Can a Scientist Believe in Miracles?

An MIT professor answers questions on God and Science

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Chapter 9

Do miracles happen?

9.1 What are miracles?

> *"There are two ways to live your life: as if nothing is a miracle or as if everything is a miracle."*

It has become common practice to attribute this quotation to Albert Einstein, although he almost certainly never said it[1]. Einstein did, however, often use religious phrases to convey his ideas — both his scientific ideas, "God doesn't play at dice"[2], and his philosophical ideas, "science without religion is lame, religion without science is blind"[3]. However, the live-your-life aphorism, despite its poetic resonance and acknowledgment of religious questions' importance, which Einstein would have appreciated, is more confusing than enlightening. The aphorism works by switching between two meanings of the word miracle. The first is approximately 'a violation of the laws of nature', the second is 'a cause of awe and wonder'. Einstein believed nothing is a miracle in the sense of violation of the laws of nature, but frequently referred in religious terms to ideas like "the grandeur of reason incarnate in existence"[4]. So maybe he lived his life simultaneously in both of the two ways.

It will help clarify our considerations if we put aside the meaning associated with living as if everything is a miracle. The wonder of the world and of life is certainly something to marvel at and, theists would say, be thankful for. But that's not what most people mean when they talk about miracles. They are not talking about the aspects of existence that, however wonderful, are the ordinary or the "everything"; instead they are talking about out-of-the-ordinary happenings, associated with the actions of God.

> *Could you define what a miracle is. How can you tell if one happens?*
> *Can you give us a scientific interpretation of miracles?*

Many people today think of a miracle as a 'violation of the laws of nature'. But since Bible miracles are the ones that matter most to the relationship between science and Christianity we should ask what the Bible meaning is. Obviously the English word miracle doesn't occur in the original Greek of

the New Testament. Instead there are three Greek words that on different occasions express the events we commonly call miraculous. One is 'sign' (Greek: semeion) a second is 'wonder' (or 'marvel') (Greek: teras), and the third is 'mighty work' or 'work of power' (just power in Greek: dynamis)[5]. The Bible, therefore, does *not* define a miracle as a violation of the laws of nature. The idea of laws of nature got started in the scientific revolution and became a commonplace only in the 19th century. So it is actually a strange anachronism to regard biblical miracles as violations of the laws of nature. In the New Testament, a miracle was a sign, that pointed to something or someone more significant than itself, or a wonder, that produces amazement in those who witness it, causing them to marvel, or a mighty work that evidences the presence of extraordinary power, or some combination of the three.

A significant fraction of New Testament miracles require no violation of the (modern) laws of nature. They might easily be a confluence of circumstances, or coincidence. To illustrate what I mean, one might consider as an example of a law-violation, instantly turning water into wine. An event like that appears to have no explanation that is consistent with the laws of nature as we know them. In contrast, an example of a confluence of circumstances might be Jesus' prediction that the night before the crucifixion Peter would deny him three times. That might just have been a lucky guess. Such an event violates no law of nature, but it does cause those who witness it to wonder, and it serves for them as a sign pointing to Jesus. Other events such as some healings and nature miracles are ambiguous. Consider Jesus' stilling of the storm. Was this a law-violation? Perhaps so, but perhaps it was just that the storm was about to stop and circumstances came together in just such a way as to evidence his power. Either way, it certainly served as a sign and a wonder leading the disciples to ask "Who, then, is this, that even the wind and the sea obey Him?" (Mark 4:41, RSV). Even though they may function as extremely powerful signs, obviously confluence-of-circumstances type of miracles are not something that can be thought inherently impossible because of being contrary to the 'laws of nature'. There is no way science can rule them out. Don't misunderstand me. I'm not arguing that there are no law-violations in the Bible or in the world. There are plenty of New Testament miracles that so far as I can see have no explanation consistent with the normal workings of nature as we now know it. Nor am I trying to belittle the occasions that don't violate the laws of nature, as if they were somehow second-class miracles. I am simply pointing out that the Bible does not draw distinctions between law-violation and confluence-of-circumstances. Both can be signs, or wonders, or mighty-works, or all three. Practically the only biblical requirements are that a miracle be *extraordinary* and that it be an *act of God*. So that's my working definition: *a miracle is an extraordinary act of God*.[6]

How do you tell if a miracle happens? It's not entirely obvious. A bit over 30 years ago, my daughter Anna had a playmate who belonged to a Christian family in our street in England. Her playmate contracted meningitis. The girl fell into a coma, and in hospital the doctors gave a very bad prognosis. Even if she did recover consciousness she would have brain damage and be handicapped perhaps quite seriously. The elders of their church (following the pattern of the New Testament Letter of James 5:14) came to the bedside and prayed in faith for her healing. Within days, the girl was awake with apparently no ill effects, and within weeks was back at play with my daughter. What should we say? Was this or was it not a miracle? It was extraordinary. Was it an act of God?

Can science tell us? The trouble is that the methods of science demand reproducibility. But how do you apply this characteristic of science's methods to a miracle? A miracle is, by definition, extraordinary, something unique, never to be reproduced. It is intrinsic to the whole idea of miracle that it is unreproducible. Consequently natural science generally can't prove that an event is a miracle, because it can't do repeatable experiments or observations on it. That explains why the world is not full of scientifically demonstrated miracles: because science is inherently incompetent to demonstrate a miracle. Science *can* investigate miraculous claims. It may be able to reveal deception, trickery, or misperception. If someone has been seen levitating on a flying carpet, then the discovery of powerful electromagnets in their basement might render implausible claims of the miraculous. But if science fails to find defeating evidence, it is unable to say one way or the other whether some reported event is a miracle.

