Philosophy of Religion

SELECTED READINGS

FIFTH EDITION

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New York Oxford
OXFORD UNIVERSITY PRESS

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Published by Oxford University Press
198 Madison Avenue, New York, New York 10016
http://www.oup.com

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CIP data is on file at the Library of Congress
Library of Congress Cataloging in Publication
Control Number: 2013048405
ISBN 978-0-19-930344-1

Printing number: 9 8 7 6 5 4 3 2 1

Printed in the United States of America
on acid-free paper

Robin Collins

The Anthropic Teleological Argument

Robin Collins (b. 1961) notes that there are a significant number of fine-tuning cosmic conditions, each of which is highly unlikely in and of itself, yet all of which are necessary for there to be conscious, knowing beings like ourselves. He also notes the beauty and elegance of the natural laws and the intelligibility and discoverability of the structure of the universe. In attempting to account for these features one may appeal to either a theistic or a naturalistic explanation. Collins introduces what he calls the likelihood principle of confirmation, according to which observations provide evidence in favor of one hypothesis over another just in case the observations are more probable under that hypothesis. Collins argues that since fine-tuning is much more probable under theism than under the naturalistic single-universe hypothesis, the principle implies that the evidence from fine-tuning supports a theistic rather than a naturalistic account of the origin of the universe. Even on the many-universes model, which holds that it is likely that a significant number of habitable universes could exist, the existence of God provides a more probable explanation. Not only are the many-universes models highly speculative, but even if such are possible, what generates the many universes has to be well designed to produce universes capable of harboring life. Again, theism provides a better explanation of the apparent design found in the beauty and elegance of the resulting universes than atheism does. The argument from fine-tuning, beauty, and discoverability is not intended to prove God's existence or even show that God's existence is likely; rather, it is intended to show that these features of the universe count as substantial evidence for God's existence in the sense of making it considerably more plausible than naturalism.

Robin Collins, "The Case for Cosmic Design," revised from http://www.infidels.org/library/modern/robin_collins/design.html.

The Case for Divine Creation from Cosmic Fine-Tuning

In his book, *The Cosmic Blueprint: New Discoveries in Nature's Creative Ability to Order the Universe*, theoretical physicist Paul Davies writes that, when looking at the overall structure of the universe, "the impression of design is overwhelming."[1] I agree. During the last one hundred years, physicists have discovered at least three features of the universe that point to divine creation:

(i) The so-called fine-tuning of laws, constants, and initial conditions of the universe for complex life of comparable intelligence to ourselves.
(ii) The extraordinary beauty and elegance of the laws and mathematical structure of the universe.
(iii) The intelligibility and discoverability of the basic structure of nature.

I will briefly look at each of these in turn, and then at why they count as significant evidence for theism.

The Evidence

Fine-Tuning of Laws for Life

The fine-tuning for life refers to the fact that the laws of nature, the constants of physics, and the initial conditions of the universe are set just right for life to evolve. As we will see, the relevant kind of life is what I call *embodied conscious agents* (ECAs) that can significantly influence each other for good or ill through what they take to be moral choices. Further, I will assume that in any universe remotely resembling ours, ECAs can only exist if the universe allows for stable, highly complex physical systems that can gather information, act upon that information, and reproduce.

To begin, consider the fine-tuning of the laws of nature. To say that the laws are fine-tuned means that if we did not have just the right combination of laws, it would be impossible for ECAs to evolve. For example, according to current physics, there are four forces in nature—gravity, the weak force, electromagnetism, and the strong nuclear force that binds protons and neutrons together in an atom. The existence of each of at least three of these forces, and probably the fourth, is necessary for complex material systems to evolve. If gravity did not exist, masses would not clump together to form stars or planets; if the electromagnetic force did not exist, there would be no chemistry; if the strong force did not exist, protons and neutrons could not bind together and hence no atoms with atomic numbers greater than hydrogen would exist. Other principles of physics also appear necessary for ECAs. For example, if the Pauli-exclusion principle did not exist—which is what keeps two electrons from occupying the same energy state in an atom—all electrons would occupy the lowest atomic energy state, and thus complex chemistry would not be possible. Thus, if any of these fundamental laws or principles were missing, the evolution of the sort of stable complex systems required for ECAs would probably be rendered impossible.

