselves require an extraordinary amount of fine-tuning prior to inflation, so that the appearance of design is not eluded. The Many Worlds Interpretation of quantum physics is so fantastic that philosopher of science John Earman characterizes its postulated splitting of space-time as a "miracle." "Not only is there no hint as to what causal mechanism would produce such a splitting," he complains, "there is not even a characterization of where and when it takes place."{25} In fact, Quentin Smith indicts the theory as incoherent, since the many worlds are supposed to exist in a timeless superspace, which is incompatible with the stipulation that they branch off serially as quantum interactions occur.{26}

Objections can be raised against each of the theories proposed for generating many worlds; but even if we conceded that a multiple universe scenario is unobjectionable, would such a move succeed in rescuing us from teleology and a cosmic Designer? This is not at all obvious. The fundamental assumption behind the Anthropic philosopher's reasoning in this regard seems to be something along the lines of

> 8. If the Universe contains an exhaustively random and infinite number of universes, then anything that can occur with non-vanishing probability will occur somewhere.

But why should we think that the number of universes is actually infinite? This is by no means inevitable, not to mention the paradoxical nature of the existence of an actually infinite number of things.{27} And why should we think that the multiple universes are exhaustively random? Again, this is not a necessary condition of many-worlds hypotheses. In order to elude the teleological argument, we are being asked to assume much more than the mere existence of multiple universes.

In any case, the move on the part of Anthropic philosophers to posit many worlds, even if viable, represents a significant concession because it implies that the popular use of the WAP to refute teleology in a Universe who properties are coextensive with the basic features of our universe is fallacious. In order to stave off the conclusion of a Designer, the Anthropic philosopher must take the metaphysically speculative step of embracing a special kind of multiple universe scenario. That will hardly commend itself to some as any less objectionable than theism.

The point is that the Anthropic Principle is impotent unless it is conjoined with a profoundly metaphysical vision of reality. According to Earman, "Some anthropic theorizers seem all too eager to embrace any form of world making that gives purchase to their modus operandi."{28} Why this desperation? John Leslie explains that although the idea of a World Ensemble is sketchy and faces powerful objections, still people think that it *must* be correct, for how else could life originate?{29} But Leslie argues that the God hypothesis is no more obscure than the World Ensemble nor less scientific, since natural laws and initial conditions are not generally taken to be scientifically explicable.{30} A scientist should consider the interpretation of a divine Designer, or else admit that he simply has no personal interest in the problem, for the only alternative to the World Ensemble is the God hypothesis, so that if we reject the latter we are stuck with the former.{31}

Martin Gardner, quoting physicist Heinz Pagels, says that the Anthropic Principle raises a new mystery:

> "How can such a sterile idea," Pagels asks, "reproduce itself so prolifically?" He suspects it may be because scientists are reluctant to make a leap of faith and say: "The reason the universe seems tailor-made for our existence is that it *was* tailor-made . . . . Faced with questions that do not neatly fit into the framework of science, they are loath to resort to religious explanations; yet their curiosity will not let them leave matters unaddressed. Hence, the anthropic principle. It is the closest that some atheists can get to God."{32}

Similarly physicist Tony Rothman writes,

> It's not a big step from the [Anthropic Principle] to the Argument from Design . . . . When confronted with the order and beauty of the universe and the strange coincidences of nature, it's very tempting to take the leap of faith from science into religion. I am sure many physicists want to. I only wish they would admit it.{33}

But if for atheist and timorous theist alike the World Ensemble and Anthropic Principle are functioning as a sort of God surrogate, what is so sad about this situation is that it is so unnecessary. For with the World Ensemble we have already launched our bark out onto the metaphysical deep; if the God hypothesis provides us a surer passage, why not avail ourselves of it? As Leslie reminds us, those who think that "science proper" has boundaries which are easy to fix are becoming increasingly rare.{34}

The Hypothesis of Divine Design

In any case, the philosopher who is a theist is certainly at liberty *qua* philosopher, if not *qua* scientist, to introduce God as his explanatory ultimate. What objections then might be raised against the theistic hypothesis? No friend of the Anthropic Principle, Earman seems sympathetic to the hypothesis of divine design, but in the end does not find it compelling because there is no need to adopt a creation theory of actuality, which this hypothesis presupposes:

> If one adopts a creation story of actuality and if one calculates that the probability of creation of a big bang model having the features in question is nil, then no anthropic principle, construed as a selection principle, is going to resolve the problem. The resolution calls rather for something akin to the traditional argument from Design.
>
> Alternatively, the need for a creation story of actuality and the need to wrestle with improbabilities of actualization can be obviated by treating actuality as a token-reflexive property of possible worlds not unlike the 'nowness' property of instants of time (see Lewis 1986). On this view all possible worlds, including the merely logically possible as well as the physically possible, are all equally 'actual'. No Creator is needed to anoint one of these worlds with the magical property of 'actuality' and the question of why this property was conferred upon a world having the features in question is mooted.{35}

Here we see the metaphysically extravagant lengths to which philosophers seem compelled to go in order to avoid a divine Designer. Earman, while excoriating Anthropic philosophers for their unwarranted postulate of a World Ensemble, shows himself quite willing to go even further, postulating the actual existence of all logically possible worlds. This involves a metaphysical commitment which is so enormous ontologically and so superfluous for explaining modal locutions that most philosophers have dismissed it as science fiction. Indeed, Plantinga has shown that such a theory of actuality entails the outrageous view that I have all my properties essentially, since it is not I, but a counterpart of me, who exists and possesses different properties in other logically possible worlds.{36} In comparison with Earman's commitment, the hypothesis of theism seems modest indeed.

Barrow and Tipler also object to the hypothesis of divine design, maintaining that "careful thinkers" would not today "jump so readily" to a Designer, for (i) the modern viewpoint stresses time's role in nature; but since an unfinished watch does not work, arguments based on omnipresent harmony have been abandoned for arguments based on co-present coincidences; and (ii) scientific models aim to be realistic, but are in fact only approximations of reality; so we hesitate to draw far-reaching conclusions about the nature of ultimate reality from models that are at some level inaccurate.{37} But Barrow and Tipler seem unduly diffident here. A careful thinker will not readily jump to any conclusion, but why may he not infer a divine Designer after a careful consideration of the evidence? Point (i) is misleading, since the operations of nature always work; at an earlier time nature is not like an *unfinished* watch, rather it is just a *less complex* watch.{38} In any case, the most powerful design argument will appeal to both present adaptedness and co-present coincidences. Point (ii) loses much of its force in light of two considerations: (a) this is a condition that affects virtually all our knowledge, which is to say that it affects none of it in particular, so that our only recourse is simply to draw conclusions based on what we determine most accurately to reflect reality; fortunately, the evidence at issue here is rather concrete and so possesses a high degree of objectivity; (b) Barrow and Tipler do not feel compelled to exercise such restraint when proposing metaphysically speculative but naturalistic accounts of the universe's basic features, for example, their defense of the Many Worlds Interpretation of quantum physics or scenarios for the origin of the universe *ex nihilo*, which leads one to suspect that a double standard is being employed here. Their objections, therefore, seem to have little force.

John Leslie's reservations with the theistic hypothesis are somewhat different: while concurring with the necessity of positing a divine Designer of the cosmos, he nonetheless argues that the ultimate explanation of the order in the universe cannot be God as traditionally conceived. Leslie plumps for what he characterizes as a Neo-platonic concept of God as the creativity of ethical requiredness. That is to say, if I understand Leslie correctly, the universe exists as it does because it *should*; it is morally necessary that a universe of free agents exist. This ethical requiredness of the universe has a sort of creative power to it that makes the world exist. If there is a personal deity, he, too, is the result of this more fundamental principle. Presumably, Leslie calls this conception Neo-platonic because according to that metaphysic the One, which takes the place of Plato's Good, produces being, the first emanation being the *Nous*, or Mind, which in turn produces the world. The God of traditional theism would be like Plotinus's *Nous* and Leslie's God like the ultimate form of the Good.