That is true of the personal story of my daughter's playmate. The girl's parents consider the experience as a miraculous healing, as a proof and confirmation of God's love and care towards them and of the reality and relevance of their faith in Christ. But what would the consulting physician say was the scientific nature of the event? Well, he might say that there was no scientific explanation but that there are many things about medicine we don't understand. He might say that he had, or had not, ever seen a case like this. If his own religious viewpoint included the possibility of God's action in the world, he might even agree with the parents' interpretation, and give thanks to God. What I suggest he could not, or at least should not, say is that the lack of explanation proves scientifically that a miracle occurred.

Deciding whether an event is an extraordinary act of God generally requires interpretation. The girl's parents very naturally place a positive interpretation on her recovery in response to prayer. For them it is a sign and a wonder. And for others like me, it is also a sign and a wonder. For those who don't share our convictions, I am quite sure, it is a coincidence, or a 'spontaneous recovery'[7]. But all of these descriptions are interpreta-

tions, and there is no scientific way to decide whether the event is an act of God. All science can do is to say statistically how normal or abnormal events of the generic type are.

9.2 Can a scientist believe in miracles?

Can a scientist believe in miracles?
Can a physicist really be open to the laws of physics being broken?
To what degree has God involved himself in nature and in history?
What do we say about New Testament miracles?

My MIT colleague Alan Lightman, who is a novelist but also trained as a physicist, wrote an article about science and faith that appeared a few years ago in the online magazine *Salon.* In it he calls "the Central Doctrine of science" the view that the laws of nature are inviolable; "science and God are compatible as long as the latter [God] is content to stand on the sidelines once the universe has begun." In other words, he thinks it is a requirement for science that the laws of the universe be complete, closed, and impervious to any outside action. On this view, science's "Central Doctrine", immediately rules out God acting in the world. The only form of creator that could survive such a restriction is one that simply happened to have set the universe going but is thereafter pretty much irrelevant to anything going on in it.

What ever such a Deistic, non-interventionist first cause, might possibly be, he or it would not be the God of the Bible, of Judaism or of Christianity. Christians like me believe that Jesus the Son of God died on the cross for our sins and rose again miraculously on the third day. Every Christian worthy of the name believes in at least that miracle. The God I believe in is active in history, and in the world today. So how do I answer Alan Lightman?

Straightforward. The presumption that the laws of nature are inviolable is just *not* a Doctrine of Science. Science's *method*, and *program*, is to describe the universe insofar as it is reproducible and follows universal laws. But science has not the slightest need to extrapolate that method and program into a presumption that everything that happens must be so describable. Science sets out to explain nature naturally. It need not insist there are no other true explanations. Alan's view is 'practical naturalism', meaning that whether or not there is a God, he can have no direct observable effect upon the world.

That was also Einstein's viewpoint. Like the rationalist pantheist philosopher Spinoza (1632-1677), whom he greatly admired, Einstein rejected the idea of a personal God. He said "I cannot prove to you that

there is no personal God, but if I were to speak of him, I would be a liar. I do not believe in the God of theology who rewards good and punishes evil. My God created laws that take care of that. His universe is not ruled by wishful thinking, but by immutable laws."[8]. Einstein's was an impersonal cosmic religion, seeing "in the laws of the Universe a spirit vastly superior to that of man, and one in the face of which we with our modest powers must feel humble."[9] Clearly, an impersonal God does not act in the world. He (it) is incompatible with Christianity and most other theisms.

But practical naturalism like this was not the viewpoint of the majority of the great scientists of history. Many of the greatest scientists: like Newton, Boyle, Dalton, Faraday, Maxwell, and many others were Christian believers who saw their science as consistent with a God who is active in the world, and on occasion performs miracles beyond the scientific laws they discovered. So the notion that for science to function, or to be a successful scientist, it is necessary to believe in inviolable universal laws is indisputably disproved by history. It is simply not true.

Based upon the evidence of history, and in contradiction of the common assertion of secularists, belief in a God who acts is not a "science stopper" — something that prevents or discourages science. There is much circumstantial evidence to indicate the opposite, that the theology of the Bible in fact provided a hospitable intellectual and philosophical climate which encouraged the initial development of modern science[10]. And it is indisputable that until the mid 19th century, priests, ministers, and monks, actually carried out a substantial fraction of the scientific research. So, yes, judging by history and the testimony of many scientists today, a physicist can be open to the laws of physics being 'broken'. If so, then New Testament miracles are not intrinsically a problem.

> *Extraordinary claims require extraordinary evidence.*
> *The problem with Christian claims is that they couldn't happen according to the rules of science. Is not this then a question of science?*

No, the reasons for adopting practical naturalism are very far from being purely scientific. The philosopher David Hume (1711 -1776) is famous for having offered the most influential arguments against miracles. Section XX of his book *An enquiry concerning human understanding* (1748) is entitled *Of Miracles.* In it he gives a series of philosophical arguments why miracles should not be believed. The primary argument is this. "A miracle is a violation of the laws of nature; and as a firm and unalterable experience has established these laws, the proof against a miracle, from the very nature of the fact, is as entire as any argument from experience can possibly be imagined." And Hume expands it as follows, "Nothing is esteemed a miracle if it ever happened in the common course of nature. ...

There must, therefore, be a uniform experience against every miraculous event, otherwise the event would not merit that appellation. And as a uniform experience amounts to a proof, there is here a direct and full *proof*, from the nature of the fact, against the existence of any miracle;" This 'proof' has been extensively criticized by philosophers ever since, for the simple reason that it is a circular argument. In effect, Hume defines a miracle as something that can't happen, and then says that's a proof that it doesn't happen[11]. The fallacy in this argument is called 'begging the question', which means embedding the proposition to be proved in the presuppositions.