Fine-Tuning of Constants and Initial Conditions

Next, consider the fine-tuning for life of the constants of physics. The constants of physics are fundamental numbers that when plugged into the laws of physics determine the basic structure of the universe. An example of a fundamental constant is Newton's gravitational constant G, which determines the strength of gravity via Newton's law $F = Gm_1m_2/r^2$. Many of the fundamental constants must fall into a *relatively* narrow range in order for complex life to exist.

To illustrate this fine-tuning, consider gravity. Using a standard measure of force strengths—which turns out to be roughly the relative strength of the various forces between two protons in a nucleus—gravity is the weakest of the forces, and the strong nuclear force is the strongest, being a factor of 10^{40}—or ten thousand billion, billion, billion, billion—times stronger than gravity. If gravity were a billion-times stronger, for instance, the force of gravity on a planet with the mass and size of the earth would be so great that organisms anywhere near the size of human beings, whether land-based or aquatic, would

be crushed. (The strength of materials depends on the electromagnetic force via the fine-structure constant, which would not be affected by a change in gravity.) Even a much smaller planet of only 40 feet in diameter—which is not large enough to sustain organisms of our size—would have a gravitational pull of one thousand times that of earth, still too strong for organisms of our brain size, and hence level of intelligence, to exist. As astrophysicist Martin Rees notes, "In an imaginary strong gravity world, even insects would need thick legs to support them, and no animals could get much larger."[2] Of course, a billion-fold increase in the strength of gravity is a lot, but compared to the total range of the strengths of the forces in nature (which span a range of 10^{40} as we saw above), it is very small, being one part in ten thousand, billion, billion, billion.

The most discussed case of fine-tuning for life is that of the cosmological constant. The cosmological constant is a term in Einstein's equation of general relativity that, when positive, acts as a repulsive force, causing space to expand and, when negative, acts as an attractive force, causing space to contract. If it were too large, space would expand so rapidly that galaxies and stars could not form, and if too small, the universe would collapse before life could evolve. In today's physics, it is taken to correspond to the energy density of empty space. The fine-tuning for life of the cosmological constant is typically estimated to be one part in 10^{120} (10^{120} is 1 followed by 120 zeroes, an enormously large number). To get an idea of how precise this is, it would be like throwing a dart at the surface of the earth from across the universe, and hitting a bull's-eye less than one trillionth of a trillionth of an inch in diameter, which is far smaller than the size of an atom! Even Nobel Laureate in physics Steven Weinberg, a critic of the fine-tuning argument, admits that the fine-tuning of the cosmological constant is highly impressive.[3]

Further examples of the fine-tuning for life of the fundamental constants of physics can also be given, such as that of mass difference between the neutron and the proton. If, for example, the mass of the neutron were slightly increased by about one part in seven hundred, stable hydrogen burning stars would cease to exist.[4]

Probably the most astounding case of fine-tuning is that of the initial conditions of the universe, which refers to the fact that the initial distribution of mass-energy—as measured by entropy—must fall within an exceedingly narrow range for complex life to evolve. According to Roger Penrose, one of Britain's leading theoretical physicists, "In order to produce a universe resembling the one in which we live, the Creator would have to aim for an absurdly tiny volume of the phase space of possible universes."[5] How tiny is this volume? According to Penrose, it is 10^{123} of the entire volume. (Phase space is the space that physicists use to measure the various possible configurations of mass-energy of a system.) This precision is much, much greater than the precision that would be required to hit an individual proton given the entire visible universe were a dart board!

It should be pointed out that some have been skeptical of some cases of fine-tuning in the literature. Elsewhere, I (and others) have pointed out the many flaws in the claims of the leading critic of the evidence for fine-tuning, retired physicist Victor Stenger.[6] Further, even if none of the cases of purported fine-tuning were well-established (which is not the case), the argument would still have significant force. As philosopher John Leslie has pointed out, "clues heaped upon clues can constitute weighty evidence despite doubts about each element in the pile."[7]

Summary of Fine-Tuning for Life Argument

The fine-tuning of the universe for life has often been cited as providing significant evidence for divine creation of the cosmos. The reason is that, because of the exceedingly special conditions required for the existence of life, it seems enormously improbable or surprising that the initial conditions, laws, and constants would be adjusted just right for highly complex life under what I call the *naturalistic single-universe hypothesis*, but not surprising under theism. Thus by the likelihood principle of confirmation theory discussed below, the fine-tuning provides strong evidence for theism over this alternative naturalistic hypothesis. (The naturalistic single-universe hypothesis is the hypothesis that there is only one

universe and it exists as a brute, inexplicable fact; when the term "naturalism" is used below, it is always to be understood that for the case of the fine-tuning for life—but not for the other evidence cited below—the naturalistic single-universe hypothesis is what is being referred to.)

