

Science: Atheism

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A proper assessment of the bearing of scientific inquiry on theistic religion requires recognition that conflict, mutual consistency, independence, or conciliation are possible but depends on the methods accepted and the claims made in each domain at particular times and places—which can, and have, varied. This chapter, therefore, focuses on questions relating to whether the best methods, findings, and theories in contemporary scientific disciplines support, cohere with, or conflict with commitments made by theistic theologies.

DOES SCIENCE FAVOR THEISM OR ATHEISM?

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With regard to nearly all gods that humans ever believed in, theists and atheists fully agree that these divinities do not exist. Homeric gods such as Zeus or Poseidon and ancient Egyptian deities like

KEY CONCEPTS

Aurora Borealis

Big Bang

Entheogen

Exoplanet

Light-Year

Near-Death Experience

New Age

Out-of-Body Experience

Quantum Cosmology

Singularity

Space-Time

solar Ra or mother Isis are considered to be fictitious characters. Social scientists and historians investigate the mental and communal functions of these cultural constructs, which allegedly explained striking empirical phenomena, reinforced group cohesion, or legitimized the reign of rulers. According to priests in ancient Egypt, for example, a god called Khnum produced the annual Nile flood, and several creation myths accounted for the existence of the cosmos.

Because contemporary theists are atheists with regard to all of these gods, we should distinguish sharply between two varieties of atheism. On one hand, universal atheists such as I hold it to be highly improbable that any god humans ever believed in exists. On the other hand, (mono-)theists may be called “exceptionalist” atheists: they endorse universal atheism with one exception, which is concerned with the god they call God, Yahweh, or Allah. Theists believe that one god exists, whereas all other gods do not.

Well-educated theists will concede that, typically, the empirical phenomena people explained by postulating divine actions in ancient Egypt, Greece, or India can be better accounted for by empirical science. Whereas in ancient Greece it was believed that the sky god Zeus caused lightning and thunder, using it as weapons against his opponents, from the nineteenth century onward scientists developed physical explanations of thunder as a shock wave in the air caused by lightning, which is a spectacular electrostatic discharge in the atmosphere. Hence, with regard to the many gods of traditional polytheisms, informed theists agree with atheists that science favors atheism, because well-confirmed scientific explanations of empirical phenomena rule out traditional religious accounts. In this section, I argue that the same holds with regard to God, that is, concerning the god of theism. My thesis is that science favors universal atheism.

Contemporary theists have invented various apologetic strategies to avoid incompatibilities between well-established results of scientific research and the contents of their theistic beliefs, legitimizing the latter. Using such a strategy, they argue that although science may not favor theism, it does not favor atheism either, at least not with regard to God. As I have argued elsewhere, none of these apologetic strategies is convincing (Philipse 2012).

Let me defend briefly three claims (discussed in the sections below) in order to support the thesis that science favors atheism with regard to God, that is, the thesis that scientific progress makes it increasingly unlikely that the god of theism exists. In order to provide content to this thesis, we have to know how theists characterize the being to which they refer with the proper name *God*. Traditionally, this god is described as “a person without a body (i.e. a spirit) who ... is eternal, perfectly free, omnipotent, omniscient, perfectly good, and the creator of all things” (Swinburne 2004, 7). How do science and theism relate to each other if theism is the view that this god exists?

SCIENTIFIC PROGRESS CAUSED GRADUAL THEISTIC RETREAT

Many scientists who endorse a monotheist creed argue that there can be no incompatibility between science and theism, because they are concerned with different domains—such as nature and the supernatural, or the world of facts and the domain of values. However, these compatibilist views have been triggered by a long learning experience, during which biblical and other religious accounts of many things have been superseded by superior scientific explanations. In other words, since the times of Nicolaus Copernicus and Galileo, scientific progress has caused a gradual theistic retreat. This has happened in all domains of science, from cosmology to medicine. Let me mention three examples to illustrate my first claim.

One of the greatest mathematical physicists ever, Isaac Newton, was a passionately pious monotheist. His religious writings are more voluminous than the *Principia* (1687) and *Opticks* (1704)

taken together. It is often forgotten today that although Newton developed the first well-confirmed universal mechanics, he also argued that some observed phenomena could be explained only with reference to God. For example, he thought that no physical explanation could be given for (1) the fact that all planets rotate around the sun in the same direction “in Orbs concentrick” and (2) the fact that the solar system does not collapse because of the gravitational attractions between the planets. He concluded that these two striking aspects of our solar system “can be the effect of nothing else than the Wisdom and Skill of a powerful ever-living Agent” (Newton [1704] 1979, 402–403).

Nearly a century after Newton had put forward this argument, the French mathematician and astronomer Pierre-Simon Laplace (1749–1827) eliminated God from scientific cosmology. He explained the unidirectional rotations of the planets by his hypothesis that the sun’s atmosphere had started to rotate when contracting because of gravitation, and he accounted for the noncollapse of the solar system by a superior calculation of gravitational planetary perturbations, showing that they remained within a limited range (Gillispie 1997, chap. 21). According to a famous anecdote, Napoléon Bonaparte would have asked his former teacher Laplace: “Monsieur Laplace, où est Dieu dans votre système?” (Mr. Laplace, where is God in your system?), and Laplace would have answered: “Sire, je n’ai pas besoin de cette hypothèse” (Your Majesty, I do not need this hypothesis).

When Laplace eliminated God from cosmology, many Christian philosopher-scientists still believed that God had created all biological species separately, as Genesis tells us. For example, William Paley published his celebrated book *Natural Theology* in 1802, in which he applied the so-called watchmaker analogy to show that the existence of animals and plants amounts to a “proof of an intelligent Creator” (Paley [1802] 2006, 277). This is why Charles Darwin argued extensively in *On the Origin of Species by Means of Natural Selection* (1859) that his evolutionary hypothesis refuted the biblical view according to which “each species has been independently created” (Darwin [1859] 1996, 105–106). The impressive progress of evolutionary biology combined with research in genetics further confirms Darwin’s hypothesis.

My third example is concerned with the temporal dimension of the universe. In the Christian tradition, many biblical experts, from Theophilus of Antioch (second century CE) to Bishop James Ussher (1581–1656) have attempted to calculate the age of the universe on the basis of biblical chronologies. Ussher’s conclusion that God created the world in 4004 BCE has become famous, because this date is mentioned in the King James Bible. Very few Christians still believe that biblical chronologies can be trusted. With regard to the age of the earth, we rely today on radiometric dating of meteorite material, which shows that our planet is about 4.54 billion years old. Because big bang cosmology has been empirically confirmed, scientists are able to investigate the chronology of the universe as well, on the basis of measurements of its expansion rate. The initiating expansion of our universe probably occurred around 13.8 billion years ago. We might mention many other instances of scientific progress that caused religious retreat. Let us now wonder why this happened.

THERE ARE NO RELIABLE SOURCES OF RELIGIOUS BELIEF

If theism were true, we might expect that scientific research would disclose ever more traces of God’s activity and authorship in the universe, because the universe would be God’s work of art. As indicated, however, the reverse has happened. Scientific progress increasingly caused religious retreat, in the sense that experts eliminated religious explanations of phenomena in favor of scientific explanations. Why did this happen, precisely? Let us define *science* in a very broad sense, including the humanities and everyday know-how, as the human endeavor to obtain knowledge by using methods of research and epistemic sources that have been well tested and shown to be reliable. My second claim is that there are no reliable sources of religious belief. This became increasingly clear during the ages of scientific progress, which explains why scientific advancement caused religious retreat. Science favors universal atheism because the belief that God exists, or that there are gods, cannot be validated by using any reliable epistemic source or method.