Those philosophers who nevertheless endorse Hume's argument, generally lay emphasis upon it being a practical argument about probability, rather than an argument on principle. Hume clearly had pragmatic considerations of probability in mind when he said "A wise man, therefore, proportions his belief to the evidence." In a softer, probabilistic, pragmatic form, the argument is something like this: A miracle is by definition a rare violation of the natural laws that govern the normal regular course of events. The evidence for the rare is always less than for the regularity. A wise man apportions his belief to the evidence. Therefore a wise man should never believe a miracle.

This softer version cannot quite so immediately be dismissed[12]. Let us suppose that the normally regular behavior of nature allows us to assign a small *a priori* probability p_m that in some event nature is non-uniform, in other words that it is a miracle. Hume's argument is (interpreted charitably) that if the miracle is attested to by a witness, then in assessing the truth of the situation we must compare this probability p_m with the probability that the witness is lying or in error p_e. If the witness is a highly trustworthy and reliable observer, p_e is small. But Hume wants to say that it will always be the case that $p_e > p_m$, that the probability of the witness being in error is greater than the probability that a miracle could occur, and so we ought pragmatically always to suppose the witness to be in error. He phrases it as a general maxim "That no testimony is sufficient to establish a miracle unless the testimony be of such a kind, that its falsehood would be more miraculous, than the fact, which it endeavors to establish;" An equivalent maxim that you may have heard before is to say concerning miracles that "extraordinary claims require extraordinary evidence". Although Hume misleadingly uses the word miraculous to mean unlikely, there is common sense in both these maxims.

We have plenty of practice evaluating the likelihood of error in witness testimony, p_e. The heart of the problem is how to estimate the probability of a miracle, p_m. Hume, being a good empiricist, says it must be done on the basis of past experience. But he hedges his bets by claiming that both by definition (nothing is esteemed a miracle if it ever happened) and in practice (uniform experience) one can conclude that p_m is essentially

zero. That is where his pragmatic argument still amounts to begging the question. There simply is no uniform human experience against miracles.

All agree that miracles are unusual, extraordinary. But to justify assigning an infinitesimal arithmetic probability requires that they should *never* have happened. Healings, feeding crowds in the wilderness, walking on water, even rising from the dead, are not so unprecedented (as claims), to allow one *on the basis of human experience* to know they never happened. For example, healing has a whole spectrum of rarity, all the way from frequent to never. So, most miracles are *not* comprehensively unprecedented. Only by a spurious definition of a miracle as something that never happened before could one justify by experience assigning it an infinitesimal probability. And even that needs to be tentative because sometimes things happen that never happened before. On early July 20th, 1969 the probability of a human setting foot on the moon was high even though it had never happened before. Neil Armstrong was no miracle worker, and Apollo 11 was not a miracle.

In practice, estimates of p_m, the *a priori* probability of a miracle, depend too much on prior metaphysical commitments to be done on the basis of human experience. In that sense, philosophy is the foundation of one's evaluation of the evidence, rather than evidence being the foundation of one's philosophy. I conclude that the philosophical arguments — even probabilistic arguments — for the inviolability of the laws of nature are unpersuasive. Anyone who claims to have an empirical outlook ought to be open to the evidence concerning God's action in the world, and not rule it out on principle, or by supposing miracles to be overwhelmingly improbable.

Perhaps sensing that his proof is highly debatable, Hume adds a second part to his essay. In it he gives four more subsidiary arguments against miracles, the first of which is (1) that there never was a miracle attested to by "a sufficient number of men, of such unquestioned good sense, education, and learning, as to secure us against all delusion ...". A moment's thought persuades us that Hume is acknowledging (in order to deny their credibility, good sense, education, and learning) lots of people who claim to have witnessed miracles. Well, if people claim miracles, as they still do[13], then it is untrue to assert that unalterable experience, or uniform experience, is against every miraculous event. In other words, Hume is contradicting his own earlier affirmations. Of course no one has access to all of uniform experience, so his earlier premise is unjustified. The other three subsidiary arguments I'll comment on elsewhere; they are (2) There is a psychological predisposition to believe in wonderful events. (3) Miracles "abound among ignorant and barbarous nations". (4) All religions have their miracles, so the opposing claims cancel out.

If when modern science offers an explanation you accept it,

does that extend to all claims. Will you always accept physics over Christianity? What about miracles?

Skeptics sometimes say that in olden times people did not understand the workings of the natural world and so everything seemed miraculous to them, whereas now we understand so much more, we are better informed, so we can't believe in miracles. This may sound like a reason to disbelieve miracles, based in science; but it isn't. To begin with, the way it is expressed is actually untrue to history and to logic. Of course people in New Testament times knew far less science than scientists know today, but that doesn't mean they knew nothing about the normal course of events. They knew perfectly well in the first century that people blind from birth don't, when they are adults, regain their sight, or that water doesn't turn instantly into wine, or that crucified people don't rise from the dead. The events functioned logically for the people of the first century as signs of God's power, as miracles, *only because* they knew them to be humanly impossible. So the influence of modern science on the plausibility of miracles is not that science shows marvels to be contrary to the ordinary course of events. It has always been understood that miracles are extraordinary.

The truth has much more to do with overall expectations. Science has provided us with a far deeper understanding of how natural events work. Science has discovered the causes of disease, how plants grow, the way that atmospheric pressure governs the wind and rain, and how the cycle of the seasons is governed by planetary dynamics. These sorts of topics were once shrouded in mystery. They were things which were of life-or-death importance, in primitive agricultural societies, but seemingly beyond human knowledge or power. Those are the characteristics of problems that engender superstition. We are much less superstitious than earlier ages concerning disease, biology, weather, and the seasons, because we know there are natural explanations of them, because we have technologies to help either control or accommodate them, and because most people on a day to day basis are far less involved with them. Indeed, our expectations in the developed world are that we ought not to have to worry about these things at all. These attitudes are symptoms of what is often called 'secularization'. There is a sense in which science underwrites a kind of 'disenchantment', a dispelling of mystery and wonder, and its replacement with technology. Yet the process of secularization that has been happening in western culture during the past two centuries has far more complex causes and content than implied by attributing it to the development of science[14].