Beauty and Elegance of Laws

The beauty and elegance of the laws of nature also point to divine creation. Nobel Prize winning physicist Steven Weinberg, for instance, devotes a whole chapter of his book *Dreams of a Final Theory* to explaining how the criteria of beauty and elegance are commonly used with great success to guide physicists in formulating laws.[8] As Weinberg points out, "mathematical structures that confessedly are developed by mathematicians because they seek a sort of beauty are often found later to be extraordinarily valuable by the physicist." Later, Weinberg comments that "Physicists generally find the ability of mathematicians to anticipate the mathematics needed in the theories of physics quite uncanny." Indeed, one of the most prominent theoretical physicists of this century, Paul Dirac, has gone so far as to claim, as Einstein did, that "it is more important to have beauty in one's equations than to have them fit experiment."[9] The beauty, elegance, and ingenuity of mathematical equations make sense if the universe was purposefully designed like an artwork, but appear surprising and inexplicable under the non-design hypothesis. Weinberg, who is a convinced atheist, even admits that "sometimes nature seems more beautiful than strictly necessary."

Some have claimed that the beauty we see in nature is merely subjective, like seeing the Big Bear or Big Dipper in the random pattern of stars in the night sky. To say that the beauty of the mathematical structure of nature is merely subjective, however, completely fails to account for the amazing success of the criterion of beauty in producing predictively accurate theories, such as Einstein's general theory of relativity. We would not expect merely subjective impressions to lead to highly successful theories.

Intelligibility and Discoverability

Finally, the laws of nature themselves seem to be carefully arranged so that they are intelligible, and in addition discoverable, by beings with our level of intelligence—like solving a clever puzzle. This has been stressed by many prominent physicists. Albert Einstein, for example, famously remarked that "the eternal mystery of the world is that it is comprehensible . . . The fact that it is comprehensible is a miracle."[10] Similarly, in his famous essay, "The Unreasonable Effectiveness of Mathematics in the Physical Sciences," Eugene Wigner, one of the principal founders of quantum mechanics, famously claimed that "The miracle of the appropriateness of the language of mathematics for the formulation of the laws of physics is a wonderful gift which we neither understand nor deserve."[11] As theoretical physicist Paul Davies notes,

> a common reaction among physicists to remarkable discoveries of the sort discussed above is a mixture of delight at the subtlety and elegance of nature, and of stupefaction: 'I would never have thought of doing it that way.' If nature is so 'clever' that it can exploit mechanisms that amaze us with their ingenuity, is that not persuasive evidence for the existence of intelligent design behind the physical universe?[12]

Further, Davies notes, "uncovering the laws of physics resembles completing a crossword in a number of ways. . . . In the case of the crossword, it would never occur to us to suppose that the words just happened to fall into a consistent interlocking pattern by accident . . ."

Summary of Argument and Method of Inference

All these features of the laws of nature, let alone the fact that our best theories seem to require that the universe have a beginning, give the impression of divine creation. The form of inference here can be thought of as what philosophers call a cumulative

case argument in which many factors, such as the fine-tuning, the beauty, intelligibility, and discoverability of the laws of nature, all point in the same direction, and seem difficult to explain on any other hypothesis. Indeed, the form of argument is similar to that used to support many scientific theories, such as the thesis of common ancestry (which is the claim that all life arose from an initial simple life form by the process of descent with modification). As evolutionary biologist and geneticist Edward Dodson summarizes the case for evolution in the sense of common ancestry,

> All [pieces of evidence] concur in *suggesting* evolution with varying degrees of cogency, but most can be explained on other bases, albeit with some damage to the law of parsimony. The strongest evidence for evolution is the concurrence of so many independent probabilities. That such different disciplines as biochemistry and comparative anatomy, genetics and biogeography should all point toward the same conclusion is very difficult to attribute to coincidence"[13]

As in the case of common ancestry, the cumulative case form of our argument for divine creation is particularly strong, since even if skeptics can explain away one type of evidence, they would still have to deal with the other types of evidence listed above.