Theists may object that our access to God must be different from the ways in which we examine the natural world. Because God is a supernatural being, sensory perception and well-calibrated

methods of scientific research will be irrelevant for getting in touch with him. According to most religious traditions, gods communicate with us via dreams, states of trance, oracle experiences, miracles, revelations, repeated rituals, and so on. In his classic biography of Muhammad, for example, the eighth-century Arab historian and hagiographer Ibn Ishaq tells us that the archangel Gabriel provided a first revelation to Muhammad while the latter was dreaming on a mountain in the cave of Hira. If God exists, he also may have implanted in humans a special cognitive mechanism via which he reveals himself to us directly, a so-called *sensus divinitatis* (Plantinga 2000, 148 and *passim*).

According to my second claim, all these special sources of religious belief are clearly unreliable. One well-known argument to this effect is the argument from the plurality of religions. Since many religions rely on sources of the same kinds in order to legitimize their claims to truth concerning God or gods (such as divine revelations), whereas these contentions contradict each other, the alleged special sources of religious knowledge cannot be relied on. Dreams should not be trusted as sources of truth, for example.

The argument from the plurality of religions may not apply to extraordinary events that legitimize one religion only and which are claimed to be unique. Let me discuss in some detail the conversion experience of Saint Paul on the road to Damascus. This extraordinary event has been crucial for Christianity. If Paul had not been converted, he would not have propagated faith in Jesus throughout the Roman Empire, and the Jesus sect would not have developed into a world religion. Why and how did the pitiless Jewish persecutor of Jesus adepts Saul transform into Paul, the most prominent early propagator of Christianity and author of some of the oldest texts of the New Testament?

Let us assume that we can rely on the biblical book Acts with regard to the natural facts concerning Saul's conversion experience. According to Acts 9:1–9, the following things occurred suddenly to Saul on the way to Damascus, when he was "still breathing threats and murder against the disciples of the Lord": (1) a light from heaven flashed about Saul, (2) he fell to the ground, (3) he heard a voice, and (4) he was without sight during three days. According to Acts 22:9, those who were traveling with Saul (5) "saw the light but did not hear the voice," whereas according to Acts 26:13, (6) the light from heaven was "brighter than the Sun," and (7) the travelers "had all fallen to the ground." Saul assumed that the resurrected Jesus was speaking to him during this baffling experience. As a consequence, he converted from a cruel persecutor of Jesus's followers to the main Jesus propagandist.

There is no doubt that natural facts (1–7) must have been deeply disturbing and perplexing to Saul and his fellow travelers. How should we explain them? Some Christians still think that the resurrected Jesus truly appeared to Saul, but this leaves unexplained quite a few aspects of the event. For example, why would a supernatural appearance of Jesus cause all travelers to fall to the ground? The best explanation of facts (1–7) was proposed in 2015 by the astrophysicist William K. Hartmann, who is cofounder of the Planetary Science Institute in Tucson, Arizona.

According to Hartmann, the description of what Saul experienced on his way to Damascus offers "a strikingly good match" to eyewitness accounts of the "explosive entry of an asteroid fragment over Chelyabinsk in 2013" (Hartmann 2015, 368). Let us suppose, then, that something similar happened to Saul and his companions on the way to Damascus. The explosion of a meteoroid in the air will have caused a shock wave that blew the travelers to the ground (2, 7). The light from heaven brighter than the sun (1, 6) was an intense ultraviolet radiation resulting from the fireball event. This caused Saul's temporary blindness, because he looked longer at the light than his fellow travelers, so that he suffered from photokeratitis afterward (4). Apparently, Saul interpreted the loud noise resulting from the explosion as a voice (3), which he attributed to the resurrected Jesus, whereas his companions did not hear a voice (5).

It is no wonder that, living in the first century and being ignorant of astrophysics, Saul and his companions interpreted their overwhelming experience in religious terms. Saul's belief that Jesus appeared to him during this shocking event should be explained psychologically. Saul may have felt a deep guilt or fear of revenge because of his cruel persecution of Jesus adepts. Perhaps he also realized that converting to Jesus would liberate him from the exigent demands of Jewish law. However

this may be, Saul's conversion experience can be accounted for completely in scientific terms without assuming any supernatural intervention. Hence, what happened to Saul on the way to Damascus cannot be relied on as a trustworthy source of religious belief.

THE TRUTH OF THEISM IS IMPROBABLE, GIVEN MANY SCIENTIFIC RESULTS

My first two claims may be interpreted as favoring agnosticism instead of universal atheism. They tell us merely that alleged evidence for theism is illusory, without showing that God does not exist. Let me finish, then, by indicating some of the many scientific results that make it improbable that theism is true.

Cosmology. Whereas according to the biblical book of Genesis God created the cosmos in order to house humanity, cosmological investigations show that life is extremely rare in the universe and that many regions of it are empty, such as the Giant Void, which measures some 1.3 billion light-years across. It is unlikely that God would have created such an inhospitable universe.

Neuroscience. Ever-more neuroscientific research shows that all mental phenomena depend on complex brain processes. Hence, it is improbable that God exists, if he is defined as a bodiless mind.

Evolutionary Biology. An infinitely good God would never have created humans by means of biological evolution, because this would have been an excessively cruel creative procedure. For example, during the evolution of life on the earth, 99 percent of all species have perished. Furthermore, humans would not have evolved if about 66 million years ago the Cretaceous-Paleogene extinction event had not happened, when a massive asteroid impact caused the extinction of about three-quarters of animal and plant species.

Paleoanthropology, Genetics, Archaeology, Sociology. As fossils from early hominins and progress in DNA sequencing have revealed, hominins must have diverged from chimps more than 7 million years ago. Modern humans speciated at least some 200,000 years ago. When they developed religious beliefs is less clear, but archaeological and historical research reveals that probably all known religions were polytheistic until the Egyptian pharaoh Amenhotep IV became a monotheist around 1343 BCE. These data imply that if God exists, he hid himself to humanity during many millennia. Furthermore, he would still hide himself today from all those who do not believe that he exists. Because God loves all humans as a father, however, he would never hide himself from any decent human being. Hence, God does not exist (Schellenberg 2015).

Theism Explained. When we wonder what explains the occurrence of theism in human history, two hypotheses should be compared. Either God caused its occurrence, or there is a purely secular explanation. If the latter accounts for the facts of religions on the earth better than the former, this is a further scientific confirmation of atheism. One of these facts is that monotheism or theism in the sense defined started to appear quite late in human history. As I said earlier, theism cannot explain this fact.

Inspired by David Hume, I propose the following secular explanation. As we read in the Old Testament, the Jewish people appealed to God often in situations of war with other tribes (e.g., Deuteronomy 20). My hypothesis is that during warfare, people often thought that they could triumph if their god was cleverer and more powerful than the gods of their opponents. This motivated a tendency to ascribe ever-greater properties to their god(s) "till at last they arrive at infinity itself, beyond which there is no farther progress" (Hume [1757] 1976, 52). As soon as people thought that their god had infinite properties, such as being omnipotent, omniscient, and perfectly good, they realized gradually that their theism excluded the existence of other gods, so that they became monotheists.