Undoubtedly superstitions abounded in history. Perhaps we are less superstitious today, although I'm not even sure about that, once you consider the superstitions of sports fans, the remarkable influence of world-wide-web urban legends and fake news, or the widespread preoccupation

with horoscopes, and vitamin supplements[15]. Superstition is generally not so much about acts of God as it is to do with control of the uncontrollable. In that sense it is aimed at a kind of occult science or technology. There's good reason for the historic relationship between alchemy and chemistry. They were once part of the same enterprise, a primitive science. C.S. Lewis puts the point cogently and colorfully like this "The progress of science has in just this way (and greatly to our benefit) made all sorts of things incredible which our ancestors believed; man-eating ants and gryphons in Scythia, men with one single gigantic foot, magnetic islands that draw all ships towards them, mermaids, and fire-breathing dragons. But those things were never put forward as supernatural interruptions of the course of nature. They were put forward as items within her ordinary course — in fact as 'science.' Later and better science has therefore rightly removed them. Miracles are in a wholly different position."[16]Superstitions and magic are forms of primitive *techn*ology more than *the*ology.

I'm just as sceptical as the next person about the proliferation of popular myths about figures of history — or of today. I certainly don't think that all miracle stories are true. However, some or even most miracle stories being implausible superstitions doesn't disprove all miracles. Miracle stories are not all equal. The evidence for or against their credibility has to be weighed. It is illogical to rule miracles out simply because they are miraculous unless you already know there's no such thing as a miracle. Science does not provide you with that knowledge.

There are, and have been for centuries, conflicting opinions among equally accomplished scientists about whether or not the laws of physics are inviolable. So, if you adopt the firm opinion that miracles just never happen, you are doing so as a matter not of physics, but of metaphysics. It might justifiably be said, you are adopting an article of faith.

9.3 How could miracles possibly work?

Einstein said God does not play dice. Do you agree?
Isn't Determinism a reason to lean to scientism or naturalism?

In the latter half of the nineteenth century, classical physics reached the pinnacle of its achievements. Maxwell's equations had unified electricity, magnetism and light; and the laws of physics were increasingly appearing to be complete and closed. Even biology appeared to be amenable to description in natural scientific terms, through Darwin's mechanism of natural selection, and the emerging discipline of biochemistry. Increasingly to many, it seemed as if the whole of the universe obeyed deterministic classical equations that meant, if one knew the initial conditions then one could solve the equations of motion and the future was totally determined.

A belief in this deterministic philosophy was one of the most important factors cited by those who rejected Christianity during the Victorian age.

Around the turn of the 20th century, however, the inability of classical physics to cope with the physics of radiation and the atom led to the realization that light is not just waves, its behavior has particle features, and that the newly discovered electron is not just a particle, its behavior has wave features. In the second half of the 20th century, stimulated in part by modern computing's ability to solve non-linear equations numerically, the field of Chaos Theory, emerged. It has provided new and fundamental insights into the behavior of non-linear and turbulent systems such as the weather. It means (to give a poetic rather than an experimentally demonstrated example) that the flap of a butterfly's wings can trigger a hurricane on the other side of the world. We know now that the solutions of even the equations of classical 19th century physics are sometimes undeterminable because of sensitivity to initial conditions. Today's physics effectively undermines determinism.

Quantum physics, emerging as a consistent mathematical theory in 1925, shows there are fundamental aspects of the universe that deterministic laws do not and cannot completely describe. For example, the timing of the radioactive decay of a particular nucleus cannot be predicted within an uncertainty of approximately its half-life. And this uncertainty is intrinsic. It is not that we simply don't know the conditions well enough; it is that the conditions are in principle unknowable. As far as current physics can tell, there is no way, and never will be, to predict measurement outcomes with complete precision at the scale of the atom. And since we can if we wish quite easily arrange that a single radioactive decay will trigger a switch that causes some macroscopic event (Schrödinger used the example of the death of a cat), that means absolute determinism does not apply even at the everyday scale where classical physics is an excellent approximation.

We may summarize the situation thus: science has labored mightily for hundreds of years to understand the world using deterministic natural laws, only to find that the universe *resists* complete description in these terms[17]. This came as an enormous shock to physicists in the 1920s, and it still does to physics students today as they grapple with the counter-intuitive descriptions of quantum reality. Einstein himself, genius though he was, could not reconcile himself to the idea that some things are intrinsically uncertain, that "God plays dice". But today the question is regarded as effectively settled: God does[18]. It might have seemed a good argument in the nineteenth century to say that science had shown the universe to be governed by inviolable physical laws, so how could there possibly be such a thing as a miracle. Today, that argument is naive and untrue even to our scientific understanding. Nature is far more mysterious than the Victorians thought.

So it is true that the scientists of history did not know what we know today. But actually what we know of physics today has if anything undermined the skeptical determinist position. The argument that the universe is a closed system of scientific laws seems substantially less plausible scientifically today than it did then. And, in particular, God's action in the world cannot justifiably be ruled out by an appeal to determinism.

