

11

The Premise Keepers

The web of this world is woven of Necessity and Chance. Woe to him who has accustomed himself from his youth up to find something necessary in what is capricious, and who would ascribe something like reason to Chance and make a religion of surrendering to it.

–Johann Wolfgang von Goethe, 1795

Faith in Science and God

A huge body of literature now exists in which authors with strong theological and scientific credentials argue that traditional religion, particularly Christianity, can be made consistent with all scientific knowledge. This new breed of scientist-theologians seeks to retain the fundamental Christian premise of a personal, loving, participating creator within a scientific framework. I will refer to them as the *premise keepers*.¹

Rather than viewing science, or, at least, naturalism, as a mortal enemy to be defeated by all possible means, fair or foul, the premise keepers follow the lead of Newton and look to science to provide insight into the nature of God. Their efforts are far more credible than those who deliberately misinterpret or incompetently apply science to promote theological doctrines that they have formulated independent of any consideration of science

The old creationists take the Bible literally and are forced to conclude that much of science is wrong. The new creationists claim that science is incomplete and requires an external "intelligent designer" to explain the complexity of the universe. By contrast, the premise keepers concede that established science, built upon a framework of materialism and naturalism, is empirically and theoretically sound and can account for complexity by natural means.

The premise keepers embrace biological evolution as basically correct, recognizing that it is still evolving and that what disputes may exist among evolutionary scientists pose no serious challenge to the overall scheme. While a few premise keepers still trot out the fine-tuning cosmological argument for design in the

universe as a whole, most are willing to admit that modern cosmology provides a viable model for a nonmiraculous origin of the universe. And while they disagree on many details, more theological than scientific, they generally view God as not so much interfering with natural processes, including chance, as working within them. As particle physicist, Anglican priest, and 2002 Templeton Prize-winner John Polkinghorne puts it, God does not work against the laws of nature because "that would be for God to act against God."² Still, one can only wonder how much of Christianity remains after its miracles are extracted.

The God of the premise keepers is not the Enlightenment deist god who set things in place at the creation and has since left us alone to live out his perfectly conceived divine plan. God still asserts creative control in the present world, but premise keepers dispute exactly how much control and the mechanism God uses in interacting with the world. The premise keeper God is also not the pantheist god—some abstract Platonic concept of perfection and order. Polkinghorne rejects Spinoza's axiom *Deus, sive Natura* (God = nature), saying, "That was Einstein's God, but it is certainly not mine."³ The God of the premise keepers is the God of the Bible, reinterpreted to assert his will within the natural laws, randomness, and chaos he purposefully wrote into creation. Whether that fits the God worshipped by most Jews, Christians, and Muslims is another matter.

Polkinghorne rightly points out that many physical notions, such as conservation laws, have been asked to carry too much metaphysical freight. He knows from his physics that conservation laws are simple symmetry principles. As Polkinghorne puts it, they are "consequences of the symmetries of creation and can easily be understood as expressions of the Creator's will rather than impositions on it." Alternatively, as I showed in chapter 8, these laws can just as easily be understood as the simplest assumptions that one can make, those that follow from the properties of the void. Polkinghorne also finds the vernacular use of the term *field* as a metaphor for omniscient spirit "quaint" and "distinctly limited."⁴ We saw in chapter 10 that electromagnetic and quantum fields have been misappropriated as sources of a "human energy field" that some equate to the soul.

Polkinghorne also has little use for cosmological creation and fine-tuning

arguments. He insists that "theology is concerned with . . . ontological questions . . . and gains little from science's fascinating, but largely theologically irrelevant, talk of temporal origins."⁵ This places him outside the large group of theistic scientists, such as Hugh Ross and John Leslie, who are obsessed with cosmology and what they see as evidence that the universe has been fine-tuned for life.

Polkinghorne claims he is not engaged in "an apologetic exercise, trying to make the faith appear acceptable in a scientific age."⁶ Following the tradition of Newton, he views science as a means to supplement scripture and revelation in learning about God.

What then remains as a basis to believe in this God? Polkinghorne can only fall back on personal tastes and desires. He sees human experience as encouraging belief in a divine mind, and in divine purpose behind the history of the world. He laments: "If cosmic history is no more than the temporary flourishing of remarkable fruitfulness followed by its subsequent decay and disappearance, then I think Macbeth was right and it is indeed a tale told by an idiot."⁷ Perhaps it is just such a tale, whether Polkinghorne likes it or not.

Chaos Theology

As we have seen, modern science has left theology in a quandary. The universe revealed by science shows humanity as an infinitesimal speck with random chance as an important factor affecting events. Natural laws do not fully determine events but simply place constraints on them. Furthermore, these laws, such as the conservation principles, follow naturally from the symmetries of the void (chap. 8) and suggest the absence of purpose. Where can God exert his influence in such a universe?

As far as we know from current science, the development of macroscopic complex systems, most notably the structures of living organisms, arises by processes of self-organization and natural selection that include a large element of chance. Our present best guess is that the behaviors of macroscopic systems are *emergent phenomena* resulting from a blend of chance and constraint. Start them up again and they will not develop the same way because of the role of chance in randomly selecting the particular path out of many possible paths a system will follow as it develops with time. This includes, but is not limited to, the evolution of life and humanity—making it quite a

theological challenge to find any purpose in it all without restoring determinism, natural or divine.

As we have noted in earlier chapters, many theists see the very existence of chance as a grave threat to their faith. The premise keepers take the opposite view; they look to chance as the place where God asserts his will. Polkinghorne and 2001 Templeton Prize winner, biochemist, and fellow Anglican priest Arthur Peacocke have urged that interpretation. They think they have found room for God to act within the framework of *chaos theory*.⁸ The two differ substantially in their specific theologies, their scientific perspectives arise from different backgrounds, and they do not view the role of chaos in exactly the same manner. Nevertheless, since they both weave their theologies with the common thread of chaos, I will group them together for this discussion.

The defining characteristic of chaotic systems is their extreme sensitivity to initial conditions, which results in their appearing to behave unpredictably. This is known as the "butterfly effect" in which, metaphorically, the flap of a butterfly's wings might affect the weather a week or so in the future. The butterfly effect was first discovered by meteorologist Edward Lorenz in 1960. He had written a computer program to model the atmosphere, but, given that computers were still in their infancy at the time, his model was necessarily crude. Still, Lorenz's model possessed feedback loops that were too complex to be analyzed by hand and, with the computer now available as a tool, this approach could be followed. His program produced outputs that were fed back as inputs, a notorious source of nonlinearity and instability.