In many respects, this secular explanation of theism's origin is empirically superior to a theistic explanation. It accounts for the facts that theism arose only locally and late in human history and that in the Old Testament God is portrayed as a god of one tribe, the Jews, who supports them

against other tribes, which are butchered by this god. The same point applies to the histories of Christianity and of Islam.

THE EFFECT OF SCIENTIFIC PROGRESS AND THE SCIENCE OF RELIGION ON THE CREDIBILITY OF THEISM

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DOES SCIENTIFIC PROGRESS FAVOR THEISM OR ATHEISM?

In the aggregate, the evidence of scientific progress has decreased the probability of theism and increased the probability of nontheistic naturalism (Carrier 2010b). This started to become apparent in the ancient history of the West. Since the seventh century BCE, when the Greek philosopher and astronomer Thales realized that lunar and solar eclipses were not caused by magical or divine forces but were merely the shadows cast by objects moving in their natural courses, science for many centuries thereafter continued discovering that theistic and supernaturalistic explanations of the phenomena of nature turned out to be false (Lloyd 1979, 2016; Carrier 2017), until scientific progress ended under Christian dominance in the fourth century CE. A thousand years later a few Christian intellectuals fought hard to recover that neglected tradition and reinvigorate scientific advancement (while before that time a brief attempt at such a revival by Muslims failed to take hold). The outcome was an even more comprehensive and rapid pace of disproving theological assertions about the world that continues to this day.

Theology has responded by continually “redefining” God or beliefs about God to fit these newly revealed facts. Nonetheless, the singular fact that theism (in any form, worldwide) never anticipated any of these developments and always has to be changed to accommodate them demonstrates that this evidence has lowered the probability that theism holds true. If that evidence hadn’t been lowering its probability, theism would not have had to continually change to fit what was being revealed. In the logic of probability, the more a theory’s predictions are disconfirmed and, consequently, the more that theory has to be revised with more additions after the fact to fit those disconfirmations, the less likely that theory is to be true (Carrier 2012)—unless evidence is acquired that independently confirms that those ad hoc additions are true. That, however, has never happened in the history of theism.

Balance of Probability. In terms of prior probability, if naturalism wins every time two horses—theism and naturalism—run a race to substantiate whose explanation of some fact of the world is correct, then, after thousands of races, the conclusion must be that theology is least likely to provide the true model for reality. That is what has happened. No theistic explanation of any phenomenon has turned out to be true. Some hypotheses remain to be fully tested against one another (principally, the grounding theories of cosmological and cognitive science: how the universe began and acquired the characteristics it has and why consciousness is experienced in the form of veridical qualia). Given past experience, the odds do not favor theism in those races; that is true by a considerable margin, owing to a vast accumulated past of scientific progress, which progress only ever continues in the absence of theistic hypotheses (Carroll 2016; Carrier 2005).

For example, in the early 200s CE, in his monumental treatise *On the Uses of the Parts of the Body*, the Greco-Roman biologist Galen produced an extended scientific defense of the theory of intelligent design in the construction of animal and human bodies; shortly before that, the Greco-Roman astronomer Ptolemy suggested the same conclusion from the elegantly complex organization of the geocentric universe in *Planetary Hypotheses*. English mathematician and astronomer Isaac Newton and English naturalist Charles Darwin subsequently overthrew both conclusions by advancing science with the discovery of what actually causes apparent biological design and all the balanced motions of the planets and stars. In neither case was it an intelligent engineer but instead the inevitable outcome of mindless objects and forces acting on one another, without the meddling of any deity. In the twentieth century, science has progressed to the point of discovering that the absence

of divine involvement better explains observations in every domain, including astrophysics and the origin and evolution of life (Carrier 2011; Carroll 2016). The ancient battle of naturalism versus theism in the creationism debate was mostly undecidable on the science known before modern times (Sedley 2008) but has since gone in every way for naturalism. The same has occurred in the domains of weather, disease, astronomical and geological events, and all of biology, psychology, chemistry, and physics.

Although theism can be reconstructed in a way compatible with science, it is never a conclusion actually confirmed by science. That the most widely believed and fiercely defended theisms are the most hostile to scientific conclusions and values is further evidence that theism is likely untrue (Cromer 1993; Loftus 2016; Carrier 2017). Even moral and social progress has proceeded on nontheistic scientific conclusions against the opposition of popular theisms (Shermer 2015; Carrier 2005). This has all been true not only in the context of Christendom but under Islamic (Ofek 2011) and Hindu (Nanda 2011) regimes as well.

Apologetic Responses. Theistic apologetics aims to deny these conclusions. At least three strategies have been attempted. One approach is to argue that scientific progress may have failed to vindicate theism but nevertheless requires a foundation of assumptions dependent on theism. The historical facts never support this claim (e.g., Carrier 2010a). Another approach is to argue that theistic hypotheses are the only ones viable for answering a certain few as yet unanswered questions, but the analytical facts never support this claim. For example, theism does not even have a working theory that properly predicts the many peculiar features of human consciousness, whereas evidence continues to mount that the only working theory will derive from computational physics (see below). Likewise, theism has never advanced any cosmological theory that makes any uniquely testable predictions—most theistic theories have been falsified (Carrier 2011)—whereas many nontheistic cosmological theories have been developed that do explain many unusual observations, including features of the universe that are theistically unnecessary and even contrary to expectation in terms of any popular theism (Carrier 2011, 2005). Though no theory has yet been confirmed, the evidence indicates that some nontheistic model will explain most observations, including the most peculiar of them.

A third approach is to argue that theism has occasionally made successful scientific predictions, but there is no actual case where this happened. Even the theosophist Rudolf Steiner's 1923 prediction of "colony collapse" in honey bee populations derived from no theological premise; it was argued entirely from natural science (Steiner 1975). Theories that require no deity are out of account, as by that very fact their being true does not support theism over naturalism. No theory requiring a deity has ever been verified by science. Attempts to claim that evolution by natural selection requires prohibitively large steps in random information gain have never survived peer review, and to this day no empirical evidence supports any such claim (Young and Edis 2004). The claim that Christian theology predicted the big bang theory is false. Christian theology predicted a radically different origin, in both time and process, and was disproved by the discovery of deep cosmological time and a particularly mechanical evolution of the cosmos (in accord with nuclear physics), which in no credible way corresponded to the account of Genesis or the writings of any theologian. Theology's only correct guess was that there is an origin point to the current cosmos in time, but that same guess was made by many nontheistic cosmologies. It still has not been scientifically proved that time itself had an origin (Veneziano 2004), the only unique prediction Christian theology can claim. Even that prediction is now made by several nontheistic cosmological theories.

DO RECENT ADVANCES IN COGNITIVE SCIENCE FAVOR THEISM OR ATHEISM?

Over the course of the twentieth century, and especially the early years of the twenty-first, cognitive science has comprehensively established the dependence of the human mind on physical structures and events in the brain (Carrier 2005, 2011, 298–302; Churchland 2013). Even some theologians are conceding this point (Murphy 2006). There is no actual science establishing that the mind can survive the death of the brain. A vast scale of scientific evidence has accumulated establishing countless defects of the mind's functioning as the result of dependence on its physical structure

(Martin and Augustine 2015). The entry for “List of Cognitive Biases” at Wikipedia, for example, is not even comprehensive yet is already daunting in scale. These facts favor atheism.