> *Are you curious to know how miracles work? What would you have seen if you had a video camera at a microscopic level?*

How do miracles work? I don't know. And it would be unreasonable to demand a *scientific* explanation of every miracle. Many of the biblical miracles are given no explanation in respect of physical mechanisms; but some of them *are* explained, and I find that significant. It tells me that, according to the Bible, an event can be agreed upon as an extraordinary act of God even if it has a natural explanation. The best example I know to illustrate this contention is the biblical description of the founding event of the Hebrew faith, namely the exodus. Of all the miracles that surround the Israelites' escape from slavery: the snakes, the frogs, the flies, the river turned to blood, and so on, the crowning event, which the Jewish people remember to this day, and Christians celebrate symbolically in baptism, was the actual escape, the crossing of the Red Sea. In Cecil B. de Mille's last and most famous movie, *The Ten Commandments*, the dramatic climax scene of the escape from Egypt has Charleton Heston (Moses) parting the Red Sea, and a cast of thousands (the Israelites) crossing between upright walls of water. If you'd had a video camera at the historic event, the result would not have looked like what came out of Paramount Pictures. The graphical impact of the film's special effects, which won the 1957 Oscar, tends to make us forget that the original account says that there was a perfectly 'natural' explanation of what happened: "Then Moses stretched out his hand over the sea; and the Lord drove the sea back by a strong east wind all night, and made the sea dry land, and the waters were divided." (Exodus 14:21). The fact that there was a natural, in a crude sense a scientific, explanation of the event to which the passage refers — the persistent east wind — does not prevent the Bible from seeing God at work in an extraordinary way. In other words, different levels of explanation are regarded as equally valid. A scientific explanation does not rule out God's action.

> *If God doesn't exist in the same way as atoms and galaxies, through what mechanism could God interact with this realm? How can something immaterial, or supernatural, interact with the natural world governed by cause and effect?*

I think one factor that contributes to puzzlement about *how* God might work miracles is a remnant of unacknowledged naturalism. Language

about God *intervening* in nature contributes to this confusion. Even if we grant the possibility of a God beyond or outside nature, we are unable to shake off the sense that nature is complete in itself. So we tend to view God as mostly hands-off, 'standing on the sidelines', letting nature look after itself, but then on rare occasions 'reaching in' to tweak things by the odd miracle here and there. But that is not the view presented by Christian theology. Hebrews 1:3 says that God the Son "upholds the universe by his word of power". The picture we are presented with is not that God set the world going like a clock, and left it to its own workings. It is rather that he continuously holds the universe in the palm of his hand, that it exists because of his continuous creative power and will: if he were to stop exerting that upholding power, stop paying attention to every part of the universe, it would instantly cease to exist. In other words, for a Christian, the primary principle of reality is the personal character and will of God, not the impersonal laws of nature. Christian theology regards the laws of nature, which describe the normal course of events, as the normal way that God upholds and orders the universe. Every single thing that happens is dependent upon God's upholding power. But God is not arbitrary; he has principles. And the laws of nature are the principles he applies to ensure a universe in which his creatures, including the sentient ones like humans, can live within a coherent environment that supports what he intends for them. A miracle, an *extraordinary* act of God, is an event in which, for some other over-riding principle of his character and will, God upholds a part of the universe in a manner different from the normal.

If this picture is anywhere close to correct, then we ought to take more seriously the original meaning of "law" in the phrase 'law of nature'. Law originally refers to the legislative decisions that dictate what ought to be the practice of society's citizens. In a democracy we entrust to elected representatives the task of deciding what the laws will be. In an absolute monarchy, the king is the sole law-giver. He has full discretion for his decisions; his word is law. A good king is still bound by law, but not through physical or military compulsion and enforcement. Instead, he is bound only by his word, his principles, his integrity, his justice. In an analogous way, God is true to his principles, and that is why the normal course of events (nature) is consistent and law-like. But the principles are not for God mechanical constraints, and they can be superseded when higher principles are at stake. We might consider somehow 'distasteful' the possibility that God is allowed actions that we might call violations of nature's laws. That's because we know only part of the picture: our world. We can imagine, though, that there might be higher purposes and principles, which on occasion lead God to act in the world differently. And if so, then our distaste is little more than a understandable personal preference for the normal, the known and the predictable.

We already know that immaterial things such as thoughts, truth, or

justice interact with the world. How they do so might be puzzling, but I see no additional difficulty with an immaterial God interacting with it.

> *Are miracles widespread enough as to cause a problem with science retrodicting the past?*

I take this question to be about whether miracles disrupt the sequence of events so much as to undermine deductions based upon scientific knowledge. Obviously no, otherwise science wouldn't work. But the follow up, probably more in the questioner's mind, is: why not?

Retrodiction means making statements about the past based upon inference or deduction. It is most often used in science to refer to prediction (deducing a future state from a current state) carried out when the result is already known. Logically there is little difference between prediction and retrodiction; but obtaining novel results that were not expected when the theory predicted them, is generally considered more dramatic evidence of the theory's truth, because the theory could not have been chosen with the already known experimental results in mind. Gravitational waves were predicted almost one hundred years ago; it is a dramatic confirmation of the theory of General Relativity that they have just been detected on Earth for the first time by the LIGO experiment.