Lorenz was surprised one day when his program gave different results after he had run it over again from what he thought was the same starting point. He soon realized that the computer had taken the number 0.506127 that was stored in its memory and rounded it off to 0.506 in a printout. Lorenz had then reentered it as 0.506000, and the results came out grossly different.⁹ Thus, this seemingly insignificant difference of 0.000127 in a single input variable dramatically changed the nature of his overall results in modeling weather.

Since then, chaos theory and its more aptly named cousin, *complexity theory*, have provided important new insights into the nature of classical (nonquantum) physical

systems, including many that surround us in everyday life. In general, a system of three or more bodies can exhibit chaotic behavior if it is *nonlinear*. That means, for example, if you drive the system with some input and double that input, the effect will not necessarily be doubled. If you push a child's swing with a certain force, and then double that force, the amplitude of the swing will double when the initial push is very gentle and the amplitude is small. But keep doubling the force and soon the response will no longer be linear. Making sure no one you like is on the swing, you can even push it over the top. The simple swing, or, more technically, the damped, driven, nonlinear pendulum, exhibits all the basic features of a chaotic system.

Besides the butterfly effect, chaotic systems exhibit other interesting properties. Important for our purposes, they can remain for some time in a quasi-stable state; but, then, a small perturbation can drive them to a completely different state. The atmosphere is again a good example. While the flap of a butterfly's wings probably won't do it, some small air movement or abrupt temperature change in one place can drive the weather over a large area from a quasi-stable calm state to a quasi-stable stormy state.

Evolution may also exhibit elements of chaos, as a small change in the environment results in the relatively abrupt movement of an ecosystem from one state to another, perhaps explaining the *punctuated equilibrium* that some paleontologists, such as Stephen Jay Gould and Niles Eldredge, claim occurs in evolution.¹⁰ Many biological and even social systems exhibit the properties of chaos. One of the most studied mathematical examples is the *logistic map*, which is a very simple model of population growth limited by resources.¹¹

Polkinghorne and Peacocke see chaotic systems as providing an opening for God to act in the world without having to violate any natural laws, or at least not violating them in any noticeable way (and thus confirming God's existence). Neither visualizes God as selectively injecting huge amounts of *energy* into various places in the universe needing his intervention, thus violently breaking the law of conservation of energy. Rather, in Polkinghorne's scheme, he injects *information*. God provides a gentle nudge that moves a complex system along the path he wishes it to go, taking advantage of the amplifying effect of chaos.

Although this type of divine intervention by information injection does not involve significant energy transfer, it must involve some. This would still violate energy conservation. Furthermore, as we saw in chapter 4, information is equivalent to entropy, or at least changes in entropy. Thus, God's intervention by the injection of information would amount to a violation of the second law of thermodynamics, with all the entropy of a process not accounted for within our universe. Like the flap of a butterfly's wings, however, the divine input could be so small as to be unmeasurable. Chaos, in Polkinghorne's scheme, thus provides a means for God to act in an undetectable way; but his act would still violate natural law.

Peacocke's vision of the role of chaos differs from Polkinghorne's, although Polkinghorne has not explicitly rejected the former's approach. Peacocke does not imagine God interfering in any specific event but acting on the whole by a process called *top-down causality*. In a trivial example, if you rotate a wheel, you are causing all the atoms of the wheel to move in a circle.

Thomas Tracy notes that Peacocke's proposal hinges on "the supposition that top-down explanations cannot be analyzed in terms of structures of bottom-up explanation."¹² Tracy points out that Peacocke makes "the move from the whole-part explanation to treating the whole (or the nature of the system) as a cause." In other words, Peacocke is asserting some new holistic principle.

Such a principle had been proposed earlier by Nobel laureate chemist Ilya Prigogine and his collaborators, with no theological intent.¹³ For example, consider the arrow of time discussed in chapter 7, which we saw emerges as a principle for many-body systems on the macroscopic scale. Prigogine agrees with this, but further conjectures that it acts down to the elementary particle level, giving time a direction on that scale.¹⁴ However, as I explained in *Timeless Reality*, all elementary processes allow for time reversibility and, indeed, quantum phenomena exhibit backward-time causality.¹⁵ If Prigogine were correct, we would expect to see time irreversibility at the quantum scale. In fact, we do not. Other conjectures about top-down causality have similarly failed to yield empirical support.¹⁶ So top-down causality seems to be a poor metaphor for God's action in the world, if that action is to be seen as in harmony with natural processes.

Peacocke does not base his case on Prigogine's model. The Templeton laureate simply mentions that Prigogine and others have demonstrated that "it is the interplay of chance and law which is in fact creative with time, for it is the combination of the two which allows new forms to evolve."¹⁷ Of course, there is nothing new in this. What is new is the notion that some principles exist that cannot be understood in the traditional scientific reduction of a system to its parts.

In fact, bottom-up explanations for all physical systems, including chaotic ones (and the rotating wheel), are conventionally made. Reductionism—in which you analyze a system in terms of its parts—does, in fact, recognize that parts can interact, creating unique systems containing novel and unpredicted properties. Reductionist analyses do lead to just this outcome. In particular, the behavior of chaotic systems was discovered by completely reductionist methods in which the parts of a system and their mutual interactions were modeled on a computer. The computer programs that produced these results used nothing but reductionist physics principles. No new fundamental physical principles, reductionistic or holistic, were either hypothesized or uncovered in the process. Far from destroying materialist reductionism, as some science writers have breathlessly reported,¹⁸ chaos and complexity theory have provided further validation for the model in which all phenomena arise from elementary particles and their interactions. The only place where some dispute remains among scientists is in the workings of the brain and how it produces what we know as consciousness.

This is not to say that everything is predictable from elementary particle theory. As already noted, chance plays such an important role in all physical phenomena that such predictability is not to be expected.

For Polkinghorne, "the most significant event in cosmic history to date [was] the dawn of consciousness."¹⁹ Here again, he calls on chaos and complexity theory to provide an explanation. He asserts that "holistic and relational concepts are coming to play an increasing role in science." These are regarded as "congenial to theological thinking," as exemplified by "much Trinitarian discussion that emphasizes relationship (communion) as the ground of being."²⁰

Polkinghorne argues that mathematics is the exploration of an existing noetic

realm."²¹ This agrees with the line promoted by his fellow Oxfordian, mathematician Roger Penrose, that "there is something absolute and 'God-given' about mathematical truth."²² "Admitting the influence of his personal yearnings, Polkinghorne says: "I believe there is a much more persuasive case for believing in the reality of the Mandelbrot set than in the reality of the Idea of a lion." (The Mandelbrot set is a mathematical contrivance with fascinating properties, including chaos, which is discussed in detail by Penrose and in many books on chaos.) According to Polkinghorne, the realm of physical and mental experience are "parts of an interlinked complementary created reality."²³ This may not be traditional Platonism, but it is Platonism nonetheless. Penrose, however, explicitly disassociated his ideas on consciousness from religion.²⁴

The New Schism

Although I am trying to avoid theological squabbles and stick to what I know best, the science, I must at least mention the sharp theological differences among the premise keepers, and even greater disputes between them and other Christian thinkers. These various internal schisms are more formidable than any that may separate them from scientists and bear little resemblance to those that have marked the history of the Church.