Scientists have identified where in a brain different kinds of memories are stored, where emotions and reason operate, where each kind of sensory experience is processed, and so on. They have observed that if any one of these parts is physically damaged, removed, or deactivated, the memories or abilities it contains are then lost. It follows that if all the parts are taken away, everything that human beings are will cease to exist. The same is true if oxygen or nutrients are removed or electrical discharges or psychoactive chemicals are introduced. Atheistic naturalism, without any additional assumptions, fully predicts observations of this kind, because no other way exists to have consciousness except as the product of a large, delicate, flawed, yet complex physical system, one that sits at the end of an extremely long, meandering, faulty process of trial and error over billions of years. Yet in no version of theism are those same observations expected, without adding an extraordinary array of excuses; but such additions guarantee the low probability of any theism that requires them (Carrier 2012, 80–81). Quite simply, if theism is true, minds do not require brains. For if God exists, it is necessarily true that minds can exist without brains. Therefore, if theism is true, it remains inexplicable why our minds require brains—at all, much less brains so flawed, vulnerable, and resource-dependent as the human brain is. The evidence therefore falls far more in favor of godless natural selection than theism, which greatly limits the probability of theism.

Theistic apologists attempt to answer this issue by noting that science has yet to confirm a physical-causal explanation of the subjective qualities of conscious experience (the argument from qualia), which fact alone does not support theism, because the prior probability remains strongly in favor of an eventual naturalist explanation (cf. Carrier 2011). Some apologists attempt, then, to argue further that a physical-causal explanation of the subjective qualities of conscious experience is impossible. There has yet to be any analytically sound demonstration of that claim (Melnik 2003; Cottrell 1999). If the subjective quality of experience is wholly without remainder caused by, and thus dependent on, physical structures and events, theism is not required to account for it. Whether one then chooses to classify the qualia of such experience as a separate ontology from the physical would be mere semantics; their causation would remain fully explained. Theism has produced no theory capable of predicting the specific correlations of brain event to qualia abundantly documented. Given past experience in discovering how the brain produces mental experience, it is unlikely any such theory will succeed. To date, computational physics remains far more promising (Koch and Tononi 2017; Cottrell 1999).

DO SCIENTIFIC DISCOVERIES ABOUT RELIGIOUS EXPERIENCE AND RELIGIOUS BELIEF FORMATION SIMPLY REVEAL GOD’S WAYS OF COMMUNICATING WITH US?

Many advances have been made in the cognitive science of religious experience (Newberg 2010), but none has confirmed the reality of any gods or anything at all beyond the natural. To the contrary, the endless diversity and demonstrated cultural dependency of religious experience and belief mean that there is no true source of the information they convey about the world (Loftus 2010, 2013). The findings of scientific anthropology must also be added to the findings of cognitive science, including the discovery that religious experiences serve identifiable social functions and are culturally constructed (Lewis 2003; Fales 1999). All of this reveals a basic truth: what humans experience and believe in the domain of religion has other causes, wholly internal to the mind, as influenced externally by its culture and environmental circumstances and without the involvement of gods or the supernatural (Guthrie 1995; Dennett 2007; Vyse 2013).

That the content of religious experience changes over time, culture, and circumstance and that all these contradictory intuitions and communications feel equally real to their percipients (yet are then often confirmed to be false) means that religious experience is not a reliable access point to any truth about reality. This author was fully convinced of the supernatural truth of Daoism by religious experiences (Carrier 2005), in the same way as every convert to Christianity, Islam, Buddhism, or any other tradition. This verifies that religious experience is all a mental construct, which percipients then convince themselves is true. The construct may be useful. That is a matter of debate. But whether it is factually true requires more objective and consistently

verifiable evidence, which is never to be found. By contrast, were gods genuinely interested in and capable of communicating with human beings, humans should have a data set on the matter that is consistent, at least to some notable extent, across the entire five thousand or so years of recorded human history and all human cultures (present and past, which number in the thousands). Explaining away the lack of this data set does not rescue the conclusion that religious experience has any real source outside the individual mind affected by culture and circumstances. Such tactics only reduce the probability of the conclusion through the accumulated additions of unverified assumptions.

That religious experience is never scientifically verified to contain any knowledge not already possessed by percipients or the cultures they are influenced by and thus routinely conforms to the ignorance and factually false beliefs of that culture and time further verifies this conclusion. The very evidence needed to verify that a religious experience came from any superhuman source is never to be found outside unverifiable legends and popular tales. This is to be expected in atheism but not in theism, thereby increasing the probable validity of atheism over theism. The authors of the Bible and Qur'an, for example, despite claiming a channel to the divine, never learned of the immorality of slavery or gender inequality or of the truth of heliocentrism or the germ theory of disease or anything at all remarkable for their time. For all these reasons, the science of religious experience actually supports atheism over theism.

RELIGIOUS EXPERIENCE AND NEUROSCIENCE

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The neuroscience of religious and mystical experience and practice is still in its infancy, though it has made many strides in the last half of the twentieth century and since the beginning of the twenty-first century (for overviews see Newberg, d'Aquili, and Rause 2001; Horgan 2003; McNamara 2006, 2009; Schjoedt 2009; Nelson 2010; McNamara and Butler 2013). It is, of course, virtually impossible to capture spontaneously unfolding religious or mystical experiences (RMEs) in a laboratory setting. Thus, the neuroscientific study of RMEs has tended to focus, on one hand, on deliberate contemplative practices, like prayer and meditation (see, e.g., Austin 1999; Newberg et al. 2003; Lutz, Dunne, and Davidson 2007; Ricard, Lutz, and Davidson 2014; Neubauer 2014), that are not as sensitive to circumstance and surroundings as, say, conversion experiences or beatific visions and, on the other hand, on relatively reliably reproducible RMEs, for example, psychedelic drug-induced mystical experiences (see, e.g., Masters and Houston [1966] 2000; Siegel [1989] 2005; Smith 2000; Hobson 2001; Shanon 2002; Strassman 2005; Griffiths et al. 2006, 2008, 2011) or related experiences, for instance, induced out-of-body experiences (see, e.g., Blanke et al. 2002, 2005; Blanke and Metzinger 2009; Lenggenhager et al. 2007). To date, the neuroscientific study of RMEs has not provided any significant, independent evidence in favor of theism (or any other religious outlook for that matter, e.g., Buddhism). Naturalism provides a more parsimonious framework for understanding these experiences (cf. Fales 2010). In that sense, atheism (at least with respect to a God that would want to provide unequivocal evidence for its existence via the induction of RMEs) is more supported by the neuroscientific study of RMEs than is theism.