If outcomes that break the laws of nature were very frequent they would interfere with prediction (including retrodiction) because at any moment a break might happen and give rise to a different result. We cannot, however, deduce that miracles *never* happen, unless it were somehow known that a single miracle would cause the breakdown of the entire predictive structure of nature. To illustrate this point, think about the mirror surface of a pool. When undisturbed it provides us with an almost perfect reflected image of whatever is beyond it. This image is analogous to science's predictive power via the laws of nature. Now suppose we allow the pool to be disturbed and ripples propagate on its surface. The image is to some extent distorted. The predictive power is degraded. A disturbance consisting of a single finger dipped briefly into the pool might represent a rare miracle. Its effects spread out across the entire pool, but rapidly decrease in amplitude so that the momentary and localized disturbance does not produce a permanent or debilitating degradation of the image. That's the situation envisaged in the Christian idea of miracles. The laws of nature rapidly restore themselves, the ripples die out, and the world proceeds once again smoothly. It might conceivably have been the case that the laws of nature were more fragile or unstable. The mirror might instead have been made of glass that, when perturbed, shattered into a thousand pieces; or it might have been such that the smallest perturbation gives rise to endless waves that either grow in amplitude, or never settle back down, producing permanent turbulence that destroys

the pool's reflective images. Such imagined fragile laws of nature could never tolerate even a single miracle. If the laws of nature were like that, and still worked, we could perhaps deduce that miracles never happen. But there are strong reasons, based on what we know in natural science, to conclude that the laws of physics are not fragile and unstable. They are instead robust and self-healing. That's what is meant technically by saying the equations of physics are *stable*. Small perturbations damp away. There are lots of detailed questions physics can address about the stability of specific phenomena, but on the whole, and on the time scales we normally care about, it seems the universe is stable, and there's no reason to suppose the perturbation introduced by a single miracle would produce drastic effects that would disrupt the entire system described by science.

9.4 What about miracles in other religions?

> *How are you able to reject the miracle claims of another religion but still accept your own?*

In the matter of miracles of different religions, David Hume once again raised important challenges that our questioners bring up. The heart of his argument is "all the prodigies of different religions are to be regarded as contrary facts, and the evidences of these prodigies, whether weak or strong, as opposite to each other." Hume is pursuing a divide and conquer approach. He says that when considering a "miracle of Mahommet" we should treat the reporters of miracles in any other religion "as if they had mentioned that Mohammedan miracle, and had in express terms contradicted it, with the same certainty as they have for the miracle they relate." In other words, Hume wants us to do a kind of probability arithmetic by 'subtracting'[19] the evidence for every miracle in another religion from the evidence for every miracle in the religion under discussion (Islam in this example). It's not hard to see that this would put every miracle at an enormous disadvantage since its evidence is to be opposed by the evidence of every single miracle of every other religion. The argument is disingenuous and even Hume himself seems too embarrassed to press to its conclusion. Instead he falls back upon the "absolute impossibility or miraculous nature of the events".

It is nevertheless a cogent question: what about miracle claims of rival religions? Recall that the biggest difficulty with assessing the evidence for a miracle is to determine the prior probability of a miracle p_m. I'm not convinced that a Christian is obliged assume all other religions' miracle claims are false[20]. But let us for the sake of argument give Hume the benefit of the doubt and suppose a Christian is obliged to assume all miracles in other religions are false, and ask what effect miracle claims in other religions have on our estimate of p_m for Christian miracle claims?

To estimate the probability that a miracle claim is true (p_t say) one must put it equal to the true-fraction of all miracle claims. In other words, take the total number of *true* miracle claims and divide it by the total number of all miracle claims (both true and false). That is, after all, the way we define mathematical probability. On this basis, increasing the denominator of the fraction (the total number of miracle claims) without increasing the numerator (the total true miracles) decreases the probability p_t. So it appears that adding all the miracle claims of another religion (which are all by presumption false) to a database in which we collect all miracle claims, reduces the probability p_t that a Christian miracle claim is true.

In fact, however, the argument is mistaken. To use the value of p_t, if we could get it, we would then have to say about any miracle claim under examination, I'll put aside any additional facts about the event other than that it is a miracle claim. On the sole basis that the event is a miracle claim, the probability that it is a genuine miracle is p_t. The mistake is that we would have ignored all the other facts about the claim, such as that it was made by a known con-man, or a high-court judge. Those other facts would certainly dominate the statistics. To use the character information about who was making the claim, we would need instead to go back to our gigantic miracle-claim database and do a new query to find out what fraction of miracle claims by *con-men* are true (p_c) and what fraction of miracle claims by *judges* are true (p_j). Common sense tells us those two probabilities would be very different, and that both would be different from our first overall true-fraction p_t. Which of the three estimates would be best? In practice, if we had a judge as our claimant, we'd take p_j. The fact that con-men also claim miracles would be practically irrelevant to our estimate. And if we had a con-man claimant we'd take the probability to be p_c, and high-court judge claims would be irrelevant. The same applies to probability estimates where we take into account differences in religion. Whether or not Muslims, or Hindus, or Buddhists, etc. make miracle claims has no relevance to statistical estimates of the probability a Christian miracle claim is true. Other factors about the claim or the claimant, including, but not limited to, religious differences are almost certainly far more significant. Now, of course, no such gigantic database exists. Nor could it exist, since compiling it would require us to have an established technique for telling if miracle claims are true, the very problem we are trying to solve. So we aren't in a position to do these calculations. But the lesson remains that, of themselves, miracle claims by a second different class of people don't affect the statistical plausibility of claims of a first class, when the classes are distinct in the sense that class influences the probability.

Since many people might find this conclusion counter-intuitive, let me illustrate it by a parallel with a less weighty question: is an observed

black colored bird a raven? Though utterly inept at bird spotting, and knowing only that ravens are black, we want to know how probable it is that the black bird we see is a raven. Suppose we have a giant database of bird sightings, compiled by bird experts who are reliably able to identify ravens. We search all the sightings of black colored birds and find the fraction of them that are ravens. We take that fraction as the probability that our particular sighting of a black bird is of a raven. Fair enough. But now, if we try to do better by adding to the database-query all the white bird sightings, and we take, as the new probability of our bird being a raven, the fraction of the total of both white and black birds that are ravens, then we are foolish. The extra information about white birds tells us nothing whatever about ravens because no ravens are white. It is the same way with miracles from other religions. If, as Hume wishes us to suppose, they are all false, then their prevalence provides exactly zero additional statistical information about the miracle claims of the religion we care about.