At this point, one might want to inquire further as to why each feature mentioned above counts as evidence in favor of theism over naturalism. As mentioned above in the case of the fine-tuning for life, the rule of inference is the likelihood principle of confirmation theory, which provides the best way of formulating the argument. According to the likelihood principle, an event or state of affairs E counts as evidence in favor of a hypothesis H_1 over a hypothesis H_2 if E is more probable under H_1 than H_2, with the degree of support proportional to the ratio of probabilities under the two respective hypotheses. (To deal with certain potential counterexamples, one might also restrict the principle to *non-ad hoc* hypotheses, such as hypotheses which were advocated by people before the discovery of the features of the universe discussed above.) The likelihood principle shows why an ink splotch that looks like the face of Abraham Lincoln would support the idea that the splotch was designed, whereas a splotch of random looking ink marks would not. Although the exact details of both kinds of ink marks are highly improbable under the chance hypothesis, only in the former case are the ink marks *not* highly improbable under design.

It is critical to point out that the sort of probability used in the likelihood principle is not statistical probability but rather what philosophers call *epistemic* probability, which can be thought of as a measure of rational degrees of expectation. For example, when scientists say that the theory of evolution is *probably* true, they are clearly not talking about statistical probability, such as the relative proportion of times the theory turns out to be true in a large number of trials. Rather, they are saying something to the effect that given the total body of available evidence, a rational person should expect that the theory of evolution is true.

Put in terms of epistemic probability, the likelihood principle can be reworded in terms of degrees of expectation, or more conveniently for our purposes, *degrees of surprise*, instead of probability, in which case it becomes what could be called the *surprise principle*. According to this principle, if an event or state of affairs E is more surprising under one hypothesis H_2 than another H_1, it counts as evidence in favor of H_1 over H_2—that is, in favor of the hypothesis under which it is the least surprising. The strength of the evidence is proportional to the relative degree to which it is more surprising under H_2 than H_1. Rewording the likelihood principle in this way is particularly helpful for those trained in the sciences who are not familiar with epistemic probability and therefore tend to confuse it with other kinds of probability, even when they are aware of the distinction.

Given this rewording, the likelihood version of the argument can be rendered as follows:

(1) The existence of a universe with the features cited above is not surprising under theism.
(2) The existence of such a universe is enormously surprising under naturalism.
(3) Therefore, by the likelihood principle, the existence of such a universe strongly supports theism over naturalism.

Why think that premises (1) and (2) are true? With regard to premise (1), theists have traditionally held that God is the greatest possible being and hence is perfectly good and has a perfect aesthetic sense. A perfectly good God would create a reality that positively, or even optimally, realizes goodness—particularly moral goodness, but also aesthetic goodness. Consequently, given that we can glimpse a greater good realized by ECAs that are vulnerable to each other and their environment, it is not highly surprising under theism that such a universe would exist. I propose that one such good is the ability to engage in particular kinds of freely chosen virtuous actions—such as self-sacrificial love, courage, and the like—that the vulnerability that comes from embodiment allows. Such virtuous actions are often recognized as goods that would not occur without the possibility of evil, but many question whether alone they are sufficient to outweigh the sorts of evils we find in the world. In a theodicy I develop elsewhere, under the rubric "connection building theodicy," I claim that these actions can result in intrinsically valuable eternal connections of appreciation, contribution, and intimacy between conscious agents that potentially can outweigh the evils in this world.[14] For example, if someone significantly helps me in times of suffering, it can create a connection of appreciation in me that has the potential of lasting all eternity, and hence growing in value. It is important to note in this regard, however, that one can accept premise (1) without accepting some solution to the problem of evil. All premise (1) requires is that one be able to *glimpse* some potential greater good that arises from the existence of ECAs. This is a fairly weak requirement.

Given the traditional attributes of God, therefore, it is not surprising that God would create a universe that is fine-tuned for the existence of ECAs. Further, since God has a perfect aesthetic sense, it is not surprising that the universe would have an elegant underlying mathematical structure. Finally, we normally assume that discovering the nature of the universe is a good thing, which is why governments are willing to spend billions of dollars on science. Hence, it is also not surprising under theism that the universe is structured to be discoverable.