There are several sources of confusion that must be guarded against in any discussion of the bearing of neuroscientific studies on the evidential import of RMEs. First, there need be no commitment to methodological naturalism when it comes to the interpretation of these studies. Contrary to a naturalistically tendentious philosophy of science, it is perfectly conceivable that the results of neuroscientific studies of RMEs could favor a nonnaturalistic or specifically theistic interpretation. If, for example, contemplative practitioners could regularly enter into, say, beatific visions through prayer, and if this could reliably be seen to correlate with an influx of energy into their brains that could not be accounted for by sensory stimulation or by endogenous neuronal activity, this would count as some evidence that the practitioner's experience correlates with nonnatural

activity making a difference in the physical world. This is somewhat analogous to John C. Eccles's ideas about empirically testing interactionist dualism (see, e.g., Eccles 1953). If, moreover, the practitioner could make reliable predictions while in such states or, say, give us demonstrable answers to unsolved problems of mathematics and science (e.g., dictate a proof, disproof, or proof of the undecidability of the Goldbach conjecture, tell us how and where to detect evidence of life on exoplanets, dictate a better theory of the aurora borealis), this would constitute even more evidence that the experiences put the practitioner into contact with an intelligent, supernatural source. It is safe to say that, to date, no such experiences have been reliably and replicably documented in laboratory settings. If there is an intelligent, supernatural being that one is in contact with during a veridical religious experience, it would seem that that being is reluctant to allow those experiences to be an unequivocal source of evidence accessible by scientific means.

Second, it is also important that one avoid simplistic “debunking” arguments about RMEs. The fact that RMEs are associated with a range of techniques, practices, and conditions that, in one way or another, alter consciousness and thus brain processes (e.g., prayer, meditation, flagellation, fasting, sleep deprivation, ingestion of entheogens, twirling, chanting, tantric sex, dimmed lights, organ music, snake handling, sensory deprivation, sensory overstimulation, dancing, hand raising to sappy praise-and-worship songs, the Sun Dance, seizures, dreams) does not, in and of itself, constitute a knockdown argument against the veridicality of these experiences. Presumably, every sort of cognitive and affective experience, from everyday visual experience to falling in love to the understanding of a mathematical proof, has some sort of neural substrate; the substrates of relatively unusual or extraordinary experience will, of course, be as unusual and extraordinary as the experiences themselves. That said, the fact that RMEs are associated with such a variety of “spiritual technologies” or practices and that there appears to be no independent way of ruling some in and others out as reliable ought to give the proponent of the evidential value of RMEs pause. If a plausible general explanation (or family of related explanations) not couched in terms of any particular religious tradition and, more specifically, not couched in theistic terms can be found for this wide variety of RMEs (and their methods of inducement), this would seem, *ceteris paribus*, to be the more reasonable approach.

Third, the number of methods for inducing RMEs and the variety of traditions and subtraditions, theistic and nontheistic, in which these methods have emerged and developed cannot be conveniently ignored in any scientific study of the neural underpinnings of RMEs. The classic “many contenders” problem plaguing the argument from religious experience reaches into the neuroscientific study of RMEs. As indicated earlier, there is a considerable body of scientific literature now on meditative practice and psychedelic (or entheogenic) drug-induced RMEs. Much of so-called contemplative neuroscience is actually motivated by varying degrees of religious (or quasi-religious) commitment to Buddhism. The Dalai Lama himself has actively cooperated with neuroscientists for many years (see, e.g., Goleman and Thurman 1991; Hayward and Varela 1992; Varela 1997; Houshmand, Livingston, and Wallace 1999; Dalai Lama 2005). While almost no one involved in this endeavor (including Tenzin Gyatso himself) would argue that contemplative neuroscience provides evidence of the signal metaphysical doctrines of Buddhism (e.g., karma and rebirth), considerable evidence for the generally positive effects of meditation on long-term practitioners has accumulated, and plausible models of the underlying neuronal processes supporting these effects have been articulated (see Ricard Lutz, and Davidson 2014 for an accessible overview, but see Khalsa et al. 2008, 2015, for cautionary studies). If a neuroscientifically based “ye shall know them by their fruits” argument can be mounted for any specific religious tradition, it can be mounted for Buddhism (see, e.g., Wallace 2003, 2007; Wallace and Hodel 2008; Flanagan 2011; Wright 2017; McMahan and Braun 2017; though see Victoria 2003, 2006, and Jerryson and Juergensmeyer 2010 for some caution here about “fruits”—equally applicable, by the way, to Judaism, Christianity, Islam, and Hinduism).

Most theists would, of course, be quick to point out that a plausible non-Buddhist explanation of the generally positive effects of meditation (and the neural substrates of those effects) would not be all that hard to articulate. After all, any sort of long-term practice (e.g., musical training, brain games, athletic practice) correlates with brain changes mediated by neuronal plasticity. If one devotes oneself to the control of attention (as in single-pointed meditation), the control of anxious and “grasping” tendencies (as in mindfulness or open monitoring meditation), and the

cultivation of compassion and altruism (as in loving-kindness meditation), it will not be all that surprising to find neuronal changes in the relevant brain regions—the attention control centers (e.g., prefrontal cortex), startle-reflex-related areas (e.g., amygdala), and so on (see Ricard Lutz, and Davidson 2014 for references and details). This eminently plausible response to a neuroscience-based argument for Buddhism would, of course, cut equally against any analogous argument mounted for a theistic conclusion, unless some special phenomena (like those suggested earlier) were reliably shown to attend specifically theistic religious experience.

RMEs induced by psilocybin, DMT, LSD, mescaline, and other psychotropic substances cannot be dismissed *a priori* by the theist or by a superficial *a posteriori* firsthand or secondhand survey (*pace* Zaehner 1972; for a more careful classic study see Wainwright 1981 and Richards 2005 for a more recent discussion). In fact, the history of the use of plants and concoctions containing such substances for religious purposes seems to be more or less coincident with human history (see, e.g., Harner 1973; Furst 1976; Grinspoon and Bakalar 1979; Anderson 1996). Still, today there are many religious traditions, most of them theistic, that recognize the use of such substances as a legitimate spiritual practices (e.g., Rastafari, Native American Church, Santo Daime, União do Vegetal). While the RME-inducing potential of such substances was studied scientifically in the heyday of psychedelic enthusiasm in the 1960s (before such study was ended essentially for political reasons by the Nixon administration; see Baum 2016), since the 1990s and the next decade this study has been renewed for the classical psychedelics and other substances (in addition to the studies by Griffiths et al. 2006, 2011, 2016, see Carhart-Harris et al., 2012, 2016; Muthukumaraswamy et al. 2013). The studies on psilocybin indicate that many of the RMEs it engenders are regarded as profound and positive by the experimental subjects, and the palliative potential of psilocybin for terminally ill patients is being actively explored (Griffiths et al. 2016). The theist, at least one wedded to Christianity, Judaism, Islam, or Hinduism, is in no good position to argue on independent grounds against the genuineness or veridicality of the experiences delivered by entheogenic substances. Again, altering consciousness is the name of the game when it comes to RMEs; it is only the means that differ. There is no good independent argument that prayer and fasting, say, are the genuine means God has chosen for delivering these experiences while the ingestion of psilocybin (etc.) is not.

Of course, the theist averse to the idea that God would use tryptamines, phenethylamines, and other molecules crossing the blood-brain barrier as vehicles of veridical RMEs might hasten to point out that imaging studies on psilocybin have suggested something about the unusual neuronal processes that seem to be the substrate of such experiences and that there is no need to appeal to the truth of any particular psychedelic vision to account for these experiences (see, e.g., Lebedev et al. 2015 on the mechanisms at play in experiences of “ego dissolution” engendered by psilocybin, e.g., “decreased functional connectivity between the medial temporal lobe and high-level cortical regions” [3137]). This response would, of course, be spot on. Here again, however, the response would cut against, *mutatis mutandis*, any argument for theism drawn from an analogous neuroscientific study of theistic RMEs (or some preferred subset thereof, e.g., Christian, Islamic, Hindu), were such an analogous study to exist.