I have mentioned that Polkinghorne and Peacocke differ substantially in their theologies. Polkinghorne holds on to rather conservative beliefs, such as the Virgin Birth and Resurrection, while Peacocke questions many traditional teachings. After Peacocke was awarded the million-dollar 2001 Templeton Prize for Progress in Religion, *Christianity Today* editor-at-large John Wilson commented:

Peacocke's distinguished career as a scientist included early research on DNA. His theology, alas, is typical of that of many thinkers who set out to explain what is "credible" for us to believe about God and his "interaction with the world" given the "comprehensive, indeed dazzling, perspective on the being and becoming of the world and of humanity that the sciences have . . . unveiled to our generation." This turns out to entail a rejection of anything resembling

Christian orthodoxy from the first century to the present.²⁵

Thus, from across the canyon that separates him from me, Wilson echoes the question that I have raised several times already: What is left of Christianity when it is pruned of virtually every traditional teaching?

Quantum Theology

One of the major confusions about chaos theory results from the fact that it is grossly misnamed. The term "chaos" implies randomness or lack of order. In fact, chaotic systems in physics are perfectly orderly. "Deterministic chaos" is more apt. It describes what appears when one takes the equations of classical mechanics that apply to nonisolated, many-body systems and uses a computer to solve them iteratively, that is, in a series of steps in time. Deterministic chaos also happens with purely mathematical objects such as the logistic map or Mandelbrot set. Since the paths followed by the system are very sensitive to the initial conditions, the results look "chaotic." You start the system in one place, and you get one path. You slightly change the starting point, and you get a completely different path. However, when you take care to always start the system in exactly the same place (do not round off your numbers the way Lorenz did), the system always follows exactly the same path and ends up in exactly the same place. In other words, mathematically, *chaotic systems are perfectly predictable*. Run the computer program once, and you can then predict the path the system will follow, with 100 percent certainty, each time you run the program again from the same, exact initial point.

Before the advent of quantum mechanics, the physical universe seemed to be a vast clockwork mechanism that operated according to the equations of Newtonian mechanics. In Newtonian mechanics, the motion of a particle is fully determined by its initial position, momentum, and the forces acting on it. Since everything in the material universe, including the human body, is made up of particles, then no room for choice or chance existed within this framework.

This is why so many educated people during the Enlightenment period that followed the development of Newtonian science became deists, although, as we have

seen, Newton himself did not. The deists saw no place for a god to act in the present world once he had set it all in motion at the creation. Newton believed that the God of the Bible acted in the gaps where mechanics provided no explanation, although this notion was rejected by his most important successors, notably Laplace, who saw all the gaps as potentially being filled.

However, free will, both human and divine, comprises an essential aspect of the monotheistic religions. Unless people have free will, sin and virtue are meaningless. Unless God has free will, miracles cannot occur and prayers are not answered. Both human and divine free will were threatened by the deterministic world view of classical physics.

As quantum pioneer Werner Heisenberg himself realized, the uncertainty principle that he developed in the 1920s provided a possible way out of the Newtonian world machine. Heisenberg showed that since the position and momentum of a particle cannot be measured simultaneously with unlimited precision, particle motion is ultimately indeterminate.

Nancy Murphy and other theologians have raised objections to the use of classical chaos as a medium for God's action.²⁶ She notes, as I have above, that classical chaos is a deterministic theory and so still has no room for God's action. However, quantum mechanics *can* eliminate the predictability of deterministic chaos when one is dealing not with a computer simulation but with an actual physical system.

All physical systems are fundamentally quantum in nature, but for most macroscopic examples of common experience, the classical limit of quantum mechanics provides a good approximation, and these systems behave deterministically to a good approximation. What I will operationally define as *true randomness* in otherwise-deterministic chaotic systems can come about when the Heisenberg uncertainty principle prevents the initial variables of the system from being measured with sufficient accuracy for the evolution of the system to be predictably repeated. In this way, the motion of a particle that is part of a chaotic system becomes intrinsically unpredictable even though the system itself is classically deterministic.

Murphy also objects that Polkinghorne "has not provided a clear account of *how* God works on the inside, in the process." She then proceeds to give her own account of

how God does it:

I take it that . . . it is necessary that God work in the inside of *all* created entities—which must mean in turn that God works within the smallest constituents of macroscopic entities, since these smallest constituents are entities of their own right. If we begin with this hypothesis, it is not necessary—in fact it is counterproductive—to argue for causal indeterminism at higher levels of organization (excluding the human level) since God's will is assumed to be exercised by means of the macro-effects of subatomic manipulation.²⁷

As I indicated in the previous section, as far as we know from current physics, the structures of complex, many-body systems, such as biological organisms, are not fully determined by the laws that govern the behavior of elementary particles. Chance plays a role at all levels, from elementary particles to atoms to molecules to biological systems, and so on. But in order for that chance to be fully indeterministic, it must arise from quantum interactions. So, if I interpret Murphy correctly, she is saying that God would still have to exert his control at the microlevel. For example, God could have decided just when a potassium nucleus in the blood of some early mammal decayed and the beta electron from the decay knocked another electron from an atom in its DNA, thus producing one of the millions of mutations that eventually led to the evolution of *Homo sapiens*.

The other place where quantum mechanics opens up a gap for God's action is in the entanglement of observer and observed, mentioned in chapter 10. This is not discussed much in Christian literature, perhaps because of its association with New Age ideas and Eastern mysticism.²⁸ Quantum mysticism is based on the notion that consciousness can affect reality by controlling the collapse of the quantum *wave function* which determines the state of a physical system.

In conventional applications of quantum theory, the wave function is a mathematical abstraction that allows one to calculate the probability that a system will be found in a particular volume at a particular time. The evolution of the wave function

with time is governed by the famous Schrödinger equation, which I need not present here. Suppose the "system" is a single electron emitted by an atom and has an equal probability of going in any direction. The wave function will mathematically represent that fact. Now, further suppose that we have a detector at one end of the laboratory that covers only a fraction of the solid angle, say 1 percent. That is, on average, only one in a hundred electrons will trigger that detector. If that detector registers a hit, this tells us that the electron went in that particular direction. At the moment of detection, the probability that the electron will be found in the detector volume abruptly changes from 1 to 100 percent. The probability that the electron will be found elsewhere drops to zero. The wave function is then said to "collapse" to reflect the change of information we have about the system, from it-could-be-anywhere to it's-precisely-right-here.