Why think premise (2) is true—namely, that it is highly surprising under naturalism that a universe would exist with these features? At least in the case of the fine-tuning of the constants and initial conditions of the universe for ECAs, the reason is that there seems to be a very small, quantifiable range of possibilities (e.g., one part in 10^{120} for the values of the cosmological constant) in order for the universe to be able to support ECAs. Similarly, for the case of the beauty and discoverability of the universe, the proportion of laws that exemplify these features seems vastly smaller than those that do not—just as there are far more ways to construct an ugly building than one that is exceedingly elegant. Unlike the case of the fine-tuning of the constants for ECAs, however, this judgment is based more on intuition than anything quantifiable.

One common objection, which is based on a misunderstanding, to the above version of the argument is that we are merely arguing from the purported improbability of the existence of one of the above features under naturalism. Very improbable events, however, occur all the time by chance. For example, the exact pattern of any ink splotch is very improbable—never to be repeated in the history of human beings—and yet most of them do not suggest design. The premises, however, are not merely that certain features of the universe are enormously surprising under naturalism, but that they are also *not* surprising under theism. Both of these claims are necessary for using the likelihood principle to claim that these features strongly support theism over naturalism.

Interestingly, this way of formulating the argument allows us to incorporate the strongest argument against theism—that of the problem of evil—and show that the combination of the evidence cited above with the existence of evil also strongly confirms theism over the relevant naturalistic hypothesis. The reason is that the existence of creatures with free choice that are highly vulnerable to each other and their environment will inevitably result in various sorts of evil; if God typically prevented the evils, they would not truly be vulnerable in this way. Hence, given we can glimpse a good reason, such as offered above,

for God's creating a universe with such creatures, it follows that the existence of such a universe that also contains these evils is not surprising under theism. Nonetheless, such a universe is still enormously surprising under single-universe naturalism (since it requires extreme fine-tuning). Hence, when both the existence of evil and the fine-tuning evidence are taken into account, theism is still strongly confirmed over its naturalistic contender.

One objection to the above argument is that epistemic probability is merely subjective. One response to this objection is that epistemic probability is used, and needed, for many widely accepted inferences in everyday life and science. For example, as the above quotation by Edward Dodson illustrates, the support for the thesis of common ancestry (evolution) is based on the claim that a variety of features of the world—such as the structure of the tree of life—would not be improbable if evolution is true, but would be very improbable under the other viable non-evolutionary hypotheses, such as special creation. This improbability is not one of statistical improbability, nor can it be justified by an appeal to statistical improbability, since we have no statistics regarding the relative frequency of life on a planet having these features under either the evolutionary hypothesis or some non-evolutionary hypothesis. Neither do we have any model from which to derive those statistics. Thus, if it were a statistical probability, it would be completely unjustified. Rather, it should be understood as a form of epistemic probability—e.g., as claiming that various features of the world would be much more surprising under the various contender non-evolutionary hypotheses than under the evolutionary hypothesis. Further, since we have no statistical models on which to base our judgments of epistemic probability (especially for the non-evolutionary hypotheses), these judgments of epistemic probability are not rigorously justified. Rather, after (hopefully) doing the best job of looking at the evidence, scientists and laypersons make judgments of what kind of world we should expect under each hypothesis, and then they simply trust these judgments. This sort of trust in our judgments of epistemic probability—that is, what we should rationally expect under various hypotheses—is a pervasive and indispensable feature of our intellectual life.