In the absence of dramatic, replicable discoveries that relate theistic RMEs to an influx of energy into the brain that cannot be accounted for by endogenous brain processing or known sources of sensory stimulation or that relate them to reliable predictions (this latter, of course, not really requiring any specifically neuroscientific methods), there is no good reason to think that theistic RMEs are not to be explained by the same sorts of processes (differential activity in brain regions induced by a variety of causes, neural plasticity, etc.) that explain nontheistic RMEs or psychedelic RMEs. So far, there is no reason to appeal to special explanatory posits (e.g., the activities of Jesus, Krishna, or bodhisattvas) to account for the range of these experiences. Though the details will, of course, vary (e.g., the effects of DMT on the brain are, evidently, very different from the effects of prayer vigils and fasting or meditation), so far there is nothing that demands we go beyond the basic explanatory frameworks of the neurosciences, psychology, and the social sciences to account for the variety of RMEs. Any specific theistic framework would entail that only some such experiences are veridical or legitimate, but no such framework gives us an independent way to tell the difference. It would also entail that God, at least as conceived of by exclusivist traditions, is something of a trickster when it comes to RMEs, allowing for various “spiritual technologies” and

related religio-cultural traditions and interpretive frameworks to grow up that all seek to draw evidence from the RMEs the “technologies” and traditions legitimate. This trickster God would also seem to allow this with some regularity, since RMEs seem to be more or less reliably inducible in people across traditions and cultures. A naturalistic explanation that combines neuroscience, psychology, sociology, anthropology, and perhaps evolutionary biology and can explain the wide variety of RMEs seems to be both more parsimonious and more comprehensive (cf., again, Fales 2010). It is therefore to be preferred, on elementary, well understood, and generally accepted explanatory grounds, to a theistic explanation.

NEAR-DEATH EXPERIENCES ARE NOT EVIDENCE FOR EITHER ATHEISM OR THEISM

Keith Augustine, Internet Infidels

Near-death experiences (NDEs) are ostensibly otherworldly experiences reported by a small percentage of people who were dying but returned to life (van Lommel et al. 2001) or who at least believed that they were dying though they were not medically close to death (Gabbard and Twemlow 1991; Gabbard, Twemlow, and Jones 1981; Stevenson, Cook, and McClean-Rice 1989–1990). The popular image of an NDE has become ubiquitous: feelings of joy, an out-of-body experience (OBE) in which a person seems to view the physical world from a perspective different from that of the body, rushing through a tunnel or darkness toward a brilliant light, encountering deceased loved ones, undergoing a review of one’s earthly life, and perhaps strolling through a beatific environment or running into an uncrossable point of no return.

All of these motifs are rarely reported within a single NDE, however, and the most prominent of them are characteristically absent from reports of NDEs by those with minimal exposure to Western ideas. Reports of NDEs from India, for example, typically feature being brought in front of the Hindu god of death before being returned to life because the wrong person was retrieved (Pasricha and Stevenson 1986). In addition to such stark cross-cultural differences, in the mere one-quarter of Western NDE reports that include an OBE component (van Lommel et al. 2001), the NDEs occasionally feature visions of the physical world at odds with what is actually happening at the time, such as a vision of a nonexistent addressed envelope on a table (Lindley, Bryan, and Conley 1981). Other features suggesting that at least some NDEs are hallucinatory include reports of feeling bodily sensations while ostensibly outside the body and visiting a spiritual realm (Augustine 2015), receiving prophetic visions of the future during NDEs that fail to come pass (Ring 1982, 1988), and encountering living persons (Kelly 2001) while supposedly “on the other side.” Not every NDE report includes such blatantly hallucinatory features, however.

If there is nevertheless good reason to infer that all NDEs are probably hallucinations, then NDEs are irrelevant to whether either atheism or theism is true, as well as to the more salient question of whether spiritual realms exist at all. In principle, NDE reports cannot provide evidence against the existence of some sort of spiritual reality. While they do have the potential to provide evidence for the existence of some such reality, in practice, they fail to provide such evidence.

NDES ARE NOT EVIDENCE FOR ATHEISM/NATURALISM

In the best-case scenario for atheism—or, more accurately, naturalism (the view that no spiritual realms exist)—all NDEs would be demonstrably hallucinatory. But the existence of one kind of hallucination, NDEs, would no more support naturalism than would that of another, such as dreaming. As a simple point of logic, that people hallucinate spiritual realms during NDEs cannot provide evidence that spiritual realms do not exist any more than that people hallucinate trips to Paris while dreaming can provide evidence that Paris does not exist. In other words, spiritual realms might exist even if no NDE is ever an experience of them. Thus, the only NDEs that could be relevant to whether spiritual realms exist are those that seem to be experiences of such realms—that is, NDEs that are in all probability not hallucinatory. Forceful claims have been made for the accuracy of purported visions of the

physical world said to have been obtained during some NDEs (Habermas 2018; Holden 2009; Rivas, Dirvin, and Smit 2016), however dependent on the frailties of human testimony these claims may be. Their value ultimately depends on how well they can be corroborated by *independent* testimony (i.e., testimony where agreement between witnesses is not simply the result of witnesses having talked among themselves before an investigator interviewed them, or the result of independent witnesses gleaned congruent information from the same third party).

Those experiences that are said to have been accurate are often called veridical NDEs, but it is important to be mindful that those who have not experienced them have access only to the reports of such experiences, not to the experiences themselves. No one is in a position to say that when the details of NDE reports are accurate, their accuracy derives from some paranormal source rather than from information gleaned through the normal senses (such as hearing) during such experiences, or from information gleaned through normal channels before or after such experiences, but interpolated into reconstructed memories of NDEs.

NDES ARE NOT EVIDENCE FOR THEISM/SUPERNATURALISM

Only one way exists to overcome this inherent weakness of testimonial evidence: controlled experiments. In principle, veridical paranormal perception during NDEs could suggest the existence of spiritual realms, thus supporting a kind of broad supernaturalism (though perhaps not theism *per se*). Is there any good evidence that veridical paranormal perception actually occurs during NDEs? This discussion summarizes the results of experiments that have aimed to establish the occurrence of veridical paranormal perception during OBEs and NDEs by implementing safeguards meant to prevent normal sources of information from influencing the content of reports of such experiences.

From the late 1960s to the early 1980s, parapsychologists carried out controlled experiments designed to register the effects of OBE adepts' "astral bodies" on various instruments and subjects—from strain-gauge sensors to animals to human "sensitives"—when adepts "projected" to specific physical locations at particular times. Bucking the trend, a few of these "detection studies" produced some promising early results, but they either fell apart under further scrutiny or were never further investigated. In other experiments, OBE adepts "projected" to particular locations in order to report back on the characteristics of visual targets there. With two exceptions—one from an pseudonymous Miss Z and the other from the remote viewer Ingo Swann—these target-identification experiments produced no clear-cut hits. In the two cases where there were indeed clear-cut hits, the adepts were left alone with the visual targets for significant periods, essentially running the experiments with no controls at all (Augustine and Fishman 2015).

From 1990 to 2014, the results of six target-identification experiments aimed at spontaneously occurring NDEs that include an OBE component were published. Not one of them produced a single hit (Augustine 2007; Holden 2009; Parnia et al. 2014). The AWARE study, for example, involved multiple NDE target-identification experiments running concurrently at different medical institutions across the globe.