What miracle claims of other religions, or, for that matter, miracle claims unrelated to any religion, contribute to deciding whether Christian miracle claims are true is general background about the universally acknowledged fact that humans sometimes claim to observe extraordinary events and attribute them to the supernatural. The intuitive sense that other religions' claims weaken the case for a miracle being true comes not, therefore, from reducing the *a priori* probability of a miracle (p_m), but rather from reducing the credence we place upon testimony to miracles, that is, from increasing our assessment of the probability the evidence is deceit or error (p_e). But if we've been realistic about that assessment, we will have already taken other religions' miracle claims into account as well as everything we've heard about the reliability of eye-witness testimony, and innumerable other factors. In effect, then, the only valid part of Hume's fourth subsidiary argument, about other religions' miracles, is its contribution to strengthening his argument number (2), that testimony to miracles is suspect, because people have a psychological predisposition to believe in wonderful events. I don't doubt they do. Other religions' miracles make a very modest contribution to persuading me of it.

Because of that predisposition and especially the anticipated rarity of miracles, it is perfectly reasonable to be suspicious of miracle claims, and I generally am. So also, for example, is the Roman Catholic church. Part of their standard procedure for assessing Catholic miracle claims is an investigation by scientists and doctors to find out if there is some straightforward natural explanation of the event (or some deception). Between the years 1862 and 2000, for example, out of over 6,700 cures declared by pilgrims to the shrine at Lourdes, only 66 were affirmed by the church as miraculous[21]. But I'm not so suspicious of miracles that I simply dismiss all claims out of hand. And for a miracle as widely attested as Jesus'

resurrection, it is unreasonable for anyone to do so.

In different religions miracles play different roles. And in some, they are not only far less well attested but also far less logically significant to, or compatible with, the religion's theology. Gautama Buddha (c563-c483BC) was uncommitted even to the existence of a personal God, so obviously in his original teaching and ministry, miracles as acts of God have essentially no place. Traditional tales of Buddha's wondrous powers did arise with time, despite their illogic within his world-view and his explicit discouragement of his followers from pursuing marvels. However, these 'miraculous histories' about Buddha arose centuries after his death[22]. The situation with Confucius (551-479BC) is very similar. Miracles have no logical place in his teaching, and if anything Confucianism was even more resistant than Buddhism to miracle stories, in its early centuries. Daoism, pantheistic strains of Hinduism, and indeed all pantheisms, have no concept of a personal God who acts. So miracles make no sense within their world view. Polytheism and animism, of course, do have personal supernatural beings, but in so far as the major extant examples, such as polytheistic Hinduism and Shinto, have systematic theology, it does not seem to depend upon miracles *per se*.

> *What about the claim that a horse jumped between two cities with Muhammed on board. I'm interested whether you think this can be thrown out of the window based on our knowledge of the capability of horses, or whether we must take it uncritically and just accept that it is something that can't be addressed by science. If you apply that to Islam, why not to Christianity?*

Miracles make sense within Islam's theology, and Muhammad (c570-632AD) acknowledged Moses' miracles. But he did not claim signs for himself beyond the miraculous nature of the *Quran*, saying "Signs are with Allah only, and I am only a plain warner. Is it not enough for them that We have revealed the Book to you to be recited to them." (Surah 29:50,51). Nevertheless, a few passages in the *Quran* are interpreted by later commentators as miracles. The flying horse story is an interpretation placed upon Surah 17:1 "Glory to Him Who carried His servant by night from the Sacred Mosque to the Remote Mosque". The details of Muhammad's 'Night Journey' mounted on the heavenly steed Buraq are recorded in two of the *Hadith* collections of oral narratives concerning Muhammad, referred to as the 'Authentic Six'. The written texts date from between approximately 150 and 210 years after Muhammad's death. The journey, accompanied by the angel Gabriel, began at Mecca, and the Remote Mosque is traditionally interpreted as the al-Aqsa Mosque in Jerusalem, although it was not in fact built until Jerusalem was conquered after Muhammad's death. On the way back, Muhammad toured the seven stages of heaven, and spoke

with earlier prophets such as Abraham, Moses, John the Baptist, and Jesus. With all due respect to Muslims, I do not accept this miracle story as factual history. But the primary reasons I discount it have nothing to do with science, or with the capability of horses. I disbelieve it because it is inconsistent with my theology. And I criticize it even from a theologically uncommitted stance because it appears to be an unreliable accretion based upon much later folk tales whose fantastic character doesn't really fit with even Muhammad's theology. Not coincidentally, I discount most medieval Christian miracle legends for the same sorts of reasons. In any case, I don't think even Muslims regard the Night Journey as important *evidence* to persuade us of Muhammad's prophetic status.

Do you take literally all Christian claims e.g. the virgin birth?

The virgin birth has a very different character and role within the New Testament than the resurrection. For one thing, in stark contrast to the resurrection, the virgin birth is never explicitly mentioned outside the gospels. That does not mean it was unknown to the New Testament authors. Luke devotes the first two long chapters of his gospel to telling the story of Jesus' birth, but in the second half of his history, The Acts, he never comments further on it or reports any early apostle invoking it in preaching or prayer. Paul's letter to the Galatians (4:4) mentions God's Son as "born of a woman", but draws no attention to virginity. The reason, it seems most likely to me, is that the early church believed the virgin birth, but did not see it as having evidentiary value. Jesus' birth, for all that it was surrounded, according to Luke, by angelic appearances to shepherds; and provoked a massacre of young boys, according to Matthew; was a private matter. Mary "kept all these things, pondering them in her heart", but they weren't events like the resurrection that could be verified by a crowd of witnesses. And so the virgin birth was not important as an apologetic argument for Jesus' person and stature. I think that assessment of its evidentiary status generally remains true today.