This same kind of reasoning is what is going on in the likelihood rendition of our argument: we look at the various features of the universe mentioned above, and judge that they are very surprising under naturalism, but not under theism. Then, as in the case of evolution, after a careful analysis of the evidence, we trust our judgments of epistemic probability in deciding the strength of the evidence. What if someone does not share these judgments of epistemic probability? One can either appeal to how widely shared these judgments are by those who are relevantly informed, or one can attempt to provide a deeper justification of them. In this regard, it should be noted that the judgment that features of the universe such as beauty and discoverability are surprising under naturalism is widely shared by intelligent, informed individuals, as some of the scientists and philosophers cited above illustrate. My argument in "The Teleological Argument: An Exploration of the Fine-Tuning of the Universe" is that a more rigorous, deeper justification can be offered, particularly for the case of the fine-tuning for life.[15] For example, in the case of the fine-tuning of the fundamental parameters for life, I base the claim that a life-permitting universe is very surprising under the naturalistic single-universe hypothesis on the smallness of the range that allow for ECAs as compared to some appropriately chosen comparison range, along with a revised version of the probabilistic principle of indifference. My point here, however, is that although such justification is nice to have, even if it were not offered, that should not undermine the claim that the above features provide evidence, via the likelihood principle, for theism over naturalism, just as it does not in the analogous scientific cases.

Of course, the skeptic might object that scientific theories are testable, whereas the theistic explanation is not. But why should testability be epistemically relevant? After all, testability is about being able to find evidence for or against a theory in the future. What matters for the likelihood of a hypothesis's (approximate) truth, however, is the current evidence

in its favor, not whether it is possible to find evidence for or against it at some future time. Thus, I contend, this argument for theism is on as solid ground in terms of the method of inference being deployed as many arguments we accept in science. It involves using a double standard, therefore, to accept one sort of inference without rigorous justification, but reject the other merely because it purportedly lacks such justification.

Because these features of the universe offer a *prima facie* case for theism, the burden is now on the skeptic to show what is wrong with the argument. To get a sense of the sort of objections commonly raised to the argument for theism from the above features, along with the sort of responses that can be given, I will end by considering two major objections raised against the most discussed version of this argument, that from the fine-tuning of the cosmos for life. Other objections are covered in my article in the Blackwell Companion to Natural Theology mentioned above.

Objections to Fine-Tuning for Life Argument

Grand Unified Theory Objection

One common objection is that, as far as we know, the values of the fundamental parameters will eventually be explained by some grand unified theory. Hence, it is argued, we do not need to invoke a designer to explain why these parameters have life-permitting values. However, as astrophysicists Bernard Carr and Martin Rees note, "even if all apparently anthropic coincidences could be explained [in terms of such a unified theory], it would still be remarkable that the relationships dictated by physical theory happened also to be those propitious for life."[16] For the theist, then, the development of a grand unified theory would not undercut the case for divine creation, but would only serve to deepen our appreciation of the ingenuity of the creator. Instead of separately fine-tuning each individual parameter, in this view, God carefully chose those laws that would yield life-permitting values for each parameter.

Many-Universes Objection

Another objection to considering fine-tuning for life as evidence for design is one that takes us almost into the realm of science fiction: the proposal that there are a very large number of universes, each with different values for the fundamental parameters of physics. If such multiple universes exist, it would be no surprise that the parameters in one of them would have just the right values for the existence of intelligent life, just as in the case where if enough lottery tickets were generated, it would be no surprise that one of them would turn out to be the winning number. Further, it is no surprise that we observe that *our* universe has these values, since they are necessary for our existence.

How did these universes come into existence? Typically, the answer is to postulate some kind of physical process, what I will call a "universe generator." Against the naturalistic version of the universe-generator hypothesis, one could argue that the universe generator itself must be fine-tuned to produce even one life-sustaining universe. After all, even a mundane item such as a bread-making machine, which only produces loaves of bread instead of universes, must have just the right mechanisms, programming, and proportion of ingredients (flour, yeast, gluten, and so on) to produce decent loaves of bread. Indeed, if one carefully examines the most popular and most well-developed universe-generator hypothesis, that arising out of inflationary cosmology, one finds that it contains just the right fields and laws to generate life-permitting universes. Eliminate one of the fields or laws, and no life-sustaining universes would be produced. Finally, neither the universe-generator hypothesis nor even the hypothesis that all possible universes simply exist as a brute fact can explain the other design-indicating features of our universe mentioned above, such as why *our* universe has an elegant, intelligible, and discoverable underlying mathematical structure.

Despite these objections to the naturalistic version of the universe-generator hypothesis, I am not objecting to the notion of many universes or even a universe generator. For the theist, the existence of many universes would simply support the view that

creation reflects the *infinite creativity* of the creator, who is so creative that he/she not only creates a reality with an enormous number of planets and galaxies, but also one with many universes.