But why is the traditional concept of God so unpalatable? Leslie's critique on this score is disappointing and surprisingly weak.{39} Proceeding from the Leibnizian question, "Why is there something rather than nothing?" Leslie rejects the answer of God conceived as either a factually or a logically necessary being. For if God is only factually necessary, then He exists logically contingently, albeit eternally, and no reason is supplied for His contingent existence. On the other hand, God cannot be shown to exist necessarily in the logical sense, for when the ontological argument asserts, "It is possible that God exist," this possibility is epistemic only and, hence, does not show that God's existence is logically possible.

But this objection seems confused. If God is merely a factually necessary being, then there are possible worlds in which He does not exist. But then it is logically impossible for Him to exist in all possible worlds, that is to say, it is logically necessary that He exist contingently. But then, assuming that God is the explanatory ultimate in any world in which He exists, it makes no sense to seek a reason for His existence. To demand a reason for His existence is to ask for a logically necessary being which accounts for the fact

that God exists. But on this hypothesis, it is logically impossible that there be such a being, for if it were possible such a being would exist in every possible world, including this one, and so God would not be the explanatory ultimate. Hence, if God is a mere factually necessary being, it is logically impossible for there to be a reason for His existence. One need only add that it is wrong-headed to indict a position for not supplying what is logically impossible.

On the other hand, why hold that God is merely factually necessary? The Leibnizian Principle of Sufficient Reason might lead us to reject the concept of God as a merely factually necessary being and hold instead that He is logically necessary. The failure of the ontological argument as a piece of natural theology is irrelevant to the coherence of this conception of God. Leslie correctly points out that when the ontological argument asserts that the proposition "A maximally great being exists" (where maximal greatness entails being omnipotent, omniscient, and morally perfect in every possible world) is possible, there is an ambiguity between "epistemically possible" and "logically possible." To say that such a proposition is epistemically possible is only to say that for all we know it is true. So understood, it makes sense to say, "Possibly a maximally great being exists, and possibly He doesn't." This sense is insufficient for the purposes of the ontological argument. But if we are talking about logical possibility, then to say that the proposition "A maximally great being exists" is possible is to say that He does exist. For if He exists in any possible world, then by definition He exists in all. Thus, if this proposition is possibly true in the logical sense, it is necessarily true. Now I agree with Leslie that the ontological argument seems to fail because all we intuit is that a maximally great being is epistemically possible, but we cannot say if His existence is logically possible. But how is this even relevant to the issue at hand? The coherence of the logical necessity of God's existence does not depend on the success of the ontological argument or our intuitions. It is possible that the ontological argument fails to prove God's existence, and yet for all we know God's existence is logically necessary. Philosophers such as Plantinga, Robert Adams, and William Rowe have defended the coherence of God as a logically necessary being,{40} and Leslie says nothing to impugn this notion. Using the Leibnizian query as his starting point, Leslie ought to conclude to the existence of a being which is by nature such that if it exists in any possible world, it exists in all; such a being must exist in *this* world in order to explain why something exists rather than nothing, and, therefore, in *all* worlds, thereby obviating the need for an explanation of its existence.{41} In this way Leslie's quite legitimate demand for a reason for the existence of something rather than nothing would yield an answer for the universe's existence without requiring one for God's existence, and this without endorsing the ontological argument.

As for Leslie's own alternative conception of God, I think that its lack of explanatory power seems painfully clear. How can there be design without the previsioning of an intelligent mind? Personal agents, not impersonal principles, design things. If one says that the traditional God is a sort of personal demiurge who designed the world, then how can he be produced in being by an abstract principle? Abstract objects such as numbers, propositions, and properties have no spatio-temporal locations and sustain no causal relations with concrete objects. So how does the abstract object posited by Leslie cause a concrete object like God to exist? It thus seems clear that traditional theism is the preferable explanation of the world's design.