Nevertheless, the Incarnation is central to Christian theology and to all of the New Testament. It is unambiguously addressed by Paul, Peter, John, Hebrews, and Revelation. It is, in the deepest sense, the *pre-eminent* miracle Christians affirm: that God himself entered our world in the form of a human, lived and taught among us, took upon himself our suffering, sin, and death, and triumphantly overcame it. I could not begin here to unpack the significance of the incarnation, which is rightly called The Grand Miracle[23]. But for a Christian like me, who accepts the miracle of the incarnation, the notion that God the Son should be born of a virgin doesn't seem in the least implausible. Science doesn't prove or disprove it any more than any other marvel. I see no compelling reason to doubt it. It makes complete sense for Christians to believe and celebrate it. But we

don't consider it the most compelling argument to persuade the modern skeptic.

Notes

1. There is no extant writing or speech of Einstein that contains this passage and the first documented occasion of the attribution appears to be a misunderstanding or misquotation by Gilbert Fowler White in his journal (1942-1944).

2. "The theory says a lot, but does not really bring us any closer to the secret of the 'old one.' I, at any rate, am convinced that He does not throw dice." Letter to Max Born (4 December 1926); *The Born-Einstein Letters* (translated by Irene Born) (Walker and Company, New York, 1971). The form most often cited of this phrase that Einstein often reused, appears for example in Jacob Bronowski's, *The Ascent of Man* (1974), `https://www.google.com/search?tbo=p&tbm=bks&q=isbn:1446417158`

3. Max Jammer *Einstein and Religion* (Princeton University Press, 1999) p94

4. Jammer, *op cit*, p110

5. All three words appear in a single verse, Acts 2:22, of Peter's Pentecost sermon, as means by which Jesus was approved by God. Occasionally scholars also identify Greek ergon, but it means any kind of work or doing.

6. And this definition is consistent with the preponderance of today's dictionary definitions except that they mostly say something like "event ascribed to God", which is an elaboration I would accept, and some add "because it does not follow the usual laws of nature", which as I've mentioned is often implied in the modern usage but is not the biblical meaning.

7. It is notable that medicine has coined special technical-sounding terms for saying we don't know why this happened.

8. W. Hermanns, *Einstein and the Poet – In Search of the Cosmic Man* (Branden Press, Brookline Village, MA, 1983) p 132 (cited by Jammer p123).

9. Jammer, p148

10. Alfred North Whitehead *Science and the Modern World* (MacMillan, New York, 1925). Stanley Jaki *The road of science and the ways to God* (University of Chicago Press, 1978)

11. Hume rejects the identification of a confluence of circumstance as a miracle, saying "if any suspicion remain, that the event and command concurred by accident, there is no miracle, and no transgression of the laws of nature"

12. C.S. Lewis's attempt to do so, in his mostly splendid book *Miracles* (New York, Macmillan, paperback edition 1978, p102), fails because it confuses usual uniformity with

absolute uniformity of nature.

13. Craig S Keener *Miracles The Credibility of the New Testament Accounts* (Baker Academic, Grand Rapids, 2011) for example, has gathered thousands of meticulously documented modern miracle reports.

14. See for example, James Turner *Without God, Without Creed* (The Johns Hopkins University Press, Baltimore, 1985); Stephen L. Carter *The Culture of Disbelief* (Basic Books, New York, 1993); George M. Marsden *The Soul of the American University* (Oxford University Press, New York, 1994); Charles Taylor *A Secular Age* (Belknap Press, Cambridge, MA, 2007).

15. Vitamins are essential to life, of course, but the multi-billion dollar industry surrounding the fashionable supplements draws more on hopeful superstition than established science. That's why the FDA declines to endorse them.

16. C S Lewis, *Miracles a preliminary study* (Macmillan, New York, 1947) Macmillan Paperbacks Edition (1978) p47.

17. There is a fallacious contradiction of this assertion which is to say that the equations of quantum mechanics are deterministic (which they are) and so quantum mechanics doesn't undermine determinism. This counterargument is spurious. The exquisite precision of agreement of quantum theoretical calculations with experiment is irrelevant to the matter, since that agreement applies to quantities not constrained by intrinsic uncertainty. The aspect of quantum mechanics that is indeterministic is bound up in the 'measurement problem'. The probabilistic aspect of quantum mechanics does not appear in the equations, it appears in their application to observations, to measurement. My assertion is not that the equations of quantum mechanics are indeterminate, but that the universe is. Since the measurement problem is still largely unsolved, I don't claim this as a disproof of determinism, but it is highly suggestive evidence against it.

18. Or more precisely that, while we have equations that can be solved unambiguously given initial conditions, the solutions govern not the definite outcome of measurements, but just the *probability* of different outcomes.

19. Hume doesn't have a good understanding of probability calculus. He doesn't know Rev. Bayes' theorem, because it was read to the Royal Society only posthumously in 1763, well after 1748 when Hume's book was published. Indeed, it seems that Bayes' study of probability was inspired by precisely these types of probabilistic arguments about miracles. The concurrent 18th century debate and subsequent developments are helpfully surveyed by John Earman, *Proceedings of the British Academy*, **113**, 91-109 (2002). The reader without mathematical training should skip Earman's more technical discussions because, like much Bayesian enthusiasm, it makes the mathematical treatment more obscure than it needs to be.

20. And neither was C.S. Lewis *Miracles* p132.

21. `http://www.economist.com/node/304212`

22. For example the Mahavastu `http://www.ancient-buddhist-texts.net/Reference/Early-Buddhist-T03-EBT-Mahavastu.htm`, was compiled between the 2nd century BC and the fourth AD.

23. Chapter XIV of Lewis's *Miracles*, is a worthy starting place.