Conclusion

I have argued that the fine-tuning of the cosmos for life, and the beauty and discoverability of the fundamental laws of nature, provide strong evidence, via the likelihood principle, for preferring theism over naturalism. I pointed out that although one can partially explain the fine-tuning of the constants of physics by hypothesizing some sort of many-universe generator, we have good reasons to believe that the many-universe generator itself would need to be fine-tuned, and hence that this hypothesis only pushes the case for design up one level, to that of the many-universe generator itself. Further, I argued that this hypothesis cannot explain the beauty and discoverability of the fundamental structure of the universe. The arguments I have offered do not prove the truth of theism, or even show that theism is epistemically warranted or the most plausible position to adopt. To show this would require examining all the evidence both for and against theism, along with looking at all the alternatives to theism. Rather, the arguments in this paper were only intended to show that the fine-tuning of the cosmos offers us significant reasons for preferring theism over naturalism, where naturalism is understood as the thesis that the universe exists as a brute, inexplicable fact.

Notes

1. Paul Davies, *The Cosmic Blueprint: New Discoveries in Nature's Creative Ability to Order the Universe* (New York: Simon and Schuster, 1988), p. 203.
2. Martin Rees, *Just Six Numbers* (New York: Basic Books, 2000), p. 30.
3. Steven Weinberg, "A Designer Universe?" *The New York Review of Books*, Oct. 21, 1999.
4. John Leslie, *Universes*, New York: Routledge, 1989), pp. 39–40; Robin Collins, "The Evidence for Fine-Tuning." in *God and Design: The Teleological Argument and Modern Science*, ed. Neil Manson (New York: Routledge, 2003), pp. 178–199; Luke A. Barnes, "The Fine-Tuning of the Universe for Intelligent Life," 2012, http://arxiv.org/abs/1112.4647.
5. Roger Penrose, *The Emperor's New* Mind (New York: Oxford University Press, 1989), p. 343.
6. Robin Collins, "The Fine-Tuning Evidence is Convincing," in *Oxford Dialogues in Christian Theism*, Chad Meister, J. P. Moreland, and Khaldoun Sweis, eds. (Oxford: Oxford University Press, 2014).
7. John Leslie, "How to Draw Conclusions from a Fine-Tuned Cosmos," in Robert Russell et al., eds., *Physics, Philosophy and Theology* (Vatican City State: Vatican Observatory Press, 1988), p. 300.
8. Steven Weinberg, *Dreams of a Final Theory* (New York: Vintage Books, 1994). The following quotes from Weinberg are from p. 153, p. 157, and p. 250, respectively.
9. Paul Dirac, "The Evolution of the Physicist's Picture of Nature," *Scientific American* (1963): p. 47.
10. Albert Einstein as quoted in *The Quotable Einstein*, Alice Calaprice, ed. (Princeton, N.J.: Princeton University Press, 1996), p. 197.
11. Eugene Wigner, "The Unreasonable Effectiveness of Mathematics in the Physical Sciences," *Communications on Pure and Applied Mathematics* vol.13 (Feb. 1960): p. 14.
12. Paul Davies, *Superforce* (New York: Simon and Schuster, 1984), pp. 235–36. The following quote is from pp. 235–236.
13. Edward Dodson, *The Phenomena of Man Revisited* (New York: Columbia University Press, 1984), p. 68.
14. Robin Collins, "The Connection Building Theodicy," in *The Blackwell Companion to the Problem of Evil*, Dan Howard-Snyder and Justin McBrayer, eds. (Malden, MA: Wiley-Blackwell, 2013), pp. 222–235.
15. Robin Collins, "The Teleological Argument: An Exploration of the Fine-Tuning of the Universe" in *The Blackwell Companion to Natural Theology*, William Lane Craig and J. P. Moreland, eds., (Malden, MA: Wiley-Blackwell, 2009), pp. 202–281.
16. "The Anthropic Cosmological Principle and the Structure of the Physical World." *Nature* 278, 12 April 1979: 612.

Study Questions

1. In brief, to what kind of evidence does Collins appeal to make his argument regarding the rationality of belief in God?
2. What does Collins think that this evidence really shows?
3. What objection does Collins raise against the many-universes view that suggests that the probability calculation is irrelevant since with many universes it is likely that life would be found in at least one universe, if not many?