Concluding Remarks

Teleologists and Anthropic philosophers enjoy a peculiar "love/hate" relationship: they agree that the delicate balance of cosmological and physical conditions necessary for intelligent life does cry out for some sort of interpretation which will render it intelligible; but they differ radically as to what that interpretation should be. Theistic philosophers view this sensitive nexus of conditions as evidence of wider teleology and therefore indicative of a cosmic Designer. Anthropic philosophers contend that due to the self-selection effect imposed by our own existence we can only observe a limited number of worlds; therefore, we should not be surprised at observing this one. Moreover, if a Word Ensemble exists in which all possible values of cosmological and physical quantities are somewhere instantiated, it follows necessarily that our world with its delicate balance of conditions will also obtain. We have seen, however, that in the absence of the hypothesis of the World Ensemble the reasoning of the Anthropic philosopher, based on the trivial WAP is simply logically fallacious. As for the World Ensemble, there is not only no evidence that such an ensemble of worlds exists, but there are substantive objections against each of the proposed means of generating such

an ensemble. In any case, the postulation of a world ensemble is metaphysically extravagant, for it must involve the existence of an infinite number of exhaustively random worlds if one is to guarantee that our world will by chance alone obtain in the ensemble. Theism is certainly no more objectionable than this.

Finally, I should like to say a word concerning the religious value of the hypothesis of divine design as an explanation for the wider teleology we have discovered in nature. As the debate over the Anthropic Principle has spread, it has even taken on literary dimensions, finding its way into the contemporary novel *Roger's Version* by John Updike. When Dale Kohler explains that physicists are proving the existence of God, Roger Lambert, a professor of theology, replies:

> For myself I must confess that I find your whole idea aesthetically and ethically repulsive. Aesthetically because it describes a God Who lets Himself be intellectually trapped, and ethically because it eliminates faith from religion, it takes away our freedom to believe or doubt. A God you could prove makes the whole thing immensely, oh, uninteresting. Pat. Whatever else God may be, He shouldn't be pat.{42}

Roger's objections, so typical of contemporary theology, reveal fundamental misunderstandings about the revelation of God and the nature of faith. God's handiwork in nature is not a matter of His being intellectually trapped, but of His revelation of Himself to His creation, a self-disclosure which is aesthetically beautiful; as the Psalmist says, "The heavens are telling the glory of God and the firmament proclaims his handiwork" (Ps. 19.1). And the decision to believe in God or not is not so much a matter of *assensus*, but of *fiducia*. The demonstration of His existence on the basis of His created order in no way removes our freedom to trust in ourselves rather than in Him; as Paul wrote, "although they knew God, they did not honor him as God . . ." (Rom. 1.21). The teleological argument, then, if successful, hardly makes belief in God pat.{43} Rather it helps to bring us more quickly to the true crisis of faith.

Endnotes

{1}I depend for this section on the impressive compilations by John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Clarendon Press, 1986) and John Leslie, "The Prerequisites of Life in Our Universe," in *Newton and the New Direction in Science*, ed. G.V. Coyne, M. Heller, J. Zycinski (Vatican: Citta del Vaticano, 1988). Detailed discussion and documentation may be found there.

{2}Stephen Hawking, *A Brief History of Time: from the Big Bang to Black Holes* (N.Y.: Bantam Books, 1988), p.132.

{3}Ernst Nagel, *The Structure of Science*, 2d ed. (Indianapolis: Hackett, 1979), pp. 53-54.

{4}George Gale, "Some Metaphysical Perplexities in Contemporary Physics," paper presented at the 1985 meeting of the Society of Metaphysics.

{5}Brandon Carter, "Large Number Coincidences and the Anthropic Principle," in *Confrontation of Cosmological Theories with Observational Data*, ed. M.S. Longair (Boston: D. Reidel, 1974), pp. 291-98.

{6}Barrow and Tipler, *Anthropic Principle*, p. 15.

{7}Ibid., p. 16.

{8}IBid., p. 23.

{9}Ibid., pp. 1-2.

{10}Ibid., p. 3.

{11}Ibid., p. 2.

{12}Ibid., p. 18.

{13}Ibid., p. 247.

{14}Ibid., pp. 566, 575.

{15}C.B. Collins and S.W. Hawking, "Why Is the Universe Isotropic?" *Astrophysical Journal* 180 (1973):317.