Since humans build the measuring equipment and ultimately analyze the data, some have suggested that it is an act of human consciousness that collapses the wave function. Although the wave function, in the conventional interpretation of quantum mechanics, is just a mathematical quantity, it must bear some relationship to reality since it does enable us to calculate probabilities of things happening with exceptional precision. In a Platonic worldview, that wave function is more of an objective reality than the electron it describes, in which case consciousness, or at least the detection apparatus, acts to control reality!

As I showed in *The Unconscious Quantum* and *Timeless Reality*, several alternative, nonmystical interpretations of the admittedly strange behavior of quantum systems are available. Nevertheless, many authors claim that wave function collapse provides a mechanism by which human consciousness can connect, instantaneously, to a cosmic field of force pervading the universe. While Christian theologians might be tempted to associate this field with the spirit of God, the premise-keeper theologians I have cited here are much too scientifically knowledgeable to fall into the bottomless pit of quantum mysticism.

Evolution Theology

A number of believing scientists and science-savvy theologians have woven Darwinism into their metaphysical schemes. They have taken the apparent role of chance in

complex systems to be gaps into which they can insert their God. In this they differ from the chaos and quantum theologians, who still envisage God as interfering with the process--albeit in an undetectable way.

In chapter 2, I mentioned biologist-theist Kenneth Miller's devastating critique of both the new and old versions of creationism in *Finding Darwin's God*. He sees creationists as missing a very important feature of the randomness involved in evolution, which they so abhor:

The only alternative to what they describe as randomness would be a nonrandom universe of clockwork mechanisms that would also rule out active intervention by a supreme Deity. Caught between these two alternatives, they fail to see that the one more consistent with their religious beliefs is actually the mainstream scientific view linking evolution with the quantum reality of the physical sciences.²⁹

Of course, mere consistency with a specific religious belief is not a very powerful argument for that belief. Randomness is equally consistent with a religion based on the Tooth Fairy, or no religion at all.

As discussed above, chance, or indeterminism, in science rescues theology from the old deism. If the Newtonian world machine had not been dismantled by quantum mechanics, the only place that God need have acted in the world was at the creation. Miller agrees with physicist and 1999 Templeton Prize-winner Ian Barbour that "natural laws and chance may equally be instruments of God's intentions. There can be purpose without an exact predetermined plan."³⁰

Two kinds of purpose can still be conceived in this context. In one, described above, God asserts his purpose by micromanaging the quantum events that induce the various choices on the path a system follows as it develops with time. In this case, things still come out exactly the way God wants, including the evolution of humanity. This still complements the traditional belief that we are special creations, formed in "God's image," if not exactly physically, then at least spiritually with his personal qualities of love and forgiveness.

The second possibility, which one hears from the evolution theologians, is that God does not micromanage but allows chance to operate. In this case, his purpose is served by any path that is followed, including, it seems, a path that does not lead to the evolution of humankind.

In *God After Darwin*, theologian John Haught writes:

A God whose very essence is to be the world's open future is not a planner or a designer but an infinitely liberating source of new possibilities and new life. It seems to me that neo-Darwinian biology can live and thrive quite comfortably within the horizon of such a vision of ultimate reality.³¹

In this theology, the accidental processes of nature are *the means* by which God allows freedom to exist in the universe. The future is in fact open and not predetermined by physics or God.

Chance Disputed

Christians, however, are far from unanimous on the role played by chance in the universe. Many find a God with no special place for humanity very difficult to swallow. In *A Case against Accident and Self-Organization*, Christian attorney Dean L. Overman attempts to defeat that prospect by disputing any place for chance in both the formation of the universe and the evolution of life. He asks: "is it mathematically possible that accidental or chance processes caused (a) the formation of the first form of living matter from non-living matter and (b) the formation of a universe compossible with life?"³²

Overman concludes that the probability is so small as to be impossible. Life would never have evolved if it was all left to chance. We have seen this type of argument several times before in this book and have noted that a low probability for any particular event does not make that event impossible. Overman asserts that "mathematicians normally regard anything with a probability of less than one in 10^{50} as mathematical impossibility."³³ This is simply incorrect. All one has to do is visit one of the Web sites that provide random numbers and write down the first 50 digits. In a

minute or two one can produce a sequence that had prior probability of one in 10^{50} of being due to chance.

Recall from chapter 4 that William Dembski has attempted to make a similar argument with his design inference filters. He introduces the notion of complex specified information, where complexity is defined as a sequence with chance odds of 10^{150} to 1. While this is a far stronger criterion than that used by Overman, it is still insufficient for inferring design in and by itself. Dembski knows this and so adds the criterion of *specification*. The information sequence must contain some sort of "message" that could not have occurred by chance or other natural processes. When that message is specified *in advance* and it then appears, *then* a strong inference can be drawn that some intelligence or artifice was involved. For example, if we specified in advance that a message contain 150 specific digits, such as all 7s or a 150-digit repeated sequence such as 1234512345 . . . , then it would indeed be highly improbable to obtain this message from the first 150 random numbers drawn off the Web. Much more dubious, however, is the process of looking at some sequence after the fact and then declaring it to be *specified*.

In any case, neither Overman nor Dembski can infer intelligent design by simply calculating a low probability for some physical event being undesigned without comparing that probability with one calculated for the alternative hypothesis of design. How do they know that the design probability is higher? What is the probability that God was produced by chance? Given the clear absence of design in so many phenomena, and the lack of evidence for any external designer, one might reasonably conclude that it is, in fact, the probability of design that is the smaller.

Even theists have found Overman's case against accident and self-organization unconvincing. Writing in *Christianity Today*, Rebecca Flietstra calls Overman's book "a misguided quest for proof" that "contains some crucial misunderstandings of scientific method."³⁴ She points out that arguments that may work well for law do not work well at all in science. According to Flietstra, Overman uses "inference from the universal to the particular" and claims that "inference from the particular to the universal is not valid." She notes that "science is not law; what is necessary for the lawyer is impossible for the scientist. That is, every experiment is a study of the particular, and every theory

an 'inference from the particular to the universal.'"

For example, Overman follows the lead of many creationists in dismissing the famous experiment done by Stanley Miller in 1953 in which amino acids were produced by an electrical spark in a gaseous mixture.³⁵ Since the mixture did not exactly duplicate what we now think was the atmospheric composition at that time, Overman argues that it is logically incorrect to conclude that life began in this way. Flietstra comments:

But what Overman describes as a logical misstep is more accurately understood as a result of an incomplete understanding of abiogenesis.