Although the AWARE study was designed to vindicate the view that NDEs are not hallucinations, the results ironically have had the opposite effect. The study found that of the fifty-five reported cardiac arrest experiences, forty-six (84 percent) were clearly dreamlike hallucinations, with the remaining classic NDEs constituting only 16 percent (nine of fifty-five) of the total (Parnia et al. 2014). These results alone are sufficient to refute premature arguments that it is simply impossible for the brain to generate any experiences during cardiac arrest, and thus NDEs cannot be brain-generated hallucinations (see, e.g., Greyson 2010; van Lommel 2006). They also raise the possibility that classic NDEs are simply a subset of these dreamlike hallucinations. Perhaps the more coherent of the dreamlike narratives simply get labeled as reports of NDEs because they happen to have an otherworldly theme (because expectation of imminent death during cardiac arrest calls up afterlife imagery at the time).

TAKING STOCK

The failure to secure replicable positive results in NDE target-identification experiments does not establish the nonexistence of any spiritual realms, but it does serve to substantially challenge positive arguments in favor of the existence of spiritual realms from NDE reports. For if veridical

paranormal perception occurs during OBEs or NDEs, why the failure to find it in all of the controlled experiments that have been undertaken to document it thus far? Various explanations can be put forward (Augustine and Fishman 2015), but in the absence of ad hoc maneuvering, the hallucination hypothesis predicts only one set of possible results: the results actually found. Until the time that properly controlled NDE target-identification experiments yield replicable positive results, they will take their place as historical curiosities akin to similarly unsuccessful tests of survival after death (Augustine and Fishman 2015; Berger 1996; Fox 2007; Gay et al. 1955; *Journal of the American Society for Psychical Research* 1989; Lodge 1905; Perry and Fontana 2009; Schwartz and Russek 2001; Stevenson, Oram, and Markwick 1989). While some eagerly await the results of the follow-up AWARE II study (which is recruiting subjects until 2020), at the moment the unsuccessful history of comparably easier-to-implement research into the paranormality of non-near-death OBEs does not bode well for those results.

ARGUMENTS INVOLVING COSMOLOGY AND QUANTUM PHYSICS

Taner Edis, Truman State University

PHYSICAL COSMOLOGY

Before modern physics, arguments about the creation or design of the universe depended on everyday, intuitive ideas of space and time. Creation has often been understood as an event in time linked to supernatural agency. Hence the notion of divine causation involved in creation has also been an intuitive, social concept of causality. Theistic traditions have placed creation and the design of the cosmos within a richly layered story, in which a god interacts with humans and reveals something about its purposes. In the context of such a story, supernatural agents have genuine explanatory roles. Abstract discussions about a god of the philosophers have still depended on background stories and intuitive notions of time and causality to anchor the metaphysical intuitions in play.

Historically, critical responses to creation claims have preserved everyday intuitions while attempting to deny divinity any explanatory role. With the doctrine of creation from nothing becoming dominant in established theologies, critics have often defended an infinitely old universe, denying that there was a creation event. Ideas of an always existing universe have typically been associated with pagan philosophy, heterodoxy, and doubt.

Skeptics have also had to respond to the suggestion that cosmic order was due to intelligent design. They have typically intensified the perception of order to an extent where the flexibility implied in personal causation became implausible. The laws of physics, in such a view, are where natural explanations come to an end, while divine agency could be manifest in miraculous violations of an otherwise rigidly impersonal order of nature.

Modern Views. Today's skepticism about theistic cosmology has been shaped by the way modern physics has undermined intuitive views of time and causality and the collapse in plausibility of the traditional stories that provided a context for divine agency. Cosmology has become a subfield of physics devoted to impersonal forms of explanation, so that supernatural agency has no productive role in advancing cosmological understanding.

Therefore, in an inversion of the historical pattern, in today's cosmology, supernatural creation and design have become marginalized claims. Conservative religious thinkers loyal to the traditional stories assert failures or limitations in physical cosmology to be remedied by divine agency. The big bang might be best understood as a creation event. Possible fine-tuning of physical constants or the low entropy of the early universe might indicate a universe intelligently designed to favor the presence of life and mind. Liberal theologians tend not to seek such direct employment for their gods; they more often point out that cosmology cannot decisively rule out personal supernatural powers. If there are reasons to think gods exist, these reasons may be found outside cosmology.

In this environment, atheists often point out either that physical cosmology has good candidates for solutions to the problems theistic apologists bring up or that the prospects for physics to

make progress are good. If the gods are unemployed in as important an area as making the universe, this casts doubt on their existence (Carroll 2005). Occasionally, a more ambitious atheist may argue that physical cosmology can more rigorously formulate concepts such as “nothing” and supplant traditionally metaphysical debates about how anything happens to exist (Krauss 2013).

Beginnings. The modern theoretical context for doing cosmology begins with general relativity. Time is mixed with space when changing reference frames; no such thing as a “now” is common to all observers, and physicists are compelled to think of space-time as a single geometric object, past and future included. Relativity and astronomy also indicate that time can be extended backward only until a point where all space-time and all matter and energy collapse into a singularity. For physicists, this suggests a breakdown in the applicability of general relativity; for some religious thinkers, it indicates a creation event.

It is, however, misleading to think of the big bang as a beginning or as an explosion into a pre-existing empty space. Space and time cannot be extended earlier from the big bang in much the way that it makes no sense to speak of a point north of the North Pole. Attaching a divine cause to the big bang is motivated by metaphysical intuitions, not physics. Moreover, general relativity is a classical theory. It cannot be applied in circumstances close to the big bang, where quantum gravitational effects dominate.

No adequate theory of quantum gravity is yet available. Nevertheless, cosmologists have approximate models that, while speculative, promise better understanding of the early universe. With only weak theoretical and experimental constraints on such models, however, there are a wide variety of scenarios. Some models take quantum uncertainties to smear out the big bang, retaining a space-time that cannot be extended infinitely backward while discarding the big bang as a unique infinite-density point in space-time. Some models rely on inflationary cosmology to generate many, perhaps an infinity of universes. Models that depend on string theory also can extend time back infinitely, because the string-length scale provides a limit beyond which the universe cannot become smaller.

In any case, quantum cosmology inherits the randomness in quantum mechanics. Macroscopic causality emerges from a quantum substrate where uncaused microscopic events are the rule. Therefore physical cosmology does not support traditional ideas either of creation or of an infinitely old universe with time understood in everyday terms (Edis 2002; Halper and Nayeri 2016). Some theologians advocate atemporal gods, avoiding some of the difficulties with the concept of a creation in time, but such views are also detached from physics and irrelevant to cosmology.

Fine-Tuning. Theists sometimes claim that physical constants have been fine-tuned for a universe that allows the development of complex structures, which is best explained as a divine design. In some circumstances, the fine-tuning appears exaggerated; regardless of the details, a theoretical context that would allow us to reliably assign probabilities to fundamental constants does not yet exist. Fine-tuning is highly model-dependent, and cosmological models are not always well constrained. Indeed, fine-tuning problems are known from many areas of physics and often indicate a need for novel physical approaches. Even within cosmology, solving fine-tuning problems has partially motivated important developments such as inflationary cosmology. From a physical point of view, therefore, fine-tuning appears as one of the many puzzles to be expected in a cutting-edge, highly unsettled area of physics (Stenger 2011).