{16}John Leslie, "Anthropic Principle, World Ensemble, Design," *American Philosophical Quarterly* 19 (1982):150.

{17} Similarly, the falsity of (6) does not follow from the truth of (5), for (5) may be schematized as ~S: ~ ($x) ([Mx × ~Ax] × Ox), where M is 'is me', Ox is 'is observed by me', and A is 'is alive'. From this it does not follow that ~S: ($x) ([Mx × Ax] × Ox), which is the negation of (6).

{18}Once the central fallacy is thus removed, Barrow and Tipler's argument in the lengthy quotation in the text seems to amount to little more than the old objection that any state of affairs is highly improbable and therefore the obtaining of the actual state of affairs requires no special explanation. But this objection is surely misconceived. What unprejudiced and right-minded person could possibly regard a chimpanzee's haphazardly typing out the complete plays and sonnets of Shakespeare as equally probable with any chaotic series of letters? The objection fails to reckon with the difference between randomness, order, and complexity. On the first level of randomness, there is a non-denumerably infinite number of chaotic sequences, e.g., "adfzwj," each of which is equally improbable and which collectively could serve to exhaust all sequences typed by the ape. But the meta-level of ordered letters, e.g., "crystalcrystalcrystal," need never be produced by his random efforts, were he to type for eternity. Even more improbable is the meta-meta-level of complexity, in which information is supplied, e.g., "To be or not to be, that is the question." Hence, it is fallacious to assert that since some set of conditions must obtain in the universe, the actual set is in no way improbable or in need of explanation.

{19}John A. Wheeler, "From Relativity to Mutability," in *The Physicist's Conception of Nature*, ed. J. Mehra (Dordrecht: D. Reidel, 1973).

{20}A.D. Linde, "The Inflationary Universe," *Reports on Progress in Physics* 47 (1984):925-986.

{21}Hugh Everett, "'Relative State' Formulation of Quantum Mechanics," *Reviews of Modern Physics* 29 (1957):454-462.

{22}John Leslie, "Modern Cosmology and the Creation of Life," in *Evolution and Creation*, ed. Ernan McMullin, University of Notre Dame Studies in the Philosophy of Religion (Notre Dame, Ind.: University of Notre Dame Press, 1985), pp. 97-77.

{23}See, for example, the critiques in Quentin Smith, "World Ensemble Explanations," *Pacific Philosophical Quarterly* 67 (1986):73-81; Leslie, "Prerequisites of Life."

{24}*Viz*., (i) there is no known physics which could cause the universe to oscillate, (ii) the density of the universe appears to be far below the critical level needed to bring about re-contraction, and (iii) the thermodynamic properties of oscillating models reveal that while they have an infinite future, they possess only a finite past. For discussion, see my *The* Kalam *Cosmological Argument*, Library of Philosophy and Religion (London: Macmillan, 1979), pp. 122-30, 135-36.

{25}John Earman, "The SAP Also Rises: A Critical Examination of the Anthropic Principle," *American Philosophical Quarterly* 24 (1987):312.

{26}Smith, "World Ensemble Explanations," pp. 77-78. It is not clear to me why Smith does not think that his own view of the universe as a quantum fluctuation does not succumb to this same objection, since the superspace of quantum geometrodynamics is atemporal. Perhaps he thinks of the superspace as also temporal, but then one is caught in positing time beyond time, which seems incoherent. And even if a temporal superspacetime is coherent, in infinite time some random fluctuation would have spawned an open universe, which would by this time have so expanded as to coalesce with any other universe produced in the superspacetime by a quantum fluctuation, since it has had eternity to do so, thereby eliminating any ensemble of distinct worlds.

{27}The paradoxical nature of the infinite was emphasized by Hackett, *Theism*, pp. 194-95, 294, whose exposition was the seed of my own Kalam *Cosmological Argument*, pp. 69-102.

{28}Earman, "SAP Also Rises," p. 312. He adds,"That anthropic theorists stand ready to make use of any such speculation which proves handy tells us something about their methodology" (Ibid, p. 311).

{29}John Leslie, "Observership in Cosmology: the Anthropic Principle," *Mind* 92 (1983):575.