And so, while it certainly is a leap to move from Miller's experiments to a full-fledged explanation of life's origins, that does not mean it is impossible for us to derive any information from his experiments.³⁶

I would add that Miller's results were of immense significance, not because they demonstrated exactly how life came about but because they showed that amino acids, very complex molecules that are critical components of life on Earth, are easily fabricated from much simpler ingredients by purely natural processes. Indeed, radio-astronomy has identified complex molecules in interstellar gas clouds and hydrogen cyanide, formed by natural processes in the atmosphere, can naturally polymerize and form amino acids.

Fifty years before Overman, Dembski, and other modern creationists claimed to prove that it was statistically impossible, Miller's experiment had already provided a beautiful empirical example of natural processes creating precisely the kind of information inherent in living systems. They might as well try to prove that it is impossible for humans to travel to the moon.

Flietstra also criticizes Overman's probability calculations, which greatly distort the processes of evolution. For example, he computes the odds of producing a single bacterium by chance at one in $10^{40,000}$, completely ignoring the role of natural selection. Of course, evolutionary biologists do not claim that bacteria are produced by random molecular collisions but by natural selection in concert with chance.

Natural Theology

A huge chasm exists between intelligent design "science" and evolution "theology." The basis of that disagreement is fundamental, but those fundamentals are theological rather than scientific. As we have seen, the scientific claims of the design theorists have little merit and are, in many cases, demonstrably wrong. One can only wonder why they are promoted with such fervor, and despite protestations to the contrary, the reason is clearly the survival of traditional religion. An evolution theology in which God does not poke in his finger to help things along seems to allow the possibility that humanity might not have developed at all, that we are just an accident and God's plan could have been fulfilled in many other ways—perhaps with no sentient life whatsoever.

The premise keepers not only support evolution, they regard with distaste the attempts of new and old creationists alike to cast doubts about its validity in the public forum. In a speech before the American Academy of Religion, Barbour had this to say about intelligent design:

Philosophical proponents of intelligent design, such as William Dembski and Stephen Meyer, write in the tradition of natural theology in which science is used as evidence of the existence of a designer. My own approach is not natural theology but a theology of nature in which one asks how nature as understood by science is related to the divine as understood from the religious experience of a historical community.³⁷

Dembski hotly disputes this assessment, arguing that, in fact, the opposite is true—that it is Barbour and his proevolution cohorts who are the natural theologians.³⁸

What is this "natural theology" that is to be avoided like the plague by modern theologians? Dembski informs us that it had its origin in the eight pre-Darwin Bridgewater treatises that were financed by the Rev. Francis Henry Egerton, eighth and last Earl of Bridgewater, who died in 1829. He willed that £8,000 be used by the president of the Royal Society of London to publish works on:

the Power, Wisdom and Goodness of God as manifested in the Creation illustrating such work by all reasonable arguments as, for instance, the variety and formation of God's creatures, in the animal, vegetable and mineral kingdoms; the effect of digestion and thereby of conversion; the construction of the hand of man and an infinite variety of other arguments; as also by discoveries ancient and modern in arts, sciences, and the whole extent of modern literature.

Note the charge was to illustrate and advance an already established notion, divine creation, rather than open up questions that might lend doubt to that notion. This is reminiscent of the Templeton charge, quoted in the preface, to explore "human potential within its ultimate purpose."³⁹ .

As Dembski elaborates:

The stereotypical argument of a natural theologian begins with "Isn't it amazing how..." The natural theologian then fills in the blank with some feature of the natural world that inspires admiration and argues how this feature, once properly interpreted, demonstrates the manifold wisdom, power, and goodness of God. The problem with such arguments, of course, is that they can be turned on their head. Thus for every instance where the natural theologian finds reason to sing God's praises, the natural anti-theologian finds reason to lament nature's cruelty. Darwin, for instance, thought there was "too much misery in the world" to find solace in natural theology: "I cannot persuade myself that a beneficent and omnipotent God would have designedly created the Ichneumonide with the express intention of their feeding within the living bodies of Caterpillars, or that a cat should play with mice." Other examples he pointed to included "ants making slaves" and "the young cuckoo ejecting its foster-brother."⁴⁰

Dembski argues that the proevolution science-theists, such as Polkinghorne,

Barbour, and Peacocke are "as much engaged in natural theology as any natural theologians of time past." For the only time in this book, Dembski and I find ourselves in agreement. Polkinghorne, for example, insists that he is not just engaged in apologetics but looking to science to gain further insight into a God that he has already assumed exists. The other premise keepers operate from the same basis.

Dembski tries to extract his own specialty, intelligent design, from the morass of natural theology:

The fundamental idea that animates intelligent design is that events, objects, and structures in the world can exhibit features that reliably signal the effects of intelligence. Disciplines as diverse as animal learning and behavior, forensics, archeology, cryptography, and the search for extraterrestrial intelligence thus all fall within intelligent design.⁴¹

In other words, Dembski claims that he and his colleagues in the intelligent design movement are not looking to understand the nature of God from the observations of science. Rather, they are seeking to show that science cannot proceed to explain all phenomena without recourse to external, intelligent design. The fact that they have so far failed and made several fundamental scientific errors is beside the point. Perhaps they have simply not yet found the smoking gun.

Dembski attempts to distance himself further from theology of any sort by stating:

The designer of intelligent design is not the God of any particular religious faith and not the God of any particular philosophical reflection but merely a generic intelligent cause capable of originating certain features of the natural world. Positing such a designer to account for certain types of biological complexity is like positing quarks to account for certain properties of subatomic particles. The point is to see what a designer helps explain; the point is not to establish the existence of the designer.⁴²

I have already noted, in chapter 2, that Dembski and his fellow new creationists have learned from the mistakes of the old creationists and are careful not to make overtly religious claims that will be tossed out in court. Their position here is clearly strategic. We have seen that the intelligent design movement is largely political, rather than scientific, and by admitting no religious purpose, Dembski and his colleagues expect they can install their brand of antievolutionism into school curricula. If successful, they would be insinuating religion into science through the back door. Hopefully, the courts won't be so easily deceived, although many politicians and school board officials have already taken the bait.

Dembski has an advanced degree in theology, and his books, along with those of most others in the intelligent design movement, are clearly motivated by his Christian beliefs. The subtitle of Dembski's most important book, *Intelligent Design*, reads *The Bridge between Science & Theology*. The intelligent design movement is supported by the collective financial resources of wealthy, committed Christians. No one involved leaves any doubt whom they regard as the intelligent designer: the God of the Bible. Their financial supporters are not putting up big money to disprove God's existence. And no one should be so naïve as to believe design theorists when they say that their purpose is innocent of any religious motivations.