The low entropy of the early universe may also suggest design, but again this is a physics problem on which science can claim progress—for example, noting that an expanding universe is driven away from equilibrium as the maximum possible entropy grows faster than the actual entropy. The arrow of time is not a completely solved puzzle, but it does not call for supernatural intervention (Carroll 2010).

Design as an explanation for fine-tuning or low-entropy states has its own weaknesses. A highly abstract god of the philosophers implies almost nothing about what sort of universe such a god might design. A more traditional divinity dressed up in stories does not help either, because the traditional stories are radically misinformed about the sort of universe human beings inhabit. A claim

of supernatural design responds to a puzzle with “God did it,” without engaging in the explanatory work relevant to a physical puzzle.

Cosmology as Physics. The present state of cosmology supports nontheistic views but only weakly and mainly through cosmology becoming a specialization within physics, where supernatural claims are not useful. If it is not part of a broader evidence-based argument against supernatural agency, cosmology has little significance on its own. Therefore, emphasis on physical cosmology tends to accompany more broadly naturalist and physicalist views. While such views are often associated with atheism, they are not strictly necessary for doubting the gods.

QUANTUM MECHANICS

Quantum mechanics appears in debates about religion because some believe that quantum physics supports the possibility of supernatural action or that it shows that consciousness is not reducible to mindless processes. In the nineteenth century, many thought that classical physics depicted a causally closed universe. Theists could therefore look for signs of the supernatural in exceptions to this closure. If miracles that violated the laws of physics took place, this indicated a power beyond the natural order. Free will meant that human beings are not determined by prior physical conditions, which shows that consciousness is not bound by the laws of physics. Skeptics, however, have usually thought that the case for miracles is weak. Determinism is not a comfortable position, but the rigidly impersonal order glimpsed in fundamental physics strongly contrasts with ideas of a universe subject to the whims of capricious gods.

Quantum Loopholes. The advent of quantum mechanics challenged the hyperrationalistic picture of rigid natural order. After all, the results of quantum measurements were random, and the equations of classical physics now referred to expectation values rather than completely determined outcomes. Moreover, quantum measurements were defined by a classical, macroscopic limit, where a superposition state randomly “collapsed” onto one of many possible outcomes. To some of the physicists working to formulate the early versions of quantum theory, state collapse in measurement suggested a fundamental role for consciousness in physics, because definite results were associated with the presence of an observer.

Quantum mechanics, therefore, changed the debate about supernatural intervention. In classical physics, an interaction between the universe and an outside agent would violate fundamental laws such as the conservation of energy and momentum. Quantum randomness, however, means that conservation laws apply not to the result of any single measurement but to the expectation values that are approached over a long run of identical measurements. A god could, for example, intervene in any particular event or in any small set of events. As long as the magnitude of the intervention is small enough to be lost in the statistical noise, no violation of conservation laws could be measured. If a god wanted to create humans by way of evolution, that god could make sure just the right mutations took place over a long timescale, and this intervention would be undetectable by physical means.

New Age Magic. In popular culture, *quantum* means “magic.” The supernaturalism that claims support from quantum mechanics is closer to that of Hindu religions or the more occult or mystical variants of the Middle Eastern religious traditions; its allegedly scientific basis is parapsychology rather than physics.

Neither New Age religious movements nor the more intellectual varieties of quantum mysticism currently enjoy mainstream scientific support (Stenger 1995). Parapsychology has not produced reliable experimental evidence for psychic phenomena and has not established robust theoretical links with the sciences—particularly not with quantum mechanics. Cognitive neuroscience makes progress in understanding minds without taking seriously speculations about quantum consciousness.

The measurement problem in quantum mechanics is genuinely interesting, because state collapse is not invertible, whereas all time evolution in quantum mechanics is invertible. This is not

a question unique to quantum mechanics, however; it is very closely related to the problem in statistical mechanics of macroscopic irreversibility deriving from microscopically reversible dynamics. While questions remain outstanding, this is at least a partially solved problem. Quantum measurements involve interactions with extremely complex, noisy environments, which lead to noninvertible macroscopic approximate descriptions or a time evolution toward states with classical properties. Schrödinger's cat will be either dead or alive long before any observer investigates. Conscious observers are not special to the measurement process—they are just another part of a messy environment (Edis 2002).

Miracles. The claim that quantum randomness covers up supernatural intervention without violating conservation laws is associated with more conventional forms of theism. It is also scientifically sterile (Sansbury 2007).

If any set of quantum measurements is to be claimed as evidence for intervention, it would mean that the results of the measurements were not random—that there was discernible structure in the data and that therefore quantum mechanics was violated. Currently there is not even the smallest experimental hint of violations of quantum mechanics. If, on the other hand, the interventions claimed are very few and lost in the statistical noise, they would not produce a discernible pattern, and therefore the data alone could not support supernatural intervention as an explanation. There could still be reasons to believe in intelligent design, but these reasons would have to come entirely from outside the data and theories of physics. With undetectable interventions following a purpose revealed only to those privy to special knowledge, we end up with a cosmic conspiracy theory (Edis 2018).

In other words, the current state of affairs is not very different from that with classical physics. Quantum randomness means humans live in a universe of uncaused events, which undermines older notions of causal closure. Randomness, however, does not open up the universe to alleged nonphysical interventions. Physical evidence for supernatural agency still requires robust signals combined with a successful theory of intelligent design.

Chance-and-Necessity Physicalism. The fundamental randomness manifested in quantum mechanics also affects how we conceive of physical explanations. In current physics, even the low-temperature laws of physics are often seen as an outcome of a cascade of spontaneous symmetry-breaking events, with random results. The most fundamental laws of physics, as in the standard model of particle physics, are statements about highly symmetric conditions with very low information content, while the complexities of our universe arise from symmetry breaking. Highly symmetric fundamental laws, in other words, describe the dice that were rolled to generate our universe (Edis 2002).

Acknowledging the centrality of randomness in modern physics can lead to arguments that cast doubt on all supernatural and theistic claims. Physical explanations combine rules and randomness, both of which are mindless. Therefore, as some intelligent design proponents also recognize, the signature of an agent not reducible to physical processes would be data that could not be produced by any combination of rules and randomness. In fact, possible functions exist that require infinite computational resources, which would be available to gods with traditional omni-attributes. Data that fit such functions might best be explained by an agent that is not limited by rules and randomness and therefore is beyond fundamentally mindless physical processes. Such data would not just violate quantum mechanics but also defeat any physical theory. However, none of the data available to science even remotely suggests such a possibility.

Hence quantum mechanics has an important role in formulating chance-and-necessity physicalism, according to which everything is physical, a combination of rule-bound and random processes, regardless of whether the most fundamental physical theory has yet been formulated (Edis and Boudry 2014). Religions usually take a top-down view, starting with an irreducible mind to shape the material world from above. Physicalism, whatever form it takes, supports a bottom-up understanding of the world, where life and mind are the results of complex interactions of fundamentally

mindless components. The current state of science, including quantum mechanics, supports chance-and-necessity physicalism.

If physicalism appears plausible, this does not imply certainty that there are no gods. Future data may come to support nonphysical agents. Arguments that make no reference to publicly available information may yet seem compelling. Today, however, humans live in an environment where the successful sciences have no use for the supernatural. This state of affairs puts claims for divine agency on the defensive, and it means that the burden of proof for such claims is very high.

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