{30}Leslie, "Cosmology and the Creation of Life," pp. 98, 112.

{31}John Leslie, "God and Scientific Verifiability," *Philosophy* 53 (1978):79.

{32}Martin Gardner, "WAP, SAP, PAP, & FAP," *New York Review of Books*, (May 8, 1986), p. 23. The quotation from Pagels is from Heinz Pagels, "A Cozy Cosmology," *The Sciences* (March/April, 1985).

{33}Tony Rothman, "A 'What You See Is What You Beget' Theory," *Discover*, (May 1987), p. 99.

{34}Leslie, "God and Scientific Verifiability," p. 79.

{35}Earman, "SAP also Rises," p. 310. Earman's reference is to D. Lewis, *On the Plurality of Worlds* (London: Basil Blackwell, 1986).

{36}Alvin Plantinga, *The Nature of Necessity* (Oxford: Clarendon Press, 1974), pp. 102-20.

{37}Barrow and Tipler, *Anthropic Principle*, p. 30.

{38}The response to this objection would also seem appropriate with regard to Earman's proposed satirical antidote to our surprise at the fine-tuning of the universe: "Imagine . . . the wonderment of a species of mud worms who discover that if the constant of the thermometric conductivity of mud were different by a small percentage they would not be able to survive" (Earman, "SAP also Rises,"p. 314). For if our argument has been correct, then, if mud worms possessed self-conscious intelligence, they should indeed be stunned at the fine-tuning requisite for their existence. For even if mud worms were the highest form of life, the delicate balance of conditions necessary for life itself, not to mention the unbelievable complexity involved in an organism so highly developed as a mud worm, remains unaffected by such an attenuation. Indeed, many teleologists argue for the hypothesis of design simply on the basis of a single cell, a gene, or even a DNA molecule, not to speak of organisms so fantastically intricate as a lowly mud worm. (See, *e.g.*, Charles B. Thaxton, Walter L. Bradley, and Roger L. Olsen, *The Mystery of Life's Origin* [New York: Philosophical Library, 1984]; Hubert Yockey, "A Calculation of the Probability of Spontaneous Biogenesis by Information Theory," *Journal of Theoretical Biology* 67 [1977]:377.) The argument based on the existence of intelligent human life simply heaps on the complexity to be explained.

The truth in Earman's argument is the same point made by Deist satires of the teleological argument: the mud worms could not infer that their existence was the target at which the Creator aimed nor that the Creator was some Great Mud Worm. (Cf. McMullin's similar complaint that one cannot infer from the evidence that man is the goal of creation or that it was necessary for God to create this sort of universe in order to produce man [Ernan McMullin, "How Should Cosmology Relate to Theology?" in *The Sciences and Theology in the Twentieth Century*, ed. A.R. Peacocke (Notre Dame, Ind.: University of Notre Dame Press, 1981), pp. 44-45].) But the teleological argument need not be so anthropocentrically construed. It contends merely that the complex order of the universe requires as its most plausible explanation a Cosmic Intelligence which designed the universe. To show that man (or mud worms) is the goal of creation would require additional arguments, say, the moral argument, or revelation.

{39}See John Leslie, "The World's Necessary Existence," *International Journal for Philosophy of Religion* 11 (1980):207-24.

{40}Plantinga, *Nature of Necessity*, pp. 197-221; Robert Adams, "Has It Been Proved that All Real Existence is Contingent?" *American Philosophical Quarterly* 8 (1971):284-91; William L. Rowe, *The Cosmological Argument* (Princeton: Princeton University Press, 1975), chap. 4.

{41}See the helpful comments by Thomas V. Morris, review of *The Quest for Eternity* by J.C.A. Gaskin, *Faith and Philosophy* 3 (1986):334.

{42}John Updike, *Roger's Version* (London: Deutsch, 1986).

{43}One thinks in this connection of Aristotle's God, who served in his physics and metaphysics as an explanatory principle, but was not an object of religious devotion or worship. Aristotle's conception of deity ought to make quite clear that the postulate of a divine Designer does not settle for us the religious question.

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