Ignoring his own writings on the subject, Dembski disingenuously blames proevolution Christians, such as Miller and Haught, for bringing theology into the discussion:

The juxtaposition here of God and Darwin is not coincidental. I submit that the preoccupation by critics of intelligent design with theology results not from intelligent design being inherently theological. Instead, it results from critics having built their own theology (or anti-theology as the case may be) on a foundation of Darwinism. Moreover, because intelligent design challenges that foundation, critics reflexively assume that intelligent design must be inherently theological and have a theological agenda. . . . Critics of intelligent design resort to a classic defense mechanism in which they project onto intelligent design the very thing

that intelligent design is unmasking in their own views, namely, the extent to which Darwinism, especially as it has been taken up by today's intellectual elite, has itself become a project in theology.⁴³

A few years ago, physicist-theist Howard Van Till found himself enmeshed in similar debate with intelligent design mouthpiece Phillip Johnson on the pages of the Christian journal *First Things*.⁴⁴ Van Till promotes an evolution theology akin to that which I described above, in which God does not micromanage:

In the context of this traditional Christian vision of God's creative work (notably different from Johnson's theokinetic picture), we might now wish to employ the vocabulary of twentieth-century science and speak about the full array of functionally viable forms of DNA (and the creatures thereby represented) as constituting a "possibility space" of potential lifeforms--this possibility space itself, along with all connective pathways, being an integral component of the world brought into being at the beginning. Furthermore, in the language of this theistic paradigm of evolutionary creation we would speak of DNA being enabled by the Creator to employ random genetic variation as a means to explore and discover (in contrast to create) viable pathways and novel lifeforms so that the Creator's intentions for the formative history of the Creation might be actualized in the course of time.

See, then, what this evolutionary creation paradigm accomplishes: Do material processes have to create? No, the possibility space of viable and historically achievable lifeforms is an integral aspect of the world that God created at the beginning. Material systems need only employ their God-given functional capacities to discover some of the possibilities thoughtfully prepared for them. But, one might ask, how can such "mindless" material processes function to bring about what appears to be the product of "intelligent design"? The point is that they are not really mindless at all. Rather, every one of these processes and every connective pathway in the possibility space of viable creatures is itself a

mindfully designed provision from a Creator possessing unfathomable intelligence.

But Johnson is not buying this. To him, this "theistic naturalism" is not Christianity. Rather it is science attempting to co-opt the revealed truth with nothing more than an updated deism:

I do think that theistic naturalism is ultimately incoherent, but the incoherence is not obvious and it is understandable that many rational and intelligent Christians have overlooked it. First, we have all been taught to think of "science" as a neutral, objective process of fact-finding that is not biased in favor of a comprehensive metaphysical naturalism. In consequence the conclusions of science must be accepted by anyone who wants to be considered rational by the standards of the academic world.

When "science says" that natural selection can accomplish wonders of creativity, that is the end of the matter. Religion cannot survive in a naturalistic academic culture if it opposes science, and so religion must accommodate to science on the best terms it can get. Effectively, that means that God must be exiled to that shadowy realm before the Big Bang, and He must promise to do nothing thereafter that might cause trouble between theists and the scientific naturalists.

In short, theistic naturalism is best understood as an intellectual strategy for coping with a desperate situation. It was barely tenable as a philosophical position as long as the leading scientists believed, or pretended to believe, that science is a limited research activity which does not aspire to occupy the entire realm of knowledge. Today many of the world's most famous physicists are proclaiming the imminent prospect of a "theory of everything"--and they do mean everything. It may be that these physicists--and the evolutionary biologists who talk just like them--are no longer practicing "science" and have

become metaphysicians. What is important is that they mix metaphysics and science together and present the whole package to the public with all the awe-inspiring authority of science.

While Johnson obviously wants to pick a fight with atheistic scientists, it seems, the critical battle for him is not between religion and science but between different viewpoints within Christianity—between antiscience and proscience theologies. Perhaps this is why so few atheistic scientists have taken Johnson's bait; they see nothing of scientific merit to argue with him about and, being wiser than I, leave theology to the theologians.

The premise keepers deserve credit for working with established science instead of fruitlessly challenging it. Johnson and his cohorts will not succeed in their efforts to undermine evolution theory and naturalism, at least within the scientific community. They might as well try to undermine the atomic theory of matter.

Still, Genesis says that God made Man in his image to rule over the rest of creation. Dr. David A. Staff, minister of the First Evangelical Free Church in Ames Iowa, expresses the widely held, orthodox Christian view that Man is "God's very special creation . . . The object of God's stunning, loving plan."⁴⁵ The premise keepers who reject guided evolution, who accept that humanity is an accident, have not yet succeeded in molding their God into the traditional God of Christianity.

The Altar of Hypothesis

Willem Drees is, like John Polkinghorne, another physicist-turned-theologian. He also seeks to establish criteria by which traditional ideas of God can be brought into consonance with science—in particular, modern physics and cosmology.⁴⁶

Drees recognizes that science provides no evidence for the existence of God and that nothing in current cosmology demands that the universe was purposefully created—a refreshing admission from a theologian. Drees accepts that God is a postulate motivated more by human desires than scientific facts. He admits that theology, not science, carries the burden here and hopes that by "deeply immersing ourselves in science, rather than stopping short of the innermost sanctuaries, the

tradition may show up in a new light."⁴⁷

Drees does not attempt to exploit the limitations of science as openings for theology to fill. He recognizes that science has a way of eventually filling its own gaps. Besides, Drees does not regard a God of the gaps as a desirable metaphor to describe his postulated God. His God is transcendent, beyond space and time and not in the business of filling every nook and cranny of the universe.

Drees finds the fine-tuning arguments for a universe designed for humankind wanting on a number of fronts. (It is interesting that, among the premise keepers, most of the physicists and cosmologists such as Polkinghorne and Drees have no truck with the fine-tuning argument; on the other hand, biologists like Miller, who know little cosmology, still think there is something to it). Drees points out that science may someday find the physical laws that explain these coincidences. The fine-tuning God is again a God of the gaps. Drees also views the ideas of Polkinghorne and Peacocke, that God acts via chaos theory, and other suggestions that God acts via the uncertainties in quantum mechanics, as equally futile attempts to seek the God of the gaps.⁴⁸

Drees discusses the proposal made by physicist Frank Tipler in *The Physics of Immortality* that some form of intelligent life will be able to achieve eternal life.⁴⁹ Tipler imagines a single pocket of increasingly higher level organization evolving to the ultimate *Omega Point* god, envisioned by the Jesuit priest and paleontologist Pierre Teilhard de Chardin.⁵⁰ Tipler asserts the "Final Anthropic Principle," proposed with John Barrow,⁵¹ which declares that intelligent information processing once brought into existence will never die out. Tipler suggests that the Omega Point will contain all of past life within its information-processing system, and thus every being who ever lived will become resurrected at that time—as a computer simulation. Not only that, everything that can be known will be known, and so not only will each of us live our lives over and over an infinite number of times in an instant, we will live all the other lives we might have lived, experience every conceivable pain and pleasure.⁵²

If ever there was a materialistic theory of heaven and hell, handed on a platter to those who want to believe in God, this is it. But Drees does not buy this version of scientific theology, either. He sees no point in the concept of a deity so far in the future that it can have no possible current relevance, especially since we will all be resurrected

anyway, saints and sinners alike.

Since he accepts that God is only a postulate, Drees is free to reject the Omega Point god. Similarly he rejects the deist "Zero Point god" who creates the universe and its laws, and then leaves it alone. Drees wants a God of the present, and argues that such a God is consonant with all the cosmologies formulated by science. Admitting that this is a want and not a proof, that God is unnecessary to explain the data, Drees argues that God's presence "shines through" in our desire for perfection and justice in a world apparently devoid of either.

Drees classifies three types of responses to the apparent absence of perfection in the world. In the first, we simply deny the imperfection. This he relates to the New Age movement and modern American poppsychology, in which all the ills of society are assumed to be simply a crisis of perception. All we need to do for life to be in perfect harmony with the world is to want it that way. We are capable of anything, from becoming rich to walking on fire. No work is required. If we think we can do it, then we will. Much of modern American charismatic Christianity has adopted this idea, discarding all this depressing talk of hellfire and brimstone.

The proposals of Tipler and others for ultimate harmony, fully within the material world but far in the future, are also seen as this type of response. So are the more modest visions of progress that most people hold--the idea that things will someday be better. Realistically, we have no basis to suppose that these are any more than wishes and fantasies. Perhaps things will get better; perhaps they never will. The very fact that this is undetermined gives us reason to hope that they can get better, if we ourselves make the effort. But it is consciously directed effort, not simply a felt want, that will make this happen.

These considerations make Drees's second response to apparent imperfection of the universe more hopeful than it first appears. This response has been articulated by Nobel physicist Steven Weinberg, and represents a widely-held view among scientists: "The more the universe seems comprehensible, the more it becomes pointless."⁵³ There is simply no sign of a grand design wherever we look. But, as humans we can make our own design and, by our modest efforts in art, science, and other noble human activities, lift human life above the level of farce and give it some of the "grace of tragedy."

Weinberg has attempted to clarify his position, explaining, "I did not mean that science teaches us that the universe is pointless, but rather that the universe itself suggests no point."⁵⁴ On God, he says, "The more we refine our understanding of God to make the concept plausible, the more it seems pointless."⁵⁵

Drees forthrightly admits that he has no argument against this position, except that it might paralyze the person who holds it. However, it has not paralyzed Weinberg, the late Richard Feynman, and many others who have expressed similar views. Far from being constraining, the absence of belief has always had a great liberating effect on the intellect. What motivation can anyone have for dreaming up new ideas and working hard to put them into action if those ideas and those actions are naught but the external commands of a supreme being pulling all the strings in heaven? What point would there be in trying to make the world a better place, if we have no power to do so?

Drees personally prefers a third response. The world is sufficiently ambiguous that, while perfection and justice appear absent, they cannot be ruled out. So the postulate of God, as a present transcendent reality representing the locus of the possibilities of perfection and justice, can still be consistently asserted.

So Drees finally proposes a model for God that he claims is consonant with science and the other cosmologies discussed. God is immanent, that is, present in the processes of nature. God is temporally transcendent, both as creator and perfecter. God is spatially transcendent, perhaps embedded in higher dimensions of space so he can be equidistant from all points, like the center of a sphere. God is the locus of values and possibilities, the beginning and end of perfection and justice. Finally, God is the source of actuality. Even if the universe appeared out of nothing, a quantum fluctuation in a vacuum, that nothing is something, and God is the source of that something: "Rather than seeking an understanding of divine action in the world, the world itself is understood as God's action."⁵⁶

But God remains a postulate. By postulating God, we choose to affirm our belief in the basic goodness of the world. And since we have no evidence that God exists, individuals play an active role in making that choice. We are not forced to believe by evidence or duress.

Thus, Willem Drees has made an important contribution to a sensible dialog between science and theology. Understanding the science better than most theists, he has been able to define a basis for belief, but one that still requires the usual complement of faith. In the end, Drees has affirmed that God is an additional postulate not required by the data.

The ancient introduction of immaterial spirits were honest human attempts to explain the unexplained. Science has gradually replaced these explanations with ones relying on matter alone and uncovered no sign of spirits or gods. Despite his abhorrence of the concept, Drees still presents us with a God of the gaps as an explanation for the remaining mysteries of the universe. Humanity may someday explain these mysteries without recourse to the transcendent, as it has the many mysteries of the past. Drees asks, "Can one worship a hypothesis?" I find it very difficult to bow before that altar.

In *Faith of a Physicist*, Polkinghorne was quite explicit in rejecting even the remotest chance that we live in a purely natural, purposeless universe. "The strategy of the materialist atheists," he says, "is usually to claim that science is all, and that beauty and the rest are merely human constructs arising from the hard-wiring in our brains. I cannot accept so grotesquely impoverished a view of reality."⁵⁷ But he still interprets the world from an anthropocentric, theocentric perspective. Nonbelieving scientists such as Richard Feynman and Carl Sagan looked at the material universe with wonder and found material reality to be anything but grotesquely impoverished.

Notes

1. This is a pun on "The Promise Keepers," a group of highly conservative Christian men who were very active in the United States in the 1990s.
2. John Polkinghorne, "Chaos Theory and Divine Action," in *Religion & Science: History, Method, Dialogue*, eds. W. Mark Richardson and Wesley J. Wildman. (New York and London: Routledge, 1996), pp. 243-52.

3. John Polkinghorne, *Belief in God in the Age of Science* (New Haven and London: Yale University Press, 1998), pp. 85-86.
4. *Ibid.*, p. 82.
5. *Ibid.*, p. 88.
6. *Ibid.*, p. 85.
7. *Ibid.*, p. 21.
8. John Polkinghorne, "The Metaphysics of Divine Action," in *Chaos and Complexity: Scientific Perspectives on Divine Action*, eds. R. J. Russell, N. Murphy, and A. Peacocke (Vatican City: Vatican Observatory, 1995), pp. 147-56; Polkinghorne, "Chaos Theory and Divine Action," in *Religion & Science: History, Method, Dialogue*, eds. W. Mark Richardson and Wesley J. Wildman (New York and London: Routledge, 1996), pp. 243-52; Arthur Peacocke, *Theology for a Scientific Age* (London: SCM Press, 1993); "God's Interaction with the World: The Implications of Deterministic 'Chaos' and Interdependent Complexity" in *Chaos and Complexity*, pp. 263-87.
9. James Gleick, *Chaos: Making a New Science* (New York: Penguin Books, 1987), pp. 11-18.
10. Roger Lewin, *Complexity: Life at the Edge of Chaos* (New York: Macmillan, 1992), p. 100.
11. Gleick, *Chaos*.
12. Thomas F. Tracy, "Particular Providence and the God of the Gaps," in *Chaos and Complexity*, pp. 289-324.

13. Ilya Prigogine, *From Being to Becoming* (San Francisco: W.H. Freeman, 1980); Ilya Prigogine and Isabella Stengers, *Order out of Chaos* (New York: Bantam, 1984). Note that Prigogine's frequent coauthor is Isabella Stengers, who is no relation to me.
14. Prigogine and Stengers, *Order out of Chaos*; Peter Coveney and Roger Highfield, *The Arrow of Time* (London: Flamingo, 1991).
15. The slight time asymmetry that is seen in a few rare elementary particle processes is very small, one part in a thousand, and does not forbid time reversibility. It just means that these reactions do not proceed in both time directions at exactly the same rate. They do proceed at the same rate, however, when particles are replaced by antiparticles and the process is viewed in a mirror. For more details see my *Timeless Reality*.
16. For a critical review of Prigogine's claims of a new scientific paradigm, see Jean Bricmont, "Science of Chaos, or Chaos in Science?" *Physica Magazine* 17 (1995): 159-208, reprinted in "The Flight from Science and Reason," eds. P. R. Gross, N. Levitt, and M. W. Lewis, *Annals of the New York Academy of Sciences* 775 (1996): 131-75.
17. Peacocke, *Theology for a Scientific Age*, p. 118.
18. John Briggs and F. David Peat, *Turbulent Mirror: An Illustrated Guide to Chaos Theory and the Science of Wholeness* (New York: Harper & Row, 1989); Peter Coveney and Roger Highfield, *The Arrow of Time* (London: Flamingo, 1991).
19. Polkinghorne, *Belief in God in the Age of Science*, p. 88.
20. *Ibid.*, pp. 97-98.

21. **Ibid.**, p. 128.
22. **Roger Penrose**, *The Emperor's New Mind: Concerning Computers, Minds, and the Laws of Physics* (Oxford: Oxford University Press, 1989), p. 112.
23. **Polkinghorne**, *Belief in God in the Age of Science*, pp. 128-30.
24. For more discussion of Penrose Platonism, see chapter 12 of my *The Unconscious Quantum: Metaphysics in Modern Physics and Cosmology* (Amherst, NY: Prometheus Books, 1995).
25. **John Wilson**, "Examining Peacocke's Plumage," *Christianity Today* (March 12, 2001).
26. **Nancy Murphy**, "Divine Action in the Natural Order: Buridan's Ass and Schrödinger's Cat," in *Chaos and Complexity*, pp. 325-57.
27. **Ibid.**
28. **Fritjof Capra**, *The Tao of Physics* (Boulder: Shambhala, 1975); **Gary Zukav**, *The Dancing Wu Li Masters: An Overview of the New Physics* (New York: Morrow, 1979); **Deepak Chopra**, *Ageless Body, Timeless Mind: The Quantum Alternative to Growing Old* (New York: Random House, 1993); **Amit Goswami**, *The Self-Aware Universe: How Consciousness Creates the Material World* (New York: G.P. Putnam's Sons, 1993).
29. **Kenneth R. Miller**, *Finding Darwin's God: A Scientist's Search for a Common Ground Between God and Evolution* (New York: HarperCollins, 1999), p. 213.
30. **Ian G. Barbour**, *Religion and Science* (San Francisco: Harper Collins, 1997), p. 216.

31. John F. Haught, *God after Darwin* (Boulder, Col.: Westview Press, 2000), p. 120.
32. Dean L. Overman, *A Case against Accident and Self-Organization* (New York, Oxford: Rowman & Littlefield, 1997), p. 1.
33. *Ibid.*, p. 1.
34. Rebecca Flietstra, "A Misguided Quest for Proof," *Christianity Today* 4, no. 5 (1998): p. 34.
35. Stanley L. Miller, "The Origin of Life," in *This Is Life: Essays in Modern Biology*, eds. Willis H. Johnson and William C. Steere (New York: Holt, Reinhart, and Winston, 1962), pp. 316-41.
36. Flietstra, "A Misguided Quest for Proof."
37. As quoted in William Dembski, "Is Intelligent Design a Form of Natural Theology?" *Metanexus: The Online Forum on Religion and Science* [online] www.meta-list.org/archives/fulldetails.asp?archiveid=3130&Listtype=Magazine [May 11, 2000].
38. *Ibid.*
39. Templeton Foundation [online], www.templeton.org.
40. *Ibid.*
41. *Ibid.*
42. *Ibid.*

43. Ibid.
44. Phillip E. Johnson and Howard van Till, "God and Evolution: An Exchange," *First Things* 34 (1993): 32-41.
45. David A. Staff, "Christian Orthodoxy on MAN: God's Very Special Creation," [online], <http://www.amesefc.org/sermons/sr080402.htm>.
46. Willem B. Drees, *Beyond the Big Bang: Quantum Cosmologies and God* (La Salle, Illinois: Open Court, 1990).
47. Willem B. Drees, "Gaps for God?" in *Chaos and Complexity*, pp. 223-37.
48. Ibid.
49. Drees, *Beyond the Big Bang*. Drees did not have Tipler's book as a reference in writing his own book, but relied on earlier Tipler papers.
50. For a comparative study of Teilhard and Darwin, see H. James Birx, *Interpreting Evolution: Darwin & Teilhard de Chardin* (Amherst, N.Y.: Prometheus Books, 1991).
51. John D. Barrow and Frank J. Tipler, *The Anthropic Cosmological Principle* (Oxford: Oxford University Press, 1986), ch. 6.
52. For my review of Tipler, see Victor J. Stenger, review of *The Physics of Immortality* by Frank. J. Tipler, *Free Inquiry* 15 (1995): 54-55.
53. Steven Weinberg, *The First Three Minutes* (New York: Basic Books), p. 155.
54. Steven Weinberg, *Dreams of a Final Theory* (New York: Pantheon Books, 1992), p.

- 255.
55. Ibid., p. 256.
56. Drees, "Gaps for God?"
57. John Polkinghorne, *The Faith of a Physicist* (Princeton: Princeton University Press, 1994), p